SCHEME OF MINING
&
PROGRESSIVE MINE CLOSURE PLAN

(UNDER RULE 12 & 23(B) OF MCDR 1988)

VOLUME – I (TEXT)
IN RESPECT OF SUKRANGI LEASE

LEASE AREA: 382.709 HECTARES

FOREST: 179.385 HECTARES, NON FOREST: 203.324 HECTARES

[Reserved Forest: 14.609 Hectares; Protected Forest: 163.151 Hectares;

Village Forest: 1.625 Hectares]

MINERAL: CHROME ORE

VILLAGE: SUKRANGI/ KALIAPANI, DISTRICT: JAJPUR

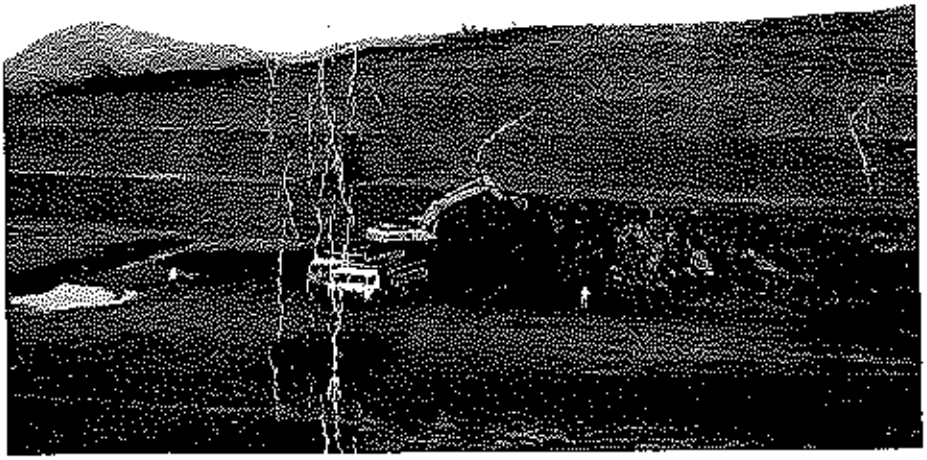
TALUKA & P.S: SUKINDA, STATE: ODISHA

CATEGORY: FULLY MECHANISED (FM)

SCHEME PERIOD: 1.4.2014 TO 31.3.2019

LEASE PERIOD (Under Deemed Renewal): 20.9.2000 TO 19.9.2020

LEASE DEED EXECUTED PERIOD: 20.9.1980 TO 19.9.2000



APPLICANT

THE ODISHA MINING CORPORATION LTD.

OMC House, Post Box No. 34, Bhubaneswar- 751001

DISTT. KHURDA, ODISHA

PREPARED BY

MECON LIMITED, RANCHI – 834002, JHARKHAND

REG.NO. RQP/RNC/113/2004/B VALID UPTO 16.12.2014

CONTENT

Volume – I

TEXT

S.No	Description	Page No.
	Cover Page	1
	Content	2-3
	Consents & Certificates from the Applicant	4-8
	Certificate from the RQP	9
	List of Annexure	10-11
	List of Drawings	12
	SCHEME OF MINING	
	Introduction	13
1.0	Review of Scheme of Mining	14-23
2.0	Proposal Under Scheme Of Mining for the Next Five Years	24
3.0	Reserves	25-40
4.0	Conceptual Mining Plan	41-47
5.0	Mining	48-55
6.0	Handling of Mine waste & separate stacking of Sub grade mineral	56-59
7.0	Use of Minerals	60
8.0	Mineral Beneficiation	61-65
9.0	Environment Management Plan	66-70
10.0	Any Other Information	71-72

(Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

S.No	Description	Page No.
	PROGRESSIVE MINE CLOSURE PLAN	
1.0	Introduction	73-77
2.0	Mines description	77
3.0	Review of implementation of PMCP	78
4.0	Progressive Mine closure plan	79-86
5.0	Economic repercussion of mine closure and Manpower retrenchment	87
6.0	Time schedule for abandonment	88-89
7.0	Abandonment cost	90-96
8.0	Financial Assurance	97
9.0	Certificates/ plans & sections	97
	Annexure	Vol.-II

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CONSENT LETTER FROM APPLICANT

The Scheme of Mining along with progressive mine closure plan, of Sukrangi chromite Mines belonging to M/s Odisha Mining Corporation Limited over an area of 382.709 Hect. in Jajpur district for the next 5 years period i.e. from 01.04.2014 to 31.03.2019) has been prepared by RQP, M/s MECON Limited (RQP Regn. RQP/RNC/113/2004/B) in the capacity of Recognized Qualified Person.

I request the Regional Controller of Mines, Bhubaneswar Region / Controller of Mines, Nagpur (Central Zone) to make further correspondence regarding the above document with the said Recognized Qualified Person in his following address:

Address of RQP

MECON Limited
RM & Mining Section
P.O. Doranda, Ranchi – 834002, Jharkhand
Ph. 0651 -2483645, 2481093
Fax. 0651 – 2482189, 2482214
E-mail: mining@meconlimited.co.in

I hereby undertake that all the information so made in the above document prepared by the Recognized Qualified Person be deemed to have been made with my knowledge and consent and shall be acceptable to me and binding to me in all respect. I have understood the contents of document and I agree to implement the same in accordance with the law.

Place: Bhubaneswar
Date: 22/8/14

(Sudhansu Kumar Das)
Signature of the Applicant In Full:
S.K. Das
Dy. General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

Name in Full in Block Letters:

Address:

CERTIFICATE

This is to certify that Scheme of Mining along with progressive mine closure plan, of Sukrangi chromite Mines belonging to M/s Odisha Mining Corporation Limited over an area of 382.709 Hect. in Jajpur district for the next 5 years period i.e. from 01.04.2014 to 31.03.2019) has been prepared with my consent and approval and that I/we will abide by all the commitments made there under. In case of default, the approval of the document would be withdrawn.

Place: Bhubaneswar
Date: 27/7/14

(Sudhanshu Kumar Das)
Signature of the Applicant in Full:
S.K. Das
Name in Full in Block Letters
By General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

CERTIFICATE

Certified that the Scheme of Mining along with progressive mine closure plan, of Sukrangi chromite Mines belonging to M/s Odisha Mining Corporation Limited over an area of 382.709 Hect. in Jajpur district for the next 5 years period i.e. from 01.04.2014 to 31.03.2019)complies all the Statutory Rules, Regulations and Orders made by the Central or State Govt. Statutory Organizations, Courts, etc. It is also certified that all the orders made by the Central or State Govt. Statutory Organizations, Courts, etc. have been taken into consideration while preparing the document.

The lessee hereby undertakes that whenever any specific permission is required the concerned authorities shall be accordingly approached and all the measures proposed in the document will be implemented in a time bound manner as proposed.

Place: Bhubaneswar
Date: 22/5/14

(Sudhansu Kumar Das)
Signature of the Applicant In Full:

Name in Full in Block Letters:
S.K. Das
By General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

CERTIFICATE

The provisions of Mines Act, Rules, Regulations made there under have been observed in the Scheme of Mining along with progressive mine closure plan, of Sukrangi chromite Mines belonging to M/s Odisha Mining Corporation Limited over an area of 382.709 Hect. in Jajpur district for the next 5 years period i.e. from 01.04.2014 to 31.03.2019) and where specific permissions are required, the applicant will approach the DGMS. Further, the standards prescribed by DGMS in respect of miners' health will be strictly implemented.

Place: Bhubaneswar
Date: 27/5/14

(Sudhanshu Kumar Das)
Signature of the Applicant In Full:
S.K. Das
Dy. General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

Name in Full in Block Letters:

OMC **Odisha Mining Corporation Limited**
(A GOLD CATEGORY STATE PSU)

Undertaking from Odisha Mining Corporation Ltd., Bhubaneswar, for compliance of Circular No.2/2010 and its addendum in respect of Sukrangi chromite Mines over an area of 382.709 hectares in Jajpur district, Odisha .

We do hereby undertake to implement CCOM's circular no. 2/2010 and its addendum regarding geo-referencing of the mining lease map and ML boundary pillars within six (6) months through ORSAC.

(Sudhansu Kumar Das)
Signature of the Authorized Person
The Odisha Mining Corporation Ltd
Bhubaneswar-751001
S.K. Das
Dy General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

Undertaking from Odisha Mining Corporation Ltd., Odisha, Bhubaneswar, for time bound exploration in respect of Sukrangi Chromite Mine over an area of 382.709 hectares in Jajpur district, Odisha

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We do hereby undertake to complete the exploration in a time bound manner as specified in this Scheme of Mining of Sukrangi chromite Mines belonging to M/s Odisha Mining Corporation Limited over an area of 382.709 Hect. in Jajpur district of Odisha state.

(Sudhansu Kumar Das)
Signature of the Authorized Person
The Odisha Mining Corporation Ltd
Bhubaneswar-751001
S.K. Das
Dy. General Manager (Geo)
Power of Attorney Holder
Odisha Mining Corporation Ltd
Bhubaneswar-751001

मेकॉन लिमिटेड (भारत सरकार का संस्थान)
MECON LIMITED (A GOVERNMENT OF INDIA ENTERPRISE)
प्रधान कार्यालय (Head Office) : राँची 2, झारखण्ड, भारत , Ranchi-2, Jharkhand, India , फोन / Phone : 0651-2483000, फैक्स / Fax : 0651-2482188/2482214
ई-मेल / E-mail : ranchi@meconlimited.co.in, वेबसाइट / Website : http://www.meconlimited.co.in

CERTIFICATE

This is to certify that the provisions of Mineral Conservation & Development Rules – 1988 and MMDR Act 1957 have been observed in the Scheme of Mining of Sukrangi lease over an area of 382.709 Hectares of land and where ever specific permissions are required the applicant will approach the concerned authorities of Indian Bureau of Mines for grant of permission.

Place: Ranchi
Date: 20.5.2014

(PK BHATTACHARJEE)
(key person)
MECON LIMITED
RANCHI – 834002
RQP NO. RQP/RNC/113/2004/B

LIST OF ANNEXURES

Annex. No.	Description	Page. No.
1	List of Board of Directors	98
2	Board resolution regarding appointment of Nominated Owner	99
3	Power of attorney (POA) by the Nominated Owner	100-107
4	Photo Id & address proof of the POA	109
5	Certificate of incorporation	110
6	List of leases held by the applicant in India	111-112
7	Copy of RQP certificate	113-114
8	Copy of Lease deed	115-138
9	Copy of the acknowledgement of the application for renewal of the lease (Form-D)	139
10	Copy of the application for renewal of lease (Form-J)	140-145
11	Copy of environment clearance	146-151
12	Copy of the consent to establish	152-157
13	Copy of the consent to operate	158-168
14	Copy of forest clearance letter	169-170
15	Copy of the violations raised and its compliance status	171-182
16	Copy of the last approved scheme of mining	183-185
17	Copy of the NABL certificate	186
18	Copy of the NABL tests report	187-198
19	Copy of the last bank guarantee paid	199-203
20	Copy of the environmental monitoring report (last 2 quarters)	204-242

(PK Bhattacharjee, key person)
MECON LIMITED
RQP/RNC/113/2004/B

21	Copy of the permission granted under rule 106(2)(b) of MMR - 1961	249-257
22	Copy of the permission for dumping of waste from S/ Kaliapani lease to Sukrangi lease	258-259
23	Disclosure by the board of directors	260-261
24	Copy of the surface rights held by the lessee	262-266
25	Copy of the surveyor certificate	267
26	Copy of the notices for sinking boreholes (Form-J)	268-298
27	Copy of the boreholes record (Form-K)	299-349
28	Documentary proof for the exploration carried out	350-368
29	Copy of the violation letters from state government and their reply	369-373
30	Copy of the water balance & material balance for S/ Kaliapani COBP (Existing with modifications proposed)	374-375
31-32	Copy of the water balance & material balance for the proposed S/ Kaliapani COBP.	376-377
33	Details of the resources established and details of the production schedules	378-385
34	Feasibility report	386-395
35	Feasibility report of IIT Kgp, in respect of ETP	396-454
36	ETP (flow sheet	455
37	Typical design of retaining wall/ settling tank	456
38	Bank Guarantee	457-459

(PK Bhattacharjee, key person)
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RQP/RNC/113/2004/B

SCHEME OF MINING
OF SUKRANGI LEASE (382.709 HA.)

APPLICANT: THE ODISHA MINING CORPORATION LTD.
RQP : MECON LIMITED

LIST OF DRAWINGS

Description of Drawing	Drawing No.
Key Plan	MEC/10G9/11/16/01
Lease Plan	MEC/10G9/11/16/02
Lease Plan (Vectorised Copy)	MEC/10G9/11/16/02A
Geological Plan	MEC/10G9/11/16/03
Surface Plan (As on Date)	MEC/10G9/11/16/04
Pit Development Plan at the End of FY 2014-15	MEC/10G9/11/16/05
Pit Development Plan at the End of FY 2015-16	MEC/10G9/11/16/06
Pit Development Plan at the End of FY 2016-17	MEC/10G9/11/16/07
Pit Development Plan at the End of FY 2017-18	MEC/10G9/11/16/08
Pit Development Plan at the End of FY 2018-19	MEC/10G9/11/16/09
Geological sections	MEC/10G9/11/16/10A to 10E
Pit development sections from 2014-15 to 2018-19 & conceptual pit sections	MEC/10G9/11/16/10F
Conceptual Pit Plan	MEC/10G9/11/16/11
Waste Dump Plans/ Sections	MEC/10G9/11/16/12A to 12B
Environmental Plan	MEC/10G9/11/16/13
Environment Management Plan	MEC/10G9/11/16/14
Financial Assurance Plan	MEC/10G9/11/16/15

(PK Bhattacharjee, Key Person)
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INRODUCTION

Sukrangi chromite lease of M/s OMC Ltd. is located in Jajpur Dist. of Odisha. The Sukrangi lease was executed on 20.9.1980 for a period of 20 years. A copy of the lease deed is enclosed as Annexure -8. Application for renewal of the lease has been done on 19.9.1999 and currently the lease is under deemed renewal stage. A copy of the renewal application (Form-J) & receipt of the application (Form-D) is enclosed as Annexure-10 & 9. The last scheme of mining was approved by IBM for the period from 1.4.2009 to 31.3.2014 vide letter No. MS/OTF.MECH/33-ORI/BHU/2009-10 dated 18.12.2009. The mine has been accorded environment clearance vide letter No. J-11015/409/2008-IA.II(M) dated 18.2.2010 for a production capacity of 1.30 lakh tonnes per annum. A copy of the same is enclosed as Annexure -11. Consent to operate have also been granted by the state pollution control board, Odisha under the Air & Water (Prevent & Control of Pollution) Act, which is valid upto 31.3.2016. A copy of the same is also enclosed as Annexure -13. The mine has also been accorded permission for diversion of 104.79 Ha. of forest land vide letter No F.NO-8-104/2000-FC dated 21.7.2011.

Permission has also been accorded for dumping of waste from the adjoining & contiguous S/Kaliapani lease to Sukrangi lease by the state government. A copy of the same is enclosed as Annexure -22.

The current submission is therefore a scheme of mining for the period from 1.4.2014 to 31.3.2019, which also incorporates the provision of dumping of waste from South Kaliapani lease to Sukrangi lease.

अनुमोदित
APPROVED

क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर/BHUBANESWAR

[PK Bhattacharjee, Key Person]
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PART - I

1.0 REVIEW OF SCHEME OF MINING

1.1 Name of the Mine: Sukrangi chromite Mines

1.2 Particulars of Approval of Mining Plan/ Scheme of Mining:

Latest scheme of mining for the period 2009-10 to 2013-14 was approved under rule 12 of MCDR '88, vide letter no. MS/OTF.MECH/33-ORI/BHU/2009-10 dated 18.12.2009.

1.3 Date of Commencement of Mining Operation:

The mining operations in the Sukrangi lease started on 27.8.85.

1.4 (a) Deficiencies , if any, that existed in the approved mining plan to be taken note of and rectified by incorporating suitable proposals for implementation in the scheme of mining.

The area put to use under mining at the start of previous approved SOM was reported as 39.40 Ha. However, as per the calculations reflected from the drawings prepared on Autocad, the land use under mining at the start of current proposal comes to 21.25 Ha.

1.4(b) Review of compliance position of salient features of the earlier scheme of mining on chapter wise basis bringing out marked deviations, if any, and justifications / reasons thereof. Items to be covered may include exploration, mine development, exploitation, afforestation program, reclamation & rehabilitation, control of dust, noise & ground vibrations and any other significant feature.

Achievements against the proposals envisaged in the approved mining scheme for the period w.e.f 2009-10 to 2013-14 (Actual figures for the FY 2013-14 has been updated upto Jan. 2014) and the justification thereof for deviations, if any, is mentioned below:

i) Exploration:

Year	Nos. of boreholes		
	Planned	Actual	Reason for deviation
2009-10	3 Nos./ 600m	NIL	Due to the delay in hand over of the forest land for non forest use by the state forest deptt.
2010-11	3 Nos./ 390m	NIL	Due to the delay in hand over of the forest land for non forest use by the state forest deptt.
2011-12	3 Nos./ 225m	16 Nos./ 2309.5m	Excess drilling is due to the continuity of lode traced while drilling.
2012-13	3 Nos./ 360m	21 Nos./ 6040.5m	Excess drilling is due to the continuity of lode traced while drilling.
2013-14	2 Nos./ 240m	10 Nos./ 2020m	Excess drilling is due to the continuity of lode traced while drilling.

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ii) **Mine Development and Exploitation:**

The achievement position as against the target in respect of ore, sub grade & waste are given below in table 1.1.

(Table 1.1) Overall Targets for Ore and Waste removal

Year	Ore, t		Sub grade, t		Waste, cubic meters	
	Planned	Actual	Planned	Actual	Planned	Actual
2009-10	111780	4579.6	12420	0	501600	70486.534
2010-11	113400	9215	12600	0	509000	236685.0
2011-12	114480	9959.36	12720	11053.125	514600	263326.0
2012-13	123660	52452.316	13740	15046.86	557500	353654.0
2013-14	132300	78921.365	14700	748.26	601300	226688.0
Total	**595620**	**155128**	**66180**	**26848.2**	**2684000**	**1150840**

The actual production of ore, sub grade & waste against their planned figures are 26%, 41% & 43% respectively, over the last five financial years. The reason for lesser production of ore and generation of sub grade and waste is non availability of forestry clearance over the planned patches of forest land over which the mine development/ production was planned.

iii) **Land Reclamation and Rehabilitation:**

In the mining scheme period it was not proposed to reclaim & rehabilitate any mined out area of land. Obviously there is no deviation in this part.

iv) **Waste dump management:**

A total of 1.15 million cubic meters of waste was generated against the planned figure of 2.68 million cubic meters. These wastes were planned to be stacked in a dump of maximum 20 m height with a design capacity of 2.7 million cubic meters. The generated wastes which was around 43% of the planned figure, was dumped in the planned areas only.

iv) **Afforestation:**

The achievement position as against the target in respect of afforestation is given below in table 1.2.

(Table 1.2) Overall Targets for Afforestation

Year	Afforestation, Nos	
	Planned	Actual, Nos.
2009-10	7500 Nos.	NIL
2010-11	7500 Nos.	2500

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2011-12	8000 Nos.	1500
2012-13	8000 Nos.	4000
2013-14	10250 Nos.	2000
Total	41250 Nos.	10000 Nos.

The afforestation is only 24% of the planned figure. As dumps were formed by progressive method of dumping simultaneous afforestation could not be carried out.

v) **Control of dust, Noise and ground vibration:**
It was proposed to carry out sampling of air, water and noise periodically and take mitigation measures to limit the pollution level of these parameters. Monitoring of the air quality, noise quality, water quality etc have been regularly carried out as per the norms and details of the same are enclosed as Annexure - 20.

1.4(c) Review of the compliance position of conditions and stipulations imposed, if any, while approving the scheme of mining. In case of non- compliance / partial compliance, detailed justifications / reasons thereof may be furnished along with proposal for compliance in the ensuing period.

Point wise review/ compliance of the last approved scheme of mining are given below:-

S.No.	Conditions imposed while approving the last SOM	Compliance status
i.	This Scheme of Mining is approved without prejudice to any other law applicable to the mine area from time to time whether made by the Central Government, State Government or any other authority.	Complied with
ii.	It is also clarified that the approval of your aforesaid Scheme of Mining does not in any way imply the approval of the Government in terms of any other provision of Mines & Minerals (Development & Regulation) Act, 1957, or the Mineral Concession Rules, 1960 and any other laws including Forest (Conservation) Act, 1980, Environment (Protection) Act, 1986, or the rules made there under.	Complied with
iii.	It is further clarified that this approval of the Scheme of Mining under Rule 12 of MCDR 1988 is subject to the provision of Forest (Conservation) Act, 1980, Forest (Conservation) Rule, 2003 and other relevant statues, orders and guidelines as maybe applicable to the lease	Complied with

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S.No.	Conditions imposed while approving the last SOM	Compliance status
	area from time to time.	
iv.	It is further clarified that this approval of the Scheme of Mining is subject to the Provision of the Mines Act, 1952 and Rule & Regulation made there under including submission of notice of opening, appointment of manager and other statutory officials as required by the Mines Act, 1952 shall be complied with.	Complied with
v.	The execution of Scheme of mining shall be subjected to vacations of prohibitory orders/ notices, if any	Complied with
vi.	This approval for mining operation and associated activities is restricted to the mine lease area only. The mining lease area is as shown on the statutory plans under Rule of Mineral Conservation and Development Rule 1988, by the Lessee/RQP/Applicant and Indian Bureau of Mines has not undertaken verification of the mining lease boundary on the ground.	Complied with
vii.	If anything is found to be concealed as required by the Mines Act in the contents of scheme of mining and the proposal for rectification has not been made, the appropriate shall be deemed to have been withdrawn with immediate effect.	Complied with
viii.	At any stage, if it is observed that the information furnished in the document of incorrect or misrepresent facts, the approval of the document shall be revoked with immediate effect.	Complied with
ix.	This approval is given for the received proposals as applicable from this date.	Complied with
x.	The scheme of Mining is approved without prejudice to any order or direction from a court of competent jurisdiction.	Complied with
xi.	Your attention is invited to the Supreme Court Interim order in W.P(C) No. 202, dated 12.12.96 for compliance. The approval of Scheme of Mining is, therefore, issue without prejudice to and is subject to the said directions of the Supreme Court applicable in your case.	Complied with
xii.	An yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the approved mine closure plan, and there is any deviation, reasons thereof should	The statement on protective and rehabilitative works carried out as per the approved mine closure plan is being sent to the concerned

[PK Bhattacharjee, Key Person]
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S.No.	Conditions imposed while approving the last SOM	Compliance status
	be submitted to Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar under Rule 23 E 9@) of MCDR, 1988.	authorities of IBM every year.
xiii.	The Financial Assurance submitted on 17.12.2009 for an amount of 42,34,050 (Rupees Forty Two Lakh Thirty Four Thousand Fifty only) is valid up to 31.03.2014 new bank guarantee is to be submitted on or before its expiry 31.03.2014 or before the expiry of scheme period which ever is earlier.	Financial assurance submitted to IBM for an amount of Rs. 4234050 is valid upto 31.3.14. The revised financial assurance for the proposed scheme period will be submitted to IBM on or before 31.03.2014.
xiv.	A copy of Environmental Monitoring Cell established by MOEF should be submitted to IBM Bhubaneswar immediately after approval of EIA – EMP for record and information.	Copy of the Environmental Monitoring Cell will be submitted to IBM Bhubaneswar very shortly.
xv.	The Environmental Monitoring Cell established by the company shall continuous monitoring ambient air quality, dust fall rate, water quality, soil sample analysis, noise level measurements at various stations established for the purpose both in the core zone and buffer zone as per requirement of Environment Guidelines and keeping view IBM's circular No. 3/92 & 2/93 season-wise every year or by engaging services of an Environmental Laboratory approved by MOEF/CPCB. The data generated shall be maintained in a bound paged register kept for the purpose and same shall be made available to the inspecting officer, on demand.	The same is being duly complied with.

1.4(d) Review of compliance of violations pointed out after inspections made under MCDR, 1988 during last 5 years. The position emerging out of the yearly review of the mining plan while checking up implementation of the mining plans in the field shall also be taken note of at this stage.

The violations pointed out during the last 5 years and their compliance status as submitted to IBM by OMC has been enclosed as Annexure – 15. However, the review of the same for ready reference is given below:-

Rule No.	Nature of Violation observed by IBM	Compliance by OMC
13(1)	i) As per the proposal made on page no. 23 of the approved scheme of mining for the	Due to want of Forest clearance the drilling of bore holes could not

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Rule No.	Nature of Violation observed by IBM	Compliance by OMC
	year 2009-10, 03 bore holes with total meterage of 600 meter were to be drilled. It has been observed that exploration proposal has not been implanted.	be executed during 2009-10. it was proposed to execute drilling of 3 bore holes after obtaining forest permission.
	ii) As per the proposal made on page no. 26 of the approved scheme of mining for the year 2009-10, mine waste of 05 lakh cubic meter was to be excavated for production of 124200 tonnes of mineral. But during the year 2009-10 only 4579 tonnes of mineral has been produced without undertaking any proportionate mine development work.	Due to forest restriction the mine working was stopped at Sukrangi Chromite Mines since 10.09.2010. Now they are excavating the O.B which is well within the specified ratio of O.B: Ore. Mining is confined to non forest area only.
	iii) As per the proposal made on page no. 40 of the approved scheme of mining, mine waste lying in close vicinity of Quarry AC was to be handled & shifted away from the ultimate pit limit. But progress in this aspect is insignificant.	At present they have commenced shifting the dump from both foot wall & hang wall side.
	iv) As per the proposal made on page no. 46 of the approved scheme of mining arrangement for coursing the rain water through ETP has not been made.	Actions taken for coursing the surface run off during the rainy season through the ETP.
16(1)	Nickeliferrous limonite has not been disposed/ stacked separately.	As the OB excavation and development work could not be done due to want of forest permission, Limonite horizon containing economical nickel content has not been excavated yet.
16(3)	Mine waste is found dumped in close proximate of hang wall & foot wall side of the Quarry AC. It is falling within the ultimate pit limit.	At present we are shifting the dump from both foot wall & hang wall side.
24(3)	Mining operation is carried out on intermittent basis in Quarry AC. But other excavation i.e. Quarry – De where mining operation are	By providing one embankment we have already prohibited un-authorised / inadvertent accesses

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Rule No.	Nature of Violation observed by IBM	Compliance by OMC
	discontinued since last five years have not been made safe by setting suitable prohibitive measures to restrict the unauthorized/inadvertent accesses to the mine.	to DE Quarry, along with appropriate round the clock security arrangement to check unauthorized access to the mine.
13(1)	Mining operation is not being carried out in accordance with the approved scheme of mining dte. 18.12.2009 to the extent indicated below:-	
	i) Proposal made on page – 23 for exploration by drilling 03 bore holes (390 meters) in the year 2010-11 and also back long of the previous year 2009-10 of drilling 03 bore holes (600 meters) were not carried out.	Proposal for exploration by drilling 3 bore holes (390 meters) in the year 2010-11 and also backing of previous year 2009-10 of drilling 03 Bore holes (600 mtrs) were not carried in want of forest clearance. However drilling work commenced from Oct, 2011. Exploration work was undertaken in the N-W portion of Sukrangi extension of North limb. Band III chromite on priority basis. However, in the meantime borehole locations have been surveyed for taking up the boreholes as was proposed during the year 2009-10 and 2010-11.
	ii) Proposal made on page – 39 for construction of retaining wall (1250 meter length, one meter height and (1.2 + 1)/2 meter width), in the year 2009-10 was not carried out.	The operation of the mine was suspended from 29.8.2009 to 10.9.2010 by DFO, Cuttack. We were allowed to do operations only in the non-forest area by way of TWP from 11.9.2010 to 25.8.2011, Mining operation resumed in approved forest area after obtaining stage – II clearance from 14.11.2011.

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Rule No.	Nature of Violation observed by IBM	Compliance by OMC
		After resumption of full fledged operation w.e.f 14.11.2011, steps have already been taken for construction of retaining wall 1250 meters length, 1 Meter Height and (1.2+1)/2 Meters width around the waste dump and ore plots, which have been completed before rainy season.
	iii) During the year 2010-11, plantation carried out was reported by planting 2950 saplings against proposal under EMP(page – 45) has not been implemented in effective manner.	During the year 2010-11, plantation could not be done due to closure of mining operation for want to Forest clearance. However, after resumption of mining operation steps have been taken for plantation programme as per mining scheme.
	iv) Proposal made under EMP (page-46) for flow of rain water outside the ML area through ETP has not been carried out.	Now State Pollution Control Board have proposed establishment of common effluent treatment plant (CETP) in Sukinda Valley for which feasibility study has been completed by IIT, Kharagpur, The same shall be established soon after we get the feasibility report as per the guide line of SPCB, Odisha Bhubaneswar.
16(1)	Sub grade material/nickel ferrous limonite has not been stacked separately.	After resumption of mining operation w.e.f 14.11.2011, nickeliferous limonite has not been encountered yet.
23E(2)	The yearly report on extent of protective and	Report has already been sent vide

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Rule No.	Nature of Violation observed by IBM	Compliance by OMC
	rehabilitative works carried out as envisaged in the approved progressive mine closure plan has not been submitted for the year 2010-11 to the Regional Controller of Mines, IBM Bhubaneswar.	our letter no. 1436/OMC/SKG/11 dtd. 22.12.2011.
29	Copies of the plan and sections as required under Rule – 28 have not been submitted to RCOM, IBM, Bhubaneswar for the year 2010-11 on or before 30th June, 2011.	Submitted vide our letter no. 1436/OMC/SKG/11 dtd. 22.12.2011.
33(2)	The waste dump has not been properly secured to prevent escape of material and surface run off due to rain water.	The mining operation was suspended for want of Forest Clearance. After resumption of mining operation with effect from 14.11.2011 action has been taken to construct retaining wall and garland drains around the waste dump to prevent escape of material and surface run off due to rain water.
13(1)	The mining operations are not being carried out in accordance with the approved proposals of Scheme of Mining dtd. 18.12.2009. i) That during the year 11-12 against the proposal of 7500 saplings only 1500 saplings have been planted.	Due to non availability of suitable land, only 1500 saplings have been planted against the proposal of 7500 saplings during the year 2011-12. Step is being taken for bulk plantation at our compensatory afforestation land in Jagannathpur village of Kamakhya Nagar, Tahasil.
23(E) (2)	The yearly report on extent of protective and rehabilitation works carried out as envisaged in the approved Scheme of Mining dtd. 18.12.2009 has not been submitted so far the year 2011-12 to RCOM, IBM, Bhubaneswar.	This is already submitted by Sr. Manager (M), Sukrangi vide letter No. 710/OMC/SKG/12 dtd. 06.08.2012.
29	The copies of plans and sections as required under Rule 28 have not been submitted for the year 2011-12 so far to the RCOM, IBM,	This is already submitted by Sr. Manager (M), Sukrangi vide letter no. 710/OMC/SKG/12 dtd.

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Rule No.	Nature of Violation observed by IBM	Compliance by OMC
	Bhubaneswar.	06.08.2012.
45 (I) (c)	The annual return for the year 2011-12 has not been submitted so far to the RCOM, IBM, Bhubaneswar.	This is already submitted by Sr. Manager (M), Sukrangi vide letter No. 725/OMC/SKG/12 dtd. 08.08.2012.

1.4(e) Any other points requiring attention in the interest of proper mine design, development & conservation and environment & ecology of the area.

Not applicable

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PART – II

2.0 PROPOSAL UNDER SCHEME OF MINING FOR THE NEXT FIVE YEARS

2.1 Name & address of the applicant

The Odisha Mining Corporation Limited
(A Govt. of Odisha Undertaking)
OMC House, Post Box No. 34
Bhubaneswar - 751001

2.2 Name & address, registration number of the RQP together with validity date

MECON Limited
RM & Mining Section, P.O – Doranda
Ranchi – 834002, Jharkhand

Tel. No. 0651-2483645, 2481093 Fax No. 0651-2482189, 2482214
e-mail address: mining@meconlimited.co.in

RQP certificate No. is RQP/RNC/113/2004/B, valid upto 16.12.2014. A copy of the RQP certificate is given as Annexure -7.

2.3 Mineral(s) to be mined: Chrome ore

2.4 Area & date of expiry of the lease

The lease extent is over an area of 382.709 Ha. and the lease deed was executed on 20.9.1980 for a period of 20 years i.e. the date of expiry of the lease is 19.9.2000. Application has been made for further renewal of this lease for a period of 20 years w.e.f 20.9.2000 and the lease is currently under deemed to be renewed stage.

2.5 Date of expiry of 5 years period for which approved on the last occasion

The scheme of mining approved on the last occasion was valid from 2009-10 to 2013-14 and will expire on 31.03.2014.

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3.0 RESERVES

3.1 Category wise (Proved, Probable and Possible) reserves estimated in earlier Mining Plan / Scheme of Mining with Grades:

The summary of the geological reserves established for Sukrangi lease in the earlier scheme of mining is given in table 3.1.

(Table – 3.1) Category wise resources reported in earlier scheme, (in Million Tons) (As on 1.4.2009)

Sl.No	Ore Zone	Reserves
1	All bands	3.78

(Table – 3.1a) Category wise reserves reported in earlier scheme as per UNFC, in Million tonnes (Mt) (As on 1.4.2010)

Classification	Code	Qty. (Mt)	Grade
Proved Mineral reserve	111	3.44	+10% Cr2o3
Probable Mineral reserve	122	0.34	

3.2 Depletion of Reserves:

Depletion of reserves is calculated on the basis of production of ore made between 1.4.2009 to 31.1.2014. The year-wise production is given in Table – 3.2.

(Table – 3.2) Year – wise Production, (in Million Tons)

Mine	Production
Total	0.155

3.3 Additional reserves established category-wise

The re-assessment of the reserves has been carried out at a Cr_2O_3 cut off of 10% as per the UNFC guidelines. The reserve/resource assessment was carried out in the Mine Planning software package "GEOVIA SURPAC". The following were utilized as basic input data for the preparation of geological model.

i. Contour data of updated pit position and surface topography
ii. Borehole logging data generated from exploration of different bands done by Directorate of Mining & Geology (DMG), Govt. Odisha and OMC.

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A summary of the exploration carried out for G1/G2 areas indicating mapping, drilling (No./ spacing), sample drawn/ analyzed etc is given in the table below:-

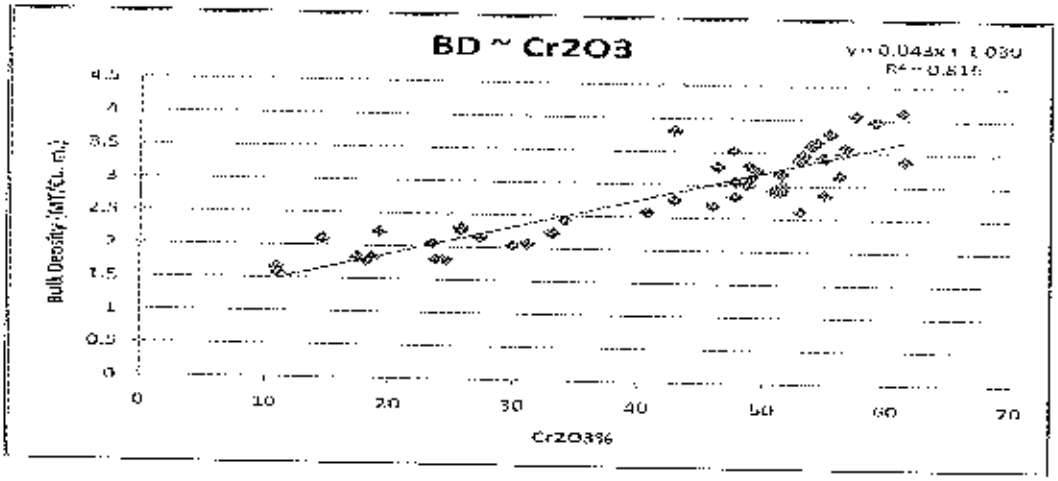
Sukrangi lease area	Borehole data				
	No. & spacing	Max. depth	Grade From/ to	Samples drawn and analyzed	Level of exploration
Band-IV-S	74 Nos (50m x 25m)	290m	2.87/62.9% Cr_2O_3	1868	G1
Band-IV-N	6 Nos	94m	7.29/51.07% Cr_2O_3	53	G1
Band-III-S	20 Nos (100m)	180m	5.56/53.12% Cr_2O_3	161	G1
Band-III-N	9 Nos. (25m x 25m)	72m	4.03/52.77% Cr_2O_3	50	G1
Band-V	35 Nos. (100m x 50m)	330m	0.26/56.2% Cr_2O_3	636	G1

Sixty (60) experiments were conducted for determination of bulk densities of different bands in ore & waste. The copies of test results are enclosed at Annexure- 18 .The samples were drawn from different ore bands in Sukrangi as well as in the adjoining South Kaliapani lease. 53 sample values were subjected to regression analysis by plotting bulk density values against the Cr_2O_3% grade of each sample. The following linear regression equation was established from the X-Y scatter plot of bulk density (BD) & Cr_2O_3% value of samples.

y = 0.043 x +1.030 at a correlation coefficient of 0.903

Where, y = Bulk density
x = Grade in Cr_2O_3 %

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The regression equation was used as tonnage factor for computation of reserves of different chromite band. On basis of the above geological works carried out, the area covered under Band-IV-S & N, Band-III-S&N and Band-V can be considered under G1 category of the geological axis as per the UNFC classification of reserves.

Parameters considered for estimation of Mineral Resources

(a) The threshold value considered as per the IBM guidelines is 10% Cr_2O_3.

(b) The entire data has been transferred to form a geological database in an ore body modeling software namely 'SURPAC'.

(i) Preparation of Database

Four basic files namely collar, survey, assay and litho files are required in Comma Separated Value (CSV) format for further processing by SURPAC Software. Ore type-wise litho codes used for database preparation is given below.

Ore Type-wise Litho Codes Used for Database Preparation

Sl. No.	Litho	Litho Code
1.	Chrome ore band (+10-40% Cr_2O_3)	1
2.	Chrome ore band (+40% Cr_2O_3)	2

(ii) Delineation of Ore Geometry and Construction of Ore Body

Preparation of Transverse Sections

Boreholes were displayed in SURPAC graphics window alongwith litho, Cr_2O_3%. Transverse sections were drawn across the strike of different chromite bands with the following details

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Band	Baseline orientation	Grid From/To	No. of Sections	Distance between adj. sections (m)
V	N57°E	500W-600E	12	100
IV-South	N57°E	750W-550E	27	50
III-South	N50°E	700W-550E	15	100
III-North	E-W	50W-25E	4	25
IV-North	N65°W	63E-213E	4	25

The ore envelopes were delineated at each section considering Cr_2O_3% cut-off of 10%. Two ore domains were considered for preparation of ore envelopes in the transverse sections with the following details.

Grade (Cr_2O_3 %)	Ore type
10% - 40%	Low grade
More than 40%	High grade

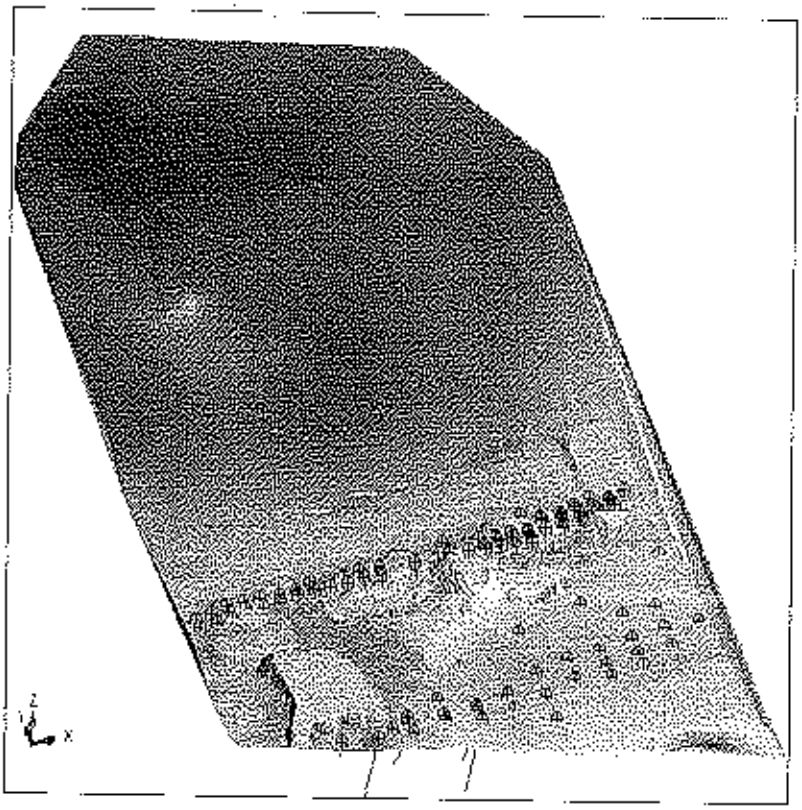
Since the ore body continues in further down-depth direction the transverse section should have been open towards the downward directions. But for ore-body modeling in the software, closed geological domain has to be considered. Hence string sections of ore were closed considering suitable influence of the borehole intercepts of ore.

Preparation of Digital Terrain Model (DTM) of Surface Topography

The digitized contour of updated surface plan with Z values have been transformed into digital terrain model (DTM) utilizing the principle of triangulation and wire framing of points with X, Y and Z co-ordinates. Digital terrain model is the most effective way of representing a surface in three dimensional computerized form. It is an important tool to calculate volume between two or more surfaces. The digital terrain model of surface topography with drill holes of Sukrangi deposit is shown in the figure below:-

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Digital Terrain Model (DTM) of Surface Topography with drill holes

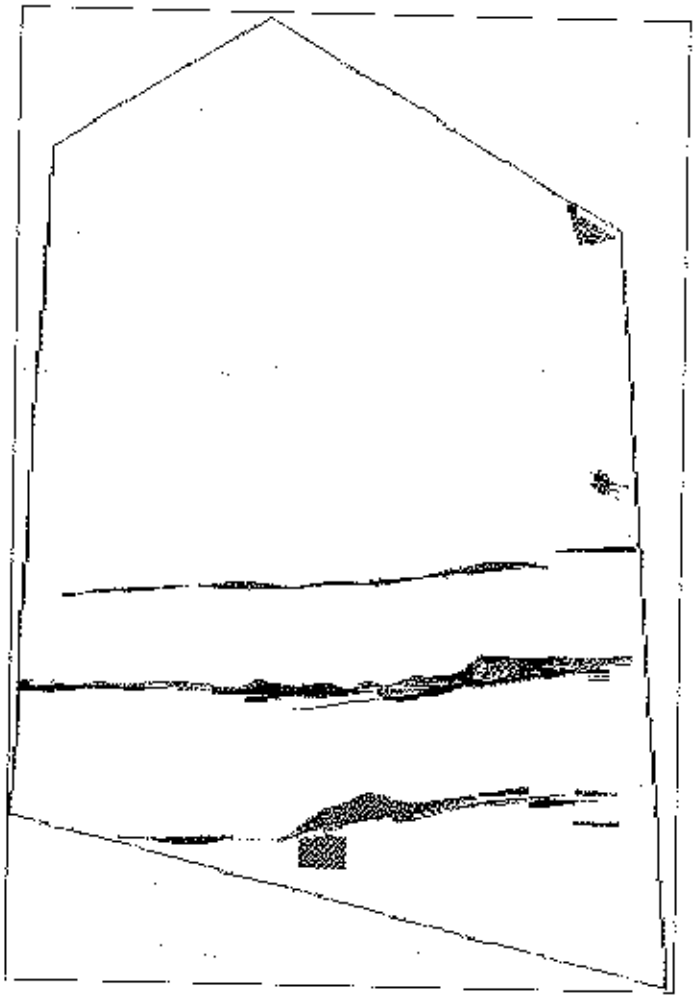


3-D Solid Modeling of Ore Body

The band wise ore zones of the respective transverse cross sections have been connected/ joined to form band-wise solid ore body models. Ore type-wise 3-D solid model of Sukrangi deposit is presented in the figure below:-

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Ore type-wise three dimensional solid model



(iii) Geo-statistical analysis (Variogram modeling)

The continuity of mineralization in different directions can be well judged through analysis of variograms. In addition, the range of influence of sample in different directions can be deciphered. A varoigram is evaluated with respect to sill, range and nugget effect. The variogram function is defined as follows,

$$\gamma(h) = 1/2n \sum [z(x+h) - z(x)]^2$$

where, n = Number of sample pairs at distance 'h'

$\gamma(h)$ = Variogram value at distance 'h'

Z(x) = Assay value at point x

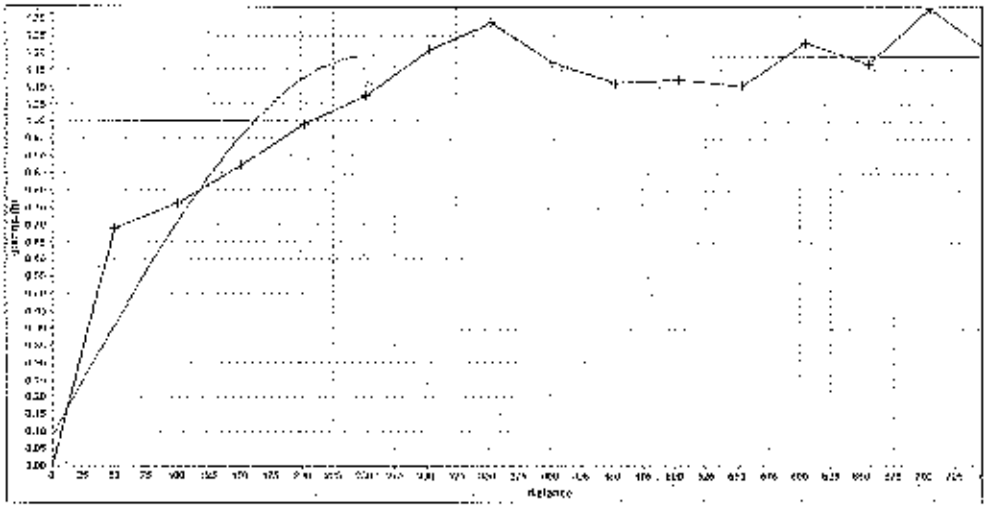
Z(x+h) = Assay value at point x+h

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The γ(h) is calculated for different distance pair 'h' and is plotted against distance pair. As the distance pair increases the γ(h) value also increases and levels off after certain distance pair. The distance pair at which the γ(h) value levels off is known as 'Range' beyond which samples become statistically independent without any correlation. This distance provides an idea of range of influence of a particular sampling point. The value of γ(h) at which the graph levels off is known as 'sill'. This value is related to the theoretical variance of the data set. 'Nugget' is the value of γ(h) at zero distance pair. The inherent variability of the data is represented by nugget. The deposit with zero or very low nugget effect possesses uniform grade distribution.

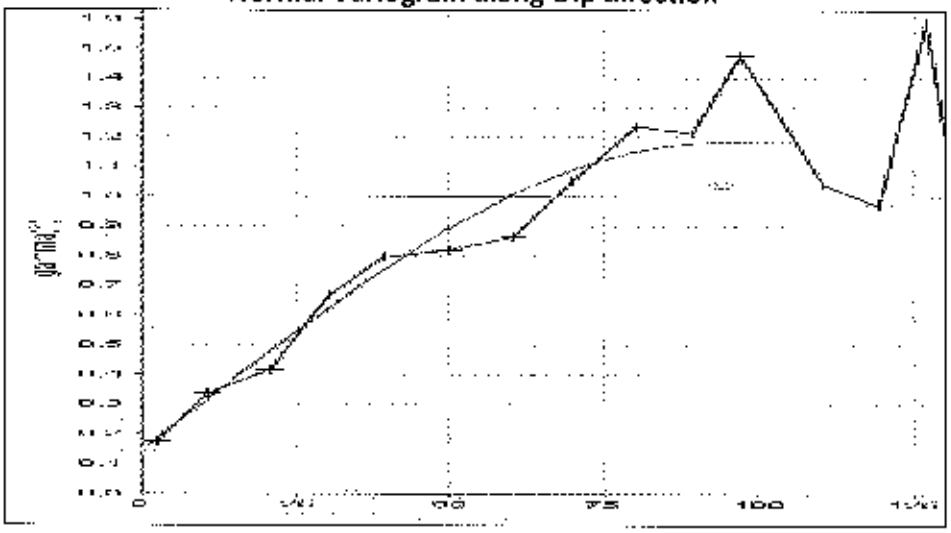
Variogram modeling has been carried out for determining the spatial variability of mineralisation & grade distribution in different directions. Composites (0.5m length) of each ore containing Cr2O3% were individually used for variogram modeling. In order to ascertain the variability of deposit of Sukrangi lease, composites all the samples of 0.5 m length within the leasehold were extracted & the normal variograms of composited assay data have been developed along strike & dip direction of the deposit and also along borehole depth. The fitted Variogram model along strike, dip and along the borehole direction of the deposit is shown in figures below. The variogram model parameter for the above directions is presented in the table below. Results of variogram modeling for above three directions for Sukrangi Chromite deposit is given in table below.

Normal Variogram along Strike direction

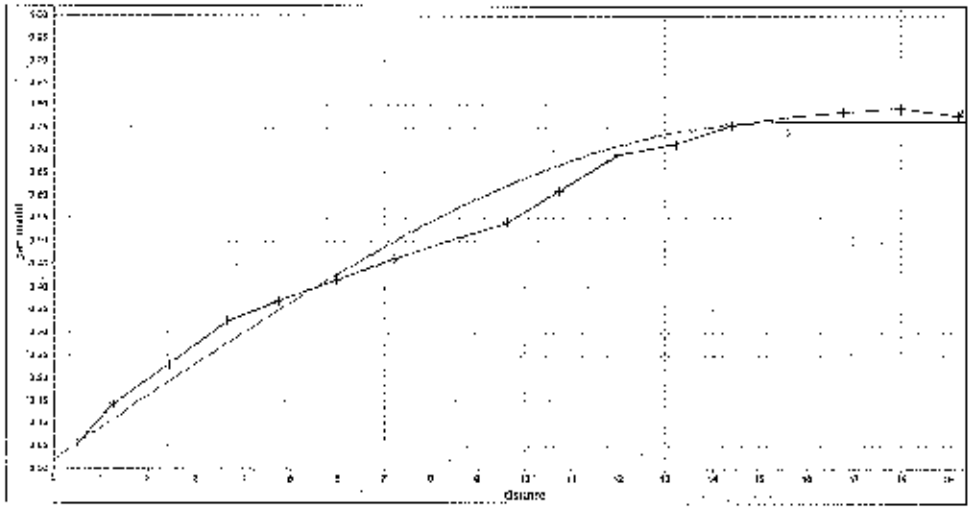


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Normal Variogram along Dip direction



Normal Variogram along down the hole



Variogram model parameters in three orthogonal directions

Sl. No.	Direction	Azimuth	Plunge	Spread	Lag	Maximum Distance
1	Along Dip Direction	0	-75	11.25	10 m	125 m
2	Along Strike direction	90	0	11.25	50 m	800 m
3	Along Borehole depth	180	-60	11.25	1 m	20 m

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Results of variogram modeling in three orthogonal directions

Sl. No.	Direction	Nugget	Sill	Range
1	Along Dip Direction	0.141996	1.039734	94.089
2	Along Strike direction	0.244677	1.105800	253.679
3	Along Borehole depth	0.019570	0.744354	15.606

Validation of Variogram

The variogram are then validated and used for further block modeling.

(iv) Block Modeling

The entire deposit is divided into no. of judiciously chosen sub-blocks for proper estimation of grade and quantity, keeping in view of the structural discontinuity of the deposit, extent etc. The estimated blocks in the block model has been used for optimum pit generation, mine planning and production scheduling.

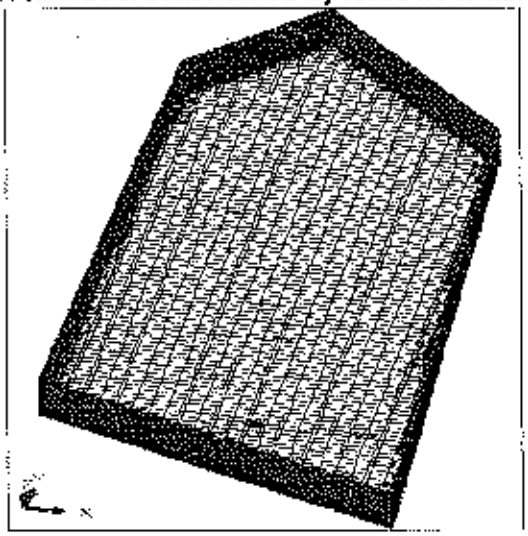
- Selection of Block Size

  Considering the accuracy desired, borehole spacing and mining constraints, a unit block of 1 m × 2 m × 1 m has been considered, in X × Y × Z directions, for block wise grade estimation.
- Development of Block Model

  In order to cover the entire extent of Sukrangi chrome ore deposit in three dimensions, a dummy block model with unit block sizes as indicated above have been generated. An constrained block model is shown in the figure below:-

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Block model constrained by lease boundary



- Addition of Attributes

  Attributes are the properties of individual block such as Cr_2O_3%, specific gravity, ore type etc. These attributes were added in the dummy block model using suitable technique.

- Application of Constraints

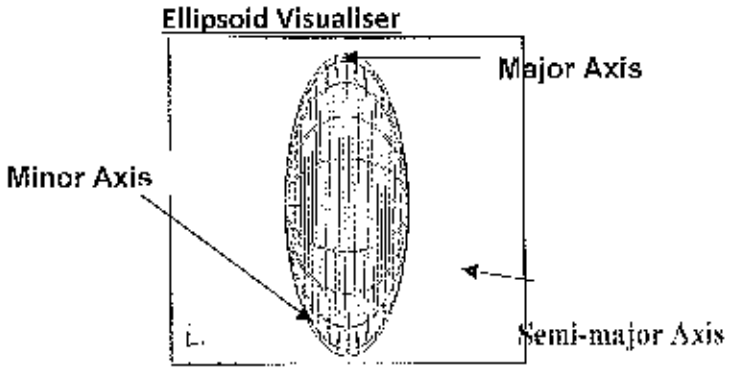
  Constraints are the logical combination of spatial operators and objects such as DTM of surface contour, solid model of ore zone, block etc. with which the block model can be enveloped/ intersected with respect to inside/ outside and above/ below their spatial position. *The block model developed for Sukrangi chrome ore deposit has been constrained with the surface DTM and updated pit positions, mining lease boundary, statutory safety barriers, individual quarry boundaries as well as ore type-wise 3-D solid models as developed and discussed in the preceding paragraphs.* In this way, the blocks have been enveloped within ore zone boundary and surface topography for the purpose of grade interpolation and reserves estimation.

- Block model estimation

  Block model estimation parameters such as anisotropic ratio, search distances etc. were derived from the results of variogram analysis discussed in previous para. Sukrangi chrome ore deposit is uniform in mineralisation. It is not erratic in behaviour. The coefficient of variation of

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grades in all the ores are low indicating uniform grade distribution and the deposit has also been explored at almost uniform grid along dip and strike direction, the globally accepted technique of Inverse Square Distance (ISD) method has been used for ore reserve estimation for different ore types. The parameters for reserve estimation have been derived from the statistical and geo-statistical analysis done previously. A search ellipsoid as indicated below has been used to select samples for assigning grade to the blocks. The axial parameters and its search orientation were derived from the results of geo-statistical analysis.



The tonnage factor for conversion of volume of solid into ore tonnage has been derived from the regression equation as described earlier.

Estimation of Reserve and Quality

For estimation resources the following parameters have been considered:-

Measured resources: -

- The entire exploratory drill holes with grid spacing of 100m X 100m & below has been considered as G1 category and has been categorized under 331 as per UNFC code.

The details of the reserves/ resources established at 10% Cr_2O_3 cut off for Sukrangi deposit as on 31.1.2014 is given in table below. The detailed calculation of the quarry-wise reserves/ resources established at 10% Cr_2O_3, cut off for Sukrangi deposit as on 31.1.2014 is given in Annexure 33.

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Resource type	Total tonnage at cut-off (+10% Cr_2O_3), million tons	Remarks
Measured mineral resources (331)	14.91/ 35.92% Cr_2O_3	All bands

Resource type	Total tonnage at cut-off (+30% Cr_2O_3), million tons	Remarks
Measured mineral resources (331)	8.63/ 47.81% Cr2O3	All bands

The Measured resources under different classes of land are given below:

Block	Total tonnage	Non Forest land	Forest land	
			Already Diverted	Remaining forest land
	(in Million Tons)			
All bands	14.91/ 35.92% Cr_2O_3	7.05/ 35.89% Cr_2O_3	7.69/ 35.84% Cr_2O_3	0.16/ 40.66 % Cr_2O_3

The Measured resources under mineable and non-mineable portions are (in Million Tons):-

Total tonnage	Mineable	Non Mineable					
		Stat. barriers	Below economic opencast UPL			Others (10-30% Cr_2O_3 mined but stacked)	Total
			Already diverted forest land	All remaining forest land	Non forest land		
14.91/ 35.92% Cr_2O_3	5.41/ 46.33% Cr_2O_3	0.04/ 27.84% Cr_2O_3	3.04/ 29.44% Cr_2O_3	0.10	4.12/ 22.14% Cr_2O_3	2.20/ 21.16% Cr_2O_3	9.50/ 30.02% Cr_2O_3

Feasibility Study was then carried out as enclosed in Annexure – 34 and the reserves/ resources classified thereafter (in Million Tons) for the G1 areas comprising of Band-IV-S&N, Band-III-S&N & part of Band-V are given below:-

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RESERVES				REMAINING RESOURCES				
Category	Quantity (Mineable)	Break-up land wise		Potentially Economic (Non-mineable)	Quantity	Constraints wise quantities		Remaining Measured Resources
Proved (111)	5.41/ 46.33% Cr_2O_3	3.55/ 45.57% Cr_2O_3	Diverted forest land	Feasibility Mineral Resources (211)	9.50/ 30.00% Cr_2O_3	7.26/ 32.67% Cr_2O_3	Below economic o/c Ultimate pit limit	Nil
		1.84/ 47.8% Cr_2O_3	Non-forest land)			0.04/ 27.84% Cr_2O_3	Lease barrier	
		0.02/ 46.64% Cr_2O_3	Un-diverted forest land			2.20/ 21.16% Cr_2O_3	Mined Sub grade	

* A recovery factor 99.5% can be applied on the economic mineable reserve which includes the reserves lost in the contact zones of ore in order to avoid dilution and termed as intercalated wastes.

In summary, the mineral resources reported as per the previous approved SOM was arrived at by deducting the production figures from the resource figures as reported in its immediate past scheme of mining. No any fresh estimates of the resources were carried out. Therefore, there was no separate estimate of the resources & reserves in the previous approved SOM. But, in the present SOM, the resources have been re-estimated at 10% Cr_2O_3 using state of the art software i.e. SURPAC by designing a three dimensional ore body model. All the boreholes sinked during the previous scheme (47 Nos.) along with the earlier sinked boreholes (144 Nos.) have been taken into consideration while re-designing the 3D-ore body model. The resources established were thereafter converted into reserves and remaining resources as per the standard UNFC guidelines as detailed in the chapter above.

The details of the exploration carried out during the previous scheme period with documentary proof indicating the order for the work, cost involved and payment details is given below:-

Name of the agency: Maheshwari Mining Pvt. Ltd.

Order for the work: The work order of the agency is enclosed as Annexure – 28.

Cost involved: The total cost involvement for the above work was Rs. 7.0 crores.

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Payment details: The payment detail as recorded in the SAP software and printed there from is also enclosed as Annexure – 28.

3.4 Category wise updated reserve with grade

Category wise updated reserves with grade are given in table 3.4.

(Table 3.4) Reserves as per UNFC classification (in tonnes and as on 1.3.2014)

Sl. No	Reserve Category (UNFC Classification)	Qty. (in Million Tons)	Grade (Cr_2O_3,%)
1	Proved Mineral Reserves (111)	5.41	46.33%
2	Probable Mineral Reserves (112)	NIL	NA
3	Feasibility Mineral Resource (211)	9.50	30.00%
	Feasibility Mineral Resource (212)	NIL	NA
4	Remaining measured resource (331)	NIL	NA
5	Indicated Resource (332)	NIL	NA
6	Inferred Resource (333)	NIL	NA
7	Reconnaissance Resource (334)	NIL	NA

3.5 Year-wise Exploration proposed during next 5 years period:

There is proposal to drill 66 boreholes with a total meterage of 17,150 during the next scheme period. The year wise details of the proposed boreholes to be drilled in different chromite bands is given in the following table. The same will be completed under rule 27(3) of MCR 1960.

CHROMITE BAND NO. V AND BARREN					
Proposed Borehole No	Location		Angle / Bearing N 33^{0}W	Proposed depth(m)	Year
	Cross section	L.S			
PBH-81	200E	109S	60^0	300.00	2014-15
PBH-82	200E	309S	60^0	300.00	
PBH-83	300E	209S	60^0	300.00	
PBH-84	400E	109S	60^0	300.00	
PBH-85	400E	309S	60^0	300.00	
PBH-86	500E	209S	60^0	300.00	
PBH-87	500E	409S	60^0	300.00	
PBH-88	600E	109S	60^0	300.00	
PBH-89	600E	309S	60^0	300.00	
PBH-90	600E	459S	60^0	300.00	
No. of Proposed Boreholes (10)			Total	3000 m	

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CHROMITE BAND NO. IV (SOUTH FLANK)

Proposed Borehole No	Location		Angle / Bearing	Proposed depth(m)	Year
	Cross section	L.S	S 33^{0}E		
PBH-39	550E(E11)	330N	60^0	300.00	2014-15
PBH-40	500E(E10)	320N	60^0	300.00	
PBH-41	450E(E9)	330N	60^0	300.00	
PBH-42	400E(E8)	320N	60^0	300.00	
PBH-43	350E(E7)	300N	50^0	300.00	
PBH-44	300E(E6)	300N	60^0	300.00	
PBH-45	200E(E4)	260N	60^0	300.00	
PBH-46	150E(E3)	240N	60^0	300.00	
PBH-47	100E(E2)	240N	60^0	300.00	
PBH-25	50E(E1)	180N	60^0	250.00	
PBH-26		250N	60^0	300.00	
PBH-27	00	270N	60^0	300.00	
PBH-28	50W(W1)	180N	45^0	200.00	2015-16
PBH-29		240N	60^0	300.00	
PBH-30	100W(W1)	210N	50^0	250.00	
PBH-31		260N	50^0	250.00	
PBH-32	150W(W3)	160N	50^0	200.00	
PBH-33		260N	50^0	300.00	
PBH-34	200W(W4)	200N	60^0	250.00	
PBH-35		250N	60^0	300.00	
PBH-36	250W(W5)	180N	60^0	250.00	
PBH-37		240N	60^0	300.00	
PBH-38	300W(W6)	220N	50^0	300.00	
PBH-48	350W(W7)	210N	60^0	300.00	
PBH-49	400W(W8)	220N	45^0	250.00	2016-17
PBH-50	450W(W9)	220N	60^0	300.00	
PBH-51	500W(W10)	210N	60^0	300.00	
PBH-52	550W(W11)	210N	60^0	300.00	
PBH-53	600W(W12)	220N	60^0	300.00	
PBH-54	650W(W13)	220N	60^0	300.00	
PBH-55	700W(W14)	220N	60^0	300.00	
PBH-56	750W(W15)	200N	50^0	300.00	
No. of Proposed Boreholes (32)			Total	9100 m	

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CHROMITE BAND NO.III(SOUTH FLANK)					
Proposed Borehole No	Location		Angle / Bearing S 40°E	Proposed depth(m)	Year
	Cross section	L.S			
PBH-69	500E(E10)	100N	50°	150.00	2017-18
PBH-70		150N	50°	200.00	
PBH-67	400E(E8)	120N	50°	150.00	
PBH-68		170N	50°	200.00	
PBH-66	300E(E6)	150N	50°	200.00	
PBH-65	100E(E2)	120N	50°	200.00	
PBH-64	100W(W1)	120N	50°	200.00	
PBH-63	300W(W6)	140N	50°	200.00	
PBH-61	500W(W10)	80N	50°	150.00	
PBH-62		130N	50°	200.00	
PBH-59	600W(W12)	80N	50°	150.00	
PBH-60		130N	50°	200.00	
PBH-58	700W(W14)	70N	50°	150.00	
PBH-57		120N	50°	200.00	
No. of Proposed Boreholes (14)			Total	2550 m	

PROVING OF CHROMITE BAND-III(NORTH FLANK) AND BARREN AREA TAKING THE NEW BASELINE					
Proposed Borehole No	Location		Angle / Bearing (N-S)	Proposed depth(m)	Year
	Cross section	L.S			
PBH-72	1200E	120S	45°	250.00	2018-19
PBH-71		320S	45°	250.00	
PBH-73	1100E	220N	45°	250.00	
PBH-74	900E	240N	45°	250.00	
PBH-75		00	45°	250.00	
PBH-76		200S	45°	250.00	
PBH-77	700E	200N	45°	250.00	
PBH-78	500E	440N	45°	250.00	
PBH-79	300E	560N	45°	250.00	
PBH-80	100E	480N	45°	250.00	
No. of Proposed Boreholes (10)			Total	2500 m	
Total no. of Proposed Boreholes (66)			Grand Total	17150 m	

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4.0 CONCEPTUAL MINING PLAN

The Sukrangi chromite mine comes under Category-A (Fully mechanized category) as per the IBM guidelines. The conceptual plan of Sukrangi lease has been prepared on the basis of the life of deposit. Conceptual mining plan has been prepared following the guidelines of IBM, keeping in view the present knowledge of the deposit, topography of the area, surface drainage pattern, mineable reserves available, mining technology and selection of the sites for waste disposal within the lease area etc.

From the six bands of chromite encountered in the Sukinda Valley the Sukrangi area consists of three sub parallel lodes. They are Band No. III, IV and V occupying different stratigraphic level. They are dipping sub – vertically towards N – W with pinch and swell structure.

(i) Band No – III

Chromite band No. III, of Sukrangi lease is the northern-most band. The average width of this band as exposed in the quarry section is around 1m and at places the maximum width observed is around 2.5m. The insitu ore body exposed in the quarries, within this band is brown, friable and medium grained.

(ii) Band – IV

The south flank of Chromite band No. IV is centrally located in the Sukrangi lease. This band consists of two lodes, out of which the southern lode of this band contains high Cr_2O_3 with high silica and maintains uniformity in grade at depth. The northern lode of this band contains low to medium Cr_2O_3 with low silica and fluctuates in grade towards depth. Both the lodes are friable in nature. In width, it ranges from 5m to 12m at surface and in depth it becomes thicker and ranges to around 21m wide. The strike direction of the ore body is N 55 deg. dipping at 50 deg. to 70 deg. towards North-West and becomes almost vertical at depth. Besides that, the ore bodies show pinch and swell structure both laterally and vertically. The ore body comprises of medium-grained friable ore with abundant inter-granular limonite, chlorite to massive colored talc and white crypto-crystalline silica, but at depth they become more homogenous and free from talcose material.

Band – V

Chromite band No. V consists of a single thick ore band running at the strike direction of N 55 deg. W for around 300 m. The dip is not clear in the exposed outcrop. Few trenches were driven across the trend of the ore body and the maximum exposed width of this ore body is recorded to be 11 m.

As per the geological ore body model prepared in the 'ore body modeling' software, the extent of the main lode characterized as band No. IV-S extends upto -44 mRL. On

(PK Bhattacharjee, Key Person)
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formulation of the ultimate pit upto -44 mRL keeping into consideration the lease boundary & safety zone of 7.5m, the stripping ratio arrived comes to a figure of around 17.7 cubic meters per tonne of ore. Therefore, on the basis of the existing cost of mining, processing cost of beneficiable grade chromite, overheads & sale price of the mineral the ultimate pit level has been optimized and accordingly the floor level of the optimized ultimate pit was fixed at 98 mRL. The stripping ratio achievable at this level is around 5.68 cubic meters per tonne of ore. The bench parameters considered for finalizing the ultimate pit limit taking into consideration the permission granted by DGMS under regulation 106 (2)(b) of the Metalliferous Mines Regulations 1961 for deep hole drilling & blasting with deployment of HEMM are given below:-

Bench height	: 6m	Bench width	: 11m
Bank slope angle	: 60 degrees	Overall pit slope angle	: 25 degrees.

In line to the ultimate pit designed for the main lode i.e. IV-S, ultimate pits have been finalized for all the remaining lodes i.e. band IV-N, band-III-N&S and band –V.

Life of Mine: The mine life of Sukrangi lease is around 41.6 years at the proposed exploitation rate of 0.13 Mt of ROM ore per year.

Disposal of Sub grade mineral: The sub-grade material generated in the range of 10-30% Cr_2O_3 will be stacked as external dumps at the year – marked places. A total of 2.2 Million tonnes of sub grade material @ 21.16% Cr_2O_3 will be generated up to the conceptual stage. The sequence of generation of sub grade materials is given in the table 4.1.

Table 4.1 (Sub grade generation upto Conceptual period)

Year	Sub grade	
	Qty., tonnes	Grade, % Cr_2O_3
2014-15	68740	20.21
2015-16	82904	22.97
2016-17	21958	22.78
2017-18	75686	21.13
2018-19	79781	23.25
Block year_19-24	139730	24.42
Block year_24-29	79761	24.83
Block year_29-34	55055	21.58
Block year_34-39	34308	21.65
2039 – Conc.	1560572	20.47
Total	2198495	21.16

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The stacks will be stacked as external dumps in the form of terraces with its individual terrace height as 20 m and in one lift only.

Waste Disposal: The waste generated during the course of mining operations will be stacked as external dumps. All the lodes continue to exist almost vertically at deeper levels. Though there is positive NPV to a depth of around -44 mRL in the main ore band No. IV-S (which is currently under production), but the stripping ratio achieved to the tune of 17.7 cubic meters per tonne to ore, poses a great problem for external dumping of waste. Accordingly, the economic pit limit has been fixed at 98 mRL at a stripping ratio of 5.68 cubic meters per tonne of ore, so that the area available at surface can be utilized for safe dumping. The selection of the dump sites for external dumping is on the basis of following criteria.

- All dump sites have been located outside the mineralized zone beyond ultimate pit limit.
- Topography features have been taken into account, particularly in the context of water drainage.
- The DGMS permission under regulation 106(2)(b) of the Metalliferous Mines Regulations 1961.

The sequence of generation of waste materials from al the lode bands existing within Sukrangi lease is given in table 4.2a.

Table 4.2a (Waste generation upto Conceptual period)

Year	Qty., cubic meters
2014-15	721954
2015-16	561784
2016-17	733888
2017-18	670526
2018-19	747714
Block year_19-24	2999562
Block year_24-29	3222582
Block year_29-34	6993906
Block year_34-39	4765082
2039 – Conc.	25863456
Total	47280454

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The designed capacity of external waste dumps at Sukrangi lease is 18.62 million cubic meter, in which 12.92 million cubic meter of waste generated from Sukrangi lease and 5.7 million cubic meter of waste to be brought from South Kaliapani lease has been planned to be dumped. Permission for stacking the waste inside the Sukrangi lease from South Kaliapani lease has already been obtained from the state government. A copy of the permission letter is enclosed as Annexure -22.

Therefore, out of 47.28 million cubic meters of waste proposed to be generated from the Sukrangi lease upto conceptual stage, only 12.92 million cubic meters can be accommodated inside the Sukrangi lease. The balance 34.36 million cubic meters needs to be further accommodated outside the lease hold area of Sukrangi lease during the conceptual period. Permission for the same will be duly acquired from the respective statutory agencies and subsequently the mining plan will be again modified. The waste during the scheme period will be dumped as external dumps at the respective destinations as shown in the table below. The detailed holding capacities of the respective dumps are given below:-

Table 4.2b (Waste dumping plan upto Conceptual period)

Waste Dump Destination	Waste Dump Location	Waste Quantity, cubic meters	Bottom RL	Top RL
WD1	Sukrangi Lease	1283738	170	210
WD2	Sukrangi Lease	5470532	142	202
WD3	Sukrangi Lease	2769459	132	192
WD4	Sukrangi Lease	3501694	195	255
Total		12919932		

The height & width of individual terraces will be 20 m with bank slope angle of 37° of individual lift for a total number of 3 lifts. The dumps will be compacted and afforested on the terraces as well as along the slopes after spreading a layer of top soil over it before rehabilitation. The location of these dumps is marked on conceptual plan. Dumps will be afforested to check against wash off and guarded with retaining walls at their toes along the lower contours. Following the retaining wall a garland drain will be developed for carrying water to the natural drainage system ultimately leading into the natural drainage pattern of the area. All the waste dumps will be rehabilitated on conceptual period by adequate plantation at the rate of 300 trees per hectare along the slopes as well as terraces so as to avoid any wash off. A total of 29000 saplings will be planted over the refuse dumps for their stabilization.

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A summarized table indicating the details like waste generation & waste dumping location during the scheme period are given in table 4.3.

(Table 4.3) Summary of material movement

Year	Total Qty., cubic meters	Waste Dump Destination	Waste Dump Location	Waste Quantity, cubic meters	Bottom RL	Top RL
2014-15	721954	WD1	Sukrangi Lease	721954	170	197
2015-16	561784	WD1	Sukrangi Lease	561784	170	210
2016-17	733888	WD2	Sukrangi Lease	733888	142	162
2017-18	670526	WD2	Sukrangi Lease	670526	142	174
2018-19	747714	WD2	Sukrangi Lease	453955	142	202
		WD3	Sukrangi Lease	293759	132	141

A total of 3,48,106 m^3 of topsoil will be generated from the freshly broken area which will be utilized for concurrent afforestation over the dumps & also for avenue plantation due to very low shelf life of the lateritic soils. The phase-wise generation of topsoil is given in table 4.4.

(Table 4.4) Top soil generation

Year	Top Soil Generation, In cu. m
2014-15	2591
2015-16	nil
2016-17	nil
2017-18	2564
2018-19	nil
2019-Conc.	342951
Total	348106

Exploration: There is proposal to drill 66 boreholes with a total meterage of 17,150 during the next scheme period. The year wise details of the proposed boreholes to be drilled in different chromite bands is given in para 3.5. The same will be completed under rule 27(3) of MCR 1960.

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Environmental monitoring: Noise, air, water and other environmental parameters will be monitored periodically to have a close check on the environmental pollution. Spraying of water on haul roads, dust arrester on drills, prevention of vibration by utilization of minimum quantity of explosive per delay, massive plantation along road and other areas will be taken up to restrict the nuisance caused by mining activities. The land use pattern at the end of conceptual period on the basis of current level of exploration data with proposed exploitation by opencast method only is given below in Table 4.5. The conceptual plan is shown in drawing No. MEC/10G9/11/16/11 and the conceptual section is shown in drawing No. MEC/10G9/11/16/10A TO 10D.

(Table 4.6) Land use in stages upto conceptual stage

S.No	Heads	Area, (Ha.)		
		Existing land use	Land use at the end of 5 year	Conceptual land use
1	Excavated area (Ultimate Pit)	21.25	26.82	142.81
2	Waste Dump	12.57	65.08	95.29
3	Mineral storage/ Sub grade	126.68	124.425	19.61
4	Infrastructure	41.80	6.99	8.36
5	Roads	4.56	5.52	1.54
6	Safety Zone	(26.25) *	(26.25) *	26.25
7	Untouched land & Nala	-	-	88.849
8	Total	206.86	228.835	382.709

*Note: Excluding * as shown in the above table.*

Studies will be conducted for underground development of the ore deposit. All necessary studies required for developing an underground mine in soft strata will be carried out followed with acquisition of permissions from the concerned statutory agencies for opening the mine by underground method. The post mining land use thereafter is given below:

Post mining land use	Area, Ha.
Partly backfilled and afforestated mined out voids	142.81
Other afforestated area	123.26
Roads	1.54
Remaining untouched areas	115.099
Total	**382.709**

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The excavated area will be partly backfilled from the existing waste dumps prevailing over the lease at that time and all proposed underground mine openings will be properly plugged from the surface. The top area of the pit will be fenced to prevent any inadvertent movement of persons into the area. The infrastructure built up will be de-commissioned and the total area covered under refuse dumps, mineral storage and infrastructure will be afforestated by plantation of a total no. of 29000 saplings. At the post mining stage the area will have partly backfilled mined out voids surrounded from all the sides by plantation and dense avenue plantation.

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5.0 MINING

5.1 Salient description of present mining method:

The Sukrangi Chromite mines comes under Category-A (Fully Mechanized category) as per the IBM guideline. The deposit is worked by opencast mining method with formation of benches. Working benches are kept 6 m high and minimum 11 m wide. The conventional mining method deploys use of 115 mm diameter drills and blasting with low density (LD) cartridge explosives. 15-25 t capacity dumper/ tipper with matching capacity hydraulic excavators/ loaders for loading and transportation of ore to sale plots and transportation of waste/ sub grade materials to their respective dumps/ stock yards have been envisaged in this scheme of mining.

In general the stratum is very soft however, occasional drilling & blasting is being carried out in the hard strata only for improved fragmentation and as per the requirement of the customers. For the purpose of carrying out drilling, 115 mm diameter down the hole (DTH) blast-hole drills are deployed. The drilling pattern for 115 mm diameter holes is at a burden of 2m and spacing of 3m. The bench height has been kept at 6 m. Therefore keeping into account the factor for sub grade drilling & extra drilling to take care of hole collapse, the depth of the hole is around 6.5 m.

Around 2.5-4 cubic meters bucket capacity hydraulic excavators (diesel powered) is being used in conjunction with 15-25t dumpers. The ROM is being segregated at the mining face itself as ore/ beneficiable ore/ sub-grade ore depending into the content of Cr_2O_3 in it. If the Cr_2O_3 content in the ore is more than 40% it is being considered into direct ore, if the Cr_2O_3 content in the ore is between 30-40% it has been considered into beneficiable ore and if the Cr_2O_3 content in the ore is in between 10-30% it is being considered as sub grade ore. Accordingly the ore is being stacked into their respective stacking plots. Waste & sub grade materials generated is being transported to their respective dumping/ stacking locations. Front end loader of around 1.5-3.0 cubic meters bucket capacity is being deployed to load the ore/ beneficiable grade ore from the respective stacking plots.

Regular sampling of the ore at mine face itself is being carried out for on-face segregation of ore/ beneficiable grade ore & sub grade ore. As per the permission granted by DGMS under regulation 106(2)(b), the bench configurations adopted at Sukrangi chromite mine is given below:-

Height	: 6 meters
Min. working width	: 11 meters
Bank slope angle	: 60 deg.
Ultimate pit slope angle	: Below 25 deg.

The dimension of the existing quarry is approx. 750m x 350m.

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The present quarry limit extends from -400E to 400E & -106N to 290N and pit floor is at 158 m RL.

5.2 Yearly pit-wise development plan proposed for the next five years, depicted on plans and sections:

5.2A At the end of FY 2014-15

Year wise pit development & production plan at the end of FY 2014-15 is shown in drawing No. MEC/10G9/11/16/5. The sections of this pit are shown in drawing No. MEC/10G9/11/16/10F. The quantum of ore raised vis a vis the quantum of sub grade & waste generated is shown in Table 5.2a.

(Table 5.2a) ROM and Waste removal for the FY 2014-15

Band to be mined	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
IV-S	114176	46.21	16493	33.54	130669	44.56	68740/ 20.21%	657	200066/ 36.19%	721954	3.61

The calculation sheet indicating the details of calculations of ore, sub grade and waste for the FY 2014-15 is shown in Annexure-33.

5.2B At the end of FY 2015-16

Year wise pit development & production plan at the end of FY 2015-16 is shown in drawing No. MEC/10G9/11/16/6. The sections of this pit are shown in drawing No. MEC/10G9/11/16/10F. The quantum of ore raised vis a vis the quantum of sub grade & waste generated is shown in Table 5.2b.

(Table 5.2b) ROM and Waste removal for the FY 2015-16

Band to be mined	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
IV-S	103705	47.25	25919	34.07	129624	44.56	82904/ 22.97	651	213179/ 36.16%	561784	2.64

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The calculation sheet indicating the details of calculations of ore, sub grade and waste for the FY 2015-16 is shown in Annexure-33.

5.2C At the end of FY 2016-17

Year wise pit development & production plan at the end of FY 2016-17 is shown in drawing No. MEC/10G9/11/16/7. The sections of this pit are shown in drawing No. MEC/10G9/11/16/10F. The quantum of ore raised vis a vis the quantum of sub grade & waste generated is shown in Table 5.2c.

(Table 5.2c) ROM and Waste removal for the FY 2016-17

Band to be mined	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
IV-S	120104	48.03	9695	35.3	129799	47.02	21958/ 22.78	652	152409/ 43.52	500203	3.28

The calculation sheet indicating the details of calculations of ore, sub grade and waste for the FY 2016-17 is shown in Annexure-33.

5.2D At the end of FY 2017-18

Year wise pit development & production plan at the end of FY 2017-18 is shown in drawing No. MEC/10G9/11/16/8. The sections of this pit are shown in drawing No. MEC/10G9/11/16/10F. The quantum of ore raised vis a vis the quantum of sub grade & waste generated is shown in Table 5.2d.

(Table 5.2d) ROM and Waste removal for the FY 2017-18

Band to be mined	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
IV-S	121152	48.28	8801	33.43	129953	47.21	75686/ 21.13	653	206292/ 37.64	670526	3.25

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The calculation sheet indicating the details of calculations of ore, sub grade and waste for the FY 2017-18 is shown in Annexure-33.

5.2E At the end of FY 2018-19

Year wise pit development & production plan at the end of FY 2018-19 is shown in drawing No. MEC/10G9/11/16/9. The sections of this pit are shown in drawing No. MEC/10G9/11/16/10F. The quantum of ore raised vis a vis the quantum of sub grade & waste generated is shown in Table 5.2e.

(Table 5.2e) ROM and Waste removal for the FY 2018-19

Band to be mined	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
IV-S	97403	48.74	31722	33.61	129125	44.97	79781/ 23.25	649	209555/ 36.70	747714	3.57

The calculation sheet indicating the details of calculations of ore, sub grade and waste for the FY 2018-19 is shown in Annexure-33.

5.3 Year wise production plan proposed for next five years along with grade blending proposal, if any, may be indicated.

The year-wise quantum of ore & waste proposed to be excavated during the scheme period is shown in Table 5.3.

(Table 5.3) Overall Targets for ROM and Waste removal

Year	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
2014-15	114176	46.21	16493	33.54	130669	44.56	68740/ 20.21%	657	200066/ 36.19%	721954	3.61

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Year	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-calated waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
2015-16	103705	47.25	25919	34.07	129624	44.56	82904/ 22.97	651	213179/ 36.16%	561784	2.64
2016-17	120104	48.03	9695	35.3	129799	47.02	21958/ 22.78	652	152409/ 43.52	500203	3.28
2017-18	121152	48.28	8801	33.43	129953	47.21	75686/ 21.13	653	206292/ 37.64	670526	3.25
2018-19	97403	48.74	31722	33.61	129125	44.97	79781/ 23.25	649	209555/ 36.70	747714	3.57

5.4 Any change in proposed method of mining and deployment of machinery, together with reasons thereof.

It has been planned to operate the Sukrangi chromite mines with the proposed fleet of mining machineries as given in table 5.4.

(Table 5.4) Proposed Fleet of Major HEMM & Auxiliary Mining Equipment

HEMM	Proposed Fleet, Nos.
Hydraulic Excavator, 2.5 – 4 cubic meters	3
Loader, 1.5-3.0 cubic meters	1
Dumper, 15-25t	11
Drill, 115mm	2
Compressor, 450cfm	2
Dozer, D-155 Equivalent (for mine/ dump/ stockpiles)	1
Explosive van, 1t	1
Water tanker, 10 KL	2
Ambulance	1
Road grader	1

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The details of the calculations for major HEMM are given in tables 5.5 to 5.8.

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(Table 5.5) Drilling Fleet Calculation

S.No.	Parameters	Ore	Waste	Remarks
1	Drill diameter, mm	115	115	Only 20% of the total wastes require drilling & blasting
2	Annual running hours	1800	1800	
3	Burden,m	2	2	
4	Spacing, m	3	3	
5	Average Bulk density, t/cubic meters	2.5	2	
6	Drill factor, T/m *(3x4x5)*	15	12	
7	Drill meterage, m/hr.	12	12	
8	Productivity per drill per year, Lt *(6x7x2)*	3.24	2.59	
9	Max. handling,Lt	2.1	2.24	
10	Drills required to operate, Nos. *(9/8)*	0.65	0.87	
11	% Availability	0.75	0.75	
12	Drill machines required, Nos.	0.86~ 1No.	1.15~ 1No.	

(Table 5.6) Excavator Fleet Calculation

S.No.	Parameters	Ore	OB
1	Annual running hours	3000	3000
2	Productivity, tph	300	300
3	Production per m/c per year, Lt *(1 x 2)*	9	9
4	Max. handling, Lt	2.1	11.21
5	Exc. required to operate, Nos. *(4/3)*	0.23	1.25
6	% Availability	0.75	0.75
7	Excavators required, Nos.	1	2

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(Table 5.7) Dumper Fleet Calculation

S.No.	Parameters	Ore	OB
1	Payload, t	20	20
2	Annual running hours	3000	3000
3	Productivity, tph @2.5 km lead (one way)	60	60
4	Production per m/c per year, Lt *(2x3)*	1.8	1.8
5	Max. handling, Lt	2.1	11.21
6	Dumpers required to operate, Nos. *(5/4)*	1.17	6.23
7	% Availability	0.75	0.75
8	Dumpers required, Nos.	1.6~2Nos.	8.3~9Nos.

(Table 5.8) Loader Fleet Calculation

S.No.	Parameters	Ore
1	Purpose	For loading of ore (dispatch)
2	Annual running hours	3000
3	Productivity, tph	150
4	Production per m/c per year, Lt *(2x3)*	4.5
5	Max. handling, Lt	1.3
6	Loaders required to operate, Nos. *(5/4)*	0.29
7	% Availability	0.75
8	Loaders required, Nos.	0.39 ~ 1No.

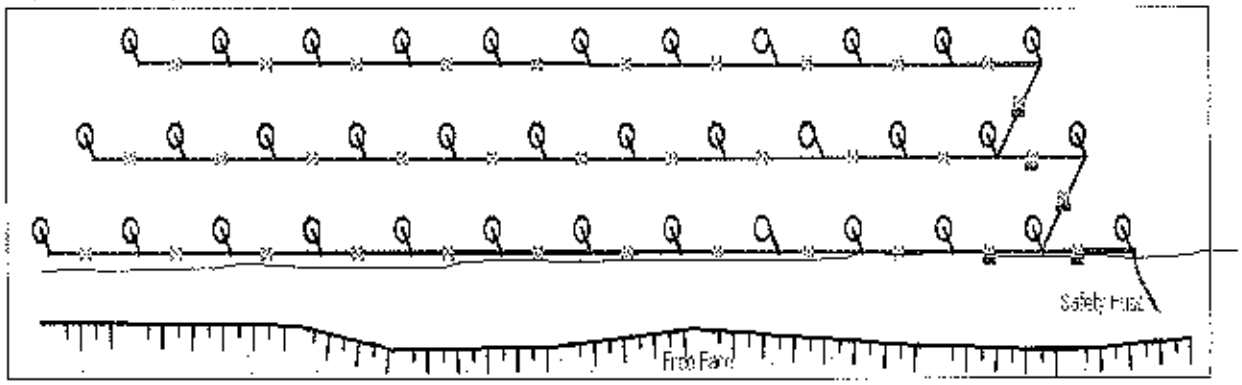
The blast design configuration for Sukrangi mines is given below:-

S.No.	Parameters	Value
1	Drill diameter, mm	115
2	Burden, m	2
3	Spacing, m	3
4	Average Bulk density, t/cubic meters	2.5
5	Yield, T/m *(3x4x5)*	15
6	Bench height, m	6
7	Hole depth, m	6.5
8	Charge length, m	2.9
9	Deck, m	1.5
10	Stemming length, m	2.1

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S.No.	Parameters	Value
11	Loading Density, kg/m	11.42
12	Charge per hole *(11x8)*	33.11
13	Production per hole *(5x6)*	90
14	Max. handling, Lt	4.5
15	No. of holes required/ yr. *(14/13)*	5000
16	Freq. of blast per week	3
17	Nos. of holes/ blast	39
18	Production per blast, t (17x13)	3510
19	Charge per blast, kgs, (12x17)	1292
20	Charge per delay, kgs	97.8
21	Powder factor, T/cubic meters, (18/19)	2.8
22	Delay interval	25/ 50 ms

Typical firing pattern for above design is given below.



NONEL is also being used occasionally in the mines in place of cord relays.

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6.0 Handling of mine waste & separate stacking of sub grade mineral:

The mine waste and sub grade mineral generated during the course of mining operations has been planned to be dumped/stacked separately in respective dumps in the Sukrangi lease. These materials will be dumped at their respective earmarked places inside Sukrangi lease.

However, during the year 2014-15 some waste from South Kaliapani lease will also be dumped inside the Sukrangi lease. The dumps shall be formed by retreating method of dumping so as to facilitate early reclamation. Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

Year	Waste generated, in cubic meters	Lease		Location where the waste will be disposed, along with its name & quantity disposed in cu.m
		From where it is generated	To where it is disposed	
2014-15	721954	Sukrangi	Sukrangi	WD1 – 721954
	2731963	South kaliapani	Sukrangi	WD1' -2731963
2015-16	561784	Sukrangi	Sukrangi	WD1-561784
2016-17	733888	Sukrangi	Sukrangi	WD2-733888
2017-18	670526	Sukrangi	Sukrangi	WD2-670526
2018-19	747714	Sukrangi	Sukrangi	WD2-453955 WD3-293759

Year wise total quantity of sub grade proposed to be generated with their location of disposal is given below:-

Year	Sub grade generated, in tonnes	Lease		Location where the waste will be disposed, along with its name & quantity disposed in tonnes
		From where it is generated	To where it is disposed	
2014-15	68740	Sukrangi	Sukrangi	SGD1-68740t
2015-16	82904	Sukrangi	Sukrangi	SGD1-82904t
2016-17	21958	Sukrangi	Sukrangi	SGD1-21958t
2017-18	75686	Sukrangi	Sukrangi	SGD1-75686t
2018-19	79781	Sukrangi	Sukrangi	SGD1-79781t

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6.1 Rate of yearly generation of waste and proposal for disposal for next 5 year:

Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

Year	Waste generated, in cubic meters	Lease		Location where the waste will be disposed, along with its name & quantity disposed in cu.m
		From where it is generated	To where it is disposed	
2014-15	721954	Sukrangi	Sukrangi	WD1 – 721954
	2731963	South kaliapani	Sukrangi	WD1' -2731963
2015-16	561784	Sukrangi	Sukrangi	WD1-561784
2016-17	733888	Sukrangi	Sukrangi	WD2-733888
2017-18	670526	Sukrangi	Sukrangi	WD2-670526
2018-19	747714	Sukrangi	Sukrangi	WD2-453955 WD3-293759

The year-wise plan & sections of the waste dumps have been shown in drawing No. MEC/10G9/11/16/12.

6.2 Built up of dumps from year to year to be shown in yearly plans and sections with description of the method & manner of disposal of waste rock, designed capacity & height of individual dumps, and precautions envisaged for confinement of the dumps together with design details of the protective works.

All the dumps will be formed be retreating method of dumping, so as to facilitate early reclamation. The height of the individual terrace will be 20 m and the maximum height of the dump will be limited to 60 m. The bank slope angle considered for designing the dump is 37 degrees and the overall slope angle of the dumps are below 25 degrees. The details of the proposed waste dumps, their designed capacity, year-wise built with top/ bottom RL/ height attained with number of terraces are given in the table below:-

Year	Waste Dump No.	Designed cap. In cubic meters	Qty. to be dumped in cubic meters	Dump Bottom RL	Dump Top RL	Total height	Terrace height
2014-15	WD1	1283738	721954	170	197	27m	1st terrace- 20 m 2nd terrace – 7 m
	WD1'	4697239	2731963	140	166	26m	1st terrace- 20 m 2nd terrace – 6 m
2015-16	WD1	1283738	561784	170	210	40m	1st terrace- 20 m 2nd terrace – 20 m

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Year	Waste Dump No.	Designed cap. in cubic meters	Qty. to be dumped in cubic meters	Dump Bottom RL	Dump Top RL	Total height	Terrace height
2016-17	WD2	1858369	733888	142	162	20m	1st terrace- 20 m
2017-18	WD2	1858369	670526	142	174	32m	1st terrace- 20 m 2nd terrace – 12 m
2018-19	WD2	1858369	453955	142	202	60m	1st terrace- 20 m 2nd terrace – 20 m 3rd terrace-20m
	WD3	293759	293759	132	141	9m	1st terrace- 9 m

The details of the protective measures envisaged for the dump with year wise proposed reclamation/ rehabilitation measures are given below:-

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits	Proposed reclamation measures
2014-15	WD1	92 m	92 m	-	-
	WD1'	609 m	900 m	1 No.	-
2015-16	WD1	"	-	-	WD1 will be completely afforestated by the end of 2015-16.
2016-17	WD2	609 m (common with WD1')	900 m (common with WD1')	1 No. (common with WD1')	-
2017-18	WD2	-	-	-	-
2018-19	WD2	-	-	-	WD2 will be completely afforestated by the end of 2018-19.
	WD3	-	243 m	-	-

The existing dumps will come within the conceptual pit and accordingly these dumps will be re-handled at the ultimate stage. Protective measures like retaining walls/ garland drains have already been provided around these existing dumps. However, it has been proposed to plant 2500 Nos. of saplings over these dumps during the scheme period.

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Depending upon the drainage pattern of the area where the dump is located, retaining walls, garland drain with settling tanks will be provided in all the dumps..The year wise plans & sections of all the dumps are given in drawings No. MEC/10G9/11/16/12.

The garland drains will be dug around 1 m beneath the adjoining contour level at the lower peripheral areas of the dump. The width of the drains shall be around 1.5 m. The settling tanks will be located at the outlet of the garland drains. It will of around 3m length with three compartments of around 1m width to arrest the suspended solids followed with the chamber to arrest any oil particles. The last chamber shall contain the clean water which will be ultimately discharged. The retaining walls will be of 1m height and 1m width at the top and around 1.2m at the base. The material of construction shall be RCC. The design detail of the retaining wall & settling tank is shown in Annexure -37. Similarly, the details of the proposed sub grade dumps, their designed capacity, year-wise built with top/ bottom RL/ height attained with number of terraces are given in the table below:-

Year	Subgrade Dump No.	Designed cap. In t	Qty. to be dumped in t	Dump Bottom RL	Total height
2014-15	SGD1	3,30,000	68740	162	1.5m
2015-16	SGD1	3,30,000	82904	162	2.5m
2016-17	SGD1	3,30,000	21958	162	3.0m
2017-18	SGD1	3,30,000	75686	162	3.0m
2018-19	SGD1	3,30,000	79781	162	5.5m

A retaining wall has already been provided around the periphery of the proposed sub grade dump.

6.3 **Quantity and grade of sub-grade material available at the mine as on date**

The total quantum of sub grade mineral (earlier classified as <40% Cr_2O_3) lying is around 75000 tonnes (approx.)

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7.0 USE OF MINERALS

7.1 Changes proposed in the use of mineral, If any, with reasons and changes in the specification, if any, imposed by the user industries

No change is proposed in the use of mineral. The mine is supposed to produce high grade ore for Metallurgical purpose, medium grade ore for charge chrome/ ferro-chrome manufacturing and sub grade ore which is being upgraded by beneficiating it in a plant located within the adjoining S/ Kaliapani lease of M/s OMC itself.

7.2 Efforts made to utilize sub-grade minerals including fines.

The sub grade materials (10-30% Cr_2O_3) generated from the lease will be stacked at their respective stacking place. These dumps will be provided with retaining walls, garland drains/ settling tanks depending upon the drainage pattern of its located area.

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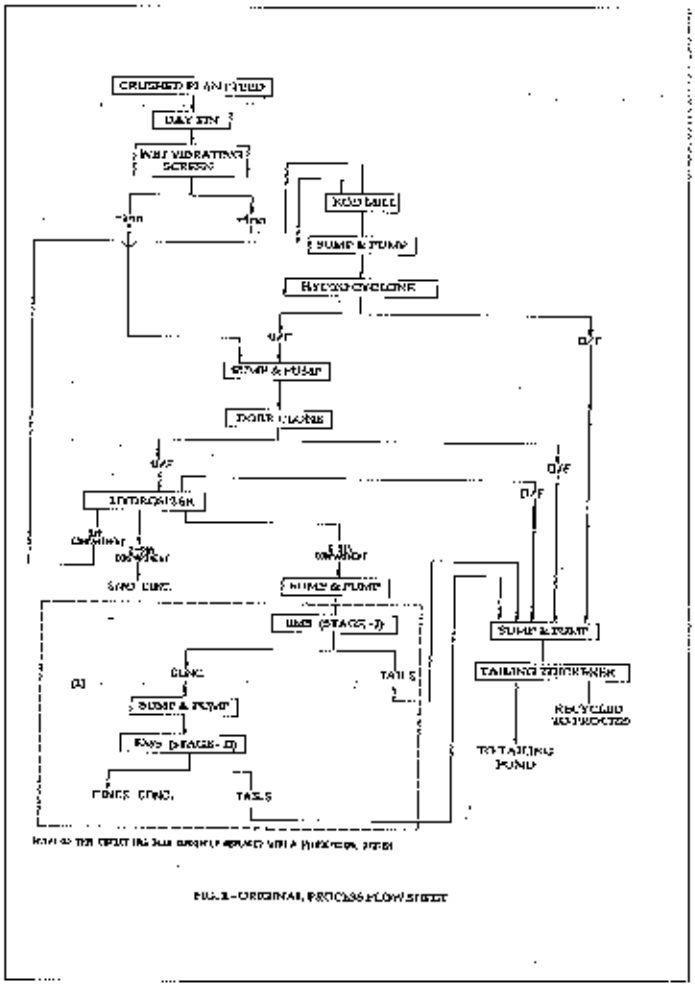
8.0 MINERAL BENEFICIATION

8.1 Results of any beneficiation investigations conducted and changes made in existing mineral beneficiation plant and tailing disposals, if any, with benefits expected (necessary flow - sheet and tailing dam designs etc. to be submitted as applicable).

The existing Chrome Ore Beneficiation (COB) Plant of Odisha Mining Corporation Limited at South Kaliapani, Jajpur district, Odisha, was commissioned in April 1995 to produce saleable concentrates by upgrading the low-grade ore. The plant was designed to treat annually 150,000 tons (dry basis) of ore analyzing about 33% Cr_2O_3 and produce coarse and fine concentrates with 50-52% and 51-53% Cr_2O_3 content respectively. The design parameters were developed based on beneficiation study carried out at the mineral processing laboratory of Bhaba Atomic Research Centre (BARC), Hyderabad.

In the plant, the feed material crushed to 18mm, is wet screened at 1mm. The screen oversize is ground to D80 150µm/d100 300µm in close circuit operation with a hydro-cyclone. The composite product comprising cyclone underflow and screen undersize material is de-slimed at about 20-30µm in a cluster of hydro-cyclones. The de-slimed product obtained as hydro-cyclone underflow is treated in hydro-sizer, a multi-compartment teeter-bed separator (TBS). The top size of +300µm from the first compartment of the hydro-sizer is recycled to the grinding mill. The coarse fraction obtained from the 2nd to 5th compartment is the final product of 46-48% Cr_2O_3. The fines obtained from 6th to 9th compartment product of the hydro-sizer and analyzing about 38-40% Cr_2O_3 was to be treated in Bartles Mosley Separator (BMS) for production of fine concentrate. However, the BMS could not be made to work properly and hence, for some recovery of the fines material, OMC provided hydro-cyclones in its place. Both sand and fine concentrates are dewatered in pan filters and stacked in ground stockpile. The original flow sheet is shown below:-

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Modification work was required in this COB plant to enable attainment of desired grade of product (50-52 % Cr_2O_3) with optimum recovery in coarse and fine concentrates. For this purpose, open circuit operation of the rod mill is planned to be converted to close circuit operation, as per the original flow-sheet, by replacing the existing cyclone with a suitable cyclone. This step is envisaged to obtain the ground product in a controlled size of d80 150µm required for a reasonable degree of liberation. In addition, the coarse product from 2nd to 5th compartment of the Hydro-sizer, which is collected in the coarse product sump, will be pumped to a bank of twin-start coarse spirals. The concentrate from these spirals will be collected in a new sump, from where it will be pumped to the existing coarse concentrate filter to obtain the desired coarse concentrate product. The tailings from these spirals will be collected in the existing tailings sump.

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The flow sheet indicating the material & water balance of the COBP alongwith the modifications proposed in the existing COBP is enclosed as Annexure - 30.

Tailing management for the present COBP: The tails generated from this COB plant is being discharged at the abandoned Quarry-1 which partly falls within the South Kaliapani lease and partly in the adjoining & contiguous Kaliapani lease of M/s OMC itself and water required for the process is being met from the abandoned Quarry-2. The top RL of Quarry-1 (where tailings are being discharged) is at around 132.4 meters where as the top RL of the tails deposited is at around 123.4 meters. The water level of the tailings is presently at 117.2 mRL.

After successful operation of the above plant, OMC decided to install another COB Plant, near to the existing COB plant, to treat annually 1,50,000 tons (dry basis) chrome ore with grade 30-35% Cr_2O_3 to produce a high grade concentrate. OMC has awarded the above job to the EPC contractor Humboldt Wedag (later merged with McNally Bharat) on turnkey basis and has engaged M. N. Dastur & Company, Kolkata as Consultant. The project is in advance engineering stage and construction work is going on at Kaliapani site which is expected to be completed by September 2014.

Description of the New Chrome Ore Beneficiation (COB) Plant:

The run of mine chrome ore will be treated in the beneficiation plant to produce concentrates. The beneficiation plant tailings will be discharged into a tailings pond. The friable ferruginous type sub grade ore received from nearby South Kaliapani and Sukrangi mines will be used as feed for the proposed beneficiation plant to produce composite concentrate of 72,000 tons (annually on dry basis) with 52% Cr_2O_3.

The beneficiation plant will be located at a right angle orientation to the existing plant building and will consist of four major sections – (a) Crushing & storage section (b) Washing & grinding section (c) Concentration section and (d) Dewatering & stockpiling section. The chrome ore of -300mm size will be directly dumped into a hopper. The ore will be drawn out from the hopper to feed a vibrating grizzly to scalp out the -18mm fraction. The grizzly oversize will be fed to a hammer mill and the crushed and scalped product will be collected in a crushed ore Storage Bin.

The crushed ore will then be scrubbed in a drum scrubber and will be fed to a wet vibrating screen of 1mm aperture. The -1mm screen undersize will be cleaned in a spiral classifier and the rake classifier sand along with +1mm fraction obtained as screen oversize will be fed to a rod mill, in close circuit with a classifying hydro-cyclone for reducing feed ore to d80 size 150µm. Underflow from the classifying hydro-cyclone will be recycled to the rod mill. The ground product obtained as overflow of close circuit

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hydro-cyclone will be further treated in a de-sliming cyclones. Underflow of de-sliming hydro-cyclone will be fed to a hydro-sizer and overflow will be collected in the tailings sump. Overflow of spiral classifier will be fed to a set of hydro-cyclones followed by tabling for further processing.

Underflow of the de-sliming hydro-cyclones will be fed to a two (2) stage hydro-sizer and will be classified for obtaining coarse, medium and fine fractions. The stray plus 300 µm fraction obtained from this equipment will be re-circulated to rod mill by gravity for size reduction. The coarse product from hydro-sizer will be processed in spiral concentrator to obtain concentrate and tails. The concentrate will be collected in concentrate sump and tails from the same will be directly sent to tailings sump.

The medium fraction will be treated in spiral concentrators for further up-gradation. Concentrate thus produced will be collected in composite concentrate sump and the tails will be discharged. Middling from spiral concentrators will be reground for further liberation in a regrinding mill and, then treated in a pair of wet tables to obtain concentrate, middling and tailings fractions. Concentrate and middling fractions will be collected in the composite concentrate sump, when the ore from South Kaliapani mine is being treated. While treating the ore from Sukrangi mine, only concentrate will be discharged to composite concentrate sump and the middling fraction will be diverted to the tailings sump.

After de-sliming with hydro-cyclones, fine fraction and overflow of hydro-sizer will be treated in a spiral concentrator. While treating the ore form Sukrangi mine, the concentrate will be transported to the composite concentrate sump and the middling fraction with tailings will be sent to the tailings sump. During, the processing of South Kaliapani ore, the concentrate and middling fraction will be collected in the composite concentrate sump and the tailings will be collected in the tailing sump.

The overflow of the spiral classifier will be treated in de-sliming hydro-cyclones. The overflow of the hydro-cyclones will be directly fed to the tailing sump and the underflow of the same will be treated in a pair of wet vibrating tables. The concentrate and tailings will be collected in the concentrate sump and tailings sump respectively. Composite concentrate and tailing from the respective sump will be processed for dewatering.

Concentrate will be pumped from concentrate sump to a concentrate thickener and thickened concentrate slurry containing about 50 per cent solid will be fed by thickener underflow pumps to a horizontal pan filter. The filter cake obtained from the filter will be delivered to ground stockpiles through belt conveyor. The filtrate will be collected in a RCC tank located adjacent to the thickener, along with thickener overflow water. Water from this tank will be pumped to a ground water storage tank to recycle to the system.

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Tails from tailings sump will be pumped to a tailings thickener. Water recovered from tailings thickener will be recycled to the plant and thickened tailings will be pumped to tailings pond.
The flow sheet indicating the material & water balance for the proposed process is enclosed as Annexure – 31 & 32.

Tailing management for the proposed COBP: The tailings from the proposed COB plant will be discharged at the southern end of the South Kaliapani lease. OMC has already carried out the detailed topographical survey of the area and has very recently completed the geo technical investigations required for designing the tailing pond. The basic engg. document for preparing the tailing pond will commence very soon.

8.2 Beneficiation test done, if any, on sub-grade mineral including fines and proposals for installation of new or additional beneficiation facility, if any (furnish process details in brief along with expected tailings loss).

No beneficiation is being carried out of the sub grade minerals generated between 10-30% Cr_2O_3. However, the same will be carried out in due course through a repute agency.

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9 ENVIRONMENT MANAGEMENT PLAN

Environment plan of the mine has been prepared and depicted as drawing no. MEC/10G9/11/16/13. The environment management plan is enclosed as drawing No. MEC/10G9/11/16/14. The results of the ambient air quality/ water quality/ noise quality monitoring reports as enclosed in Annexure – 17 indicates that the quality parameters are within the acceptable levels.

9.1 Top Soil Storage, Preservation and Utilization

A) Proposal as per approved scheme of mining:

No fresh top soil generation was envisaged in the approved scheme.

B) Position at the end of 5 years of scheme of mining period.

Complied with

C) Proposal for the next 5 year planning period:

5155 cubic meters of top soil will be generated during the next five years of mining operation. The same will be used for plantation purpose, due to its low shelf life.

9.2 Land reclamation and Rehabilitation

A) Proposal as per approved scheme of mining:

No reclamation/ rehabilitation of mined out land was envisaged during the scheme period.

B) Position at the end of 5 years of scheme of mining period:

Complied with.

C) Proposal for the next 5 year planning period:

No reclamation/ rehabilitation of mined out land has been envisaged during the scheme period.

9.3 Waste Dump Management

A) Proposal as per approved scheme of mining:

External dumping was approved within the existing dump no. 1, 2 & 3.

B) Position at the end of 5 years of scheme of mining period:

Dumping was undertaken in the above dumps as per the plan.

C) Proposal for the next 5 year planning period:

Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

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RQP/RNC/113/2004/B

C) **Proposal for the next 5 year planning period:**

Plantation proposal for the scheme period is given below in Table 9.2.

(Table 9.2) Plantation proposal

Year	Location	No. of Saplings
2014-15	Waste dumps	500
2015-16	- do -	500
2016-17	- do -	500
2017-18	- do -	500
2018-19	- do -	500
Total		**2500**

9.5 Management of quality of Air

A) **Proposal as per approved scheme of mining:**

Following measures were proposed for management of air quality:-

- Water sprinkling on haul roads.
- Plantation as envisaged in Table 9.3.
- No overloading of tippers.
- Provision of wet drilling with the drill machines.
- Regular ambient air quality monitoring.

B) **Position at the end of 5 years of scheme of mining period:**

Complied with. The result of the air quality monitoring carried out as per the statutes is given in Annexure-20.

C) **Proposal for the next 5 year planning period:**

The measures as envisaged earlier will be strictly implemented alongwith continued monitoring of environmental parameter as per the statutes.

9.6 Management of quality of water

A) **Proposal as per approved scheme of mining:**

Provisions of retaining wall/ garland drain/ check dam to arrest the suspended solids in the run off water from the proposed dumps. The surface run off to be prevented to enter the pit by the garland drains prepared all around the pit. Apart from the above regular water quality monitoring at the intake and discharge end of the water courses will be carried out.

B) **Position at the end of 5 years of scheme of mining period:**

Retaining walls, garland drains/ check dams have been constructed. The surface water quality monitoring data is shown in Annexure-22.

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RQP/RNC/113/2004/B

C) **Proposal for the next 5 year planning period:**

Depending upon the drainage pattern of the area where the dump is located, retaining walls, garland drain with settling tanks will be provided in all the dumps. The quantum of work envisaged for construction of drains, retaining walls and settling tanks are given in table 9.3.

(Table 9.3) Steps for water quality management

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits
2014-15	WD1	92 m	92 m	-
	WD1'	900 m	609 m	1 No.
2015-16	WD1	-	-	-
2016-17	WD2	900 m (common with WD1')	609 m (common with WD1')	1 No. (common with WD1')
2017-18	WD2	-	-	-
2018-19	WD2	-	-	-
	WD3	-	243 m	-

The measures as envisaged above will be strictly implemented alongwith continued monitoring of environmental parameter as per the statutes.

9.7 Management of quality of Noise and vibration

A) **Proposal as per approved scheme of mining:**

Proper blast hole design to reduce the blast induced ground vibrations and protection from noise with use of personal protective equipments.

B) **Position at the end of 5 years of scheme of mining period:**

Complied with. The result of the noise quality monitoring carried out as per the statutes is given in Annexure-17.

C) **Proposal for the next 5 year planning period:**

The measures as envisaged earlier will be strictly implemented alongwith continued monitoring of environmental parameter as per the statutes.

9.8 Treatment of Mine water

The existing pit has not touched the ground water table. Therefore, there is no accumulation of water inside the pit except during the rainy season. However, garland drains have been provided to avert movement of water into the pit. Garland drains have also been provided around the dump. Presently there is no any ETP inside the Sukrangi

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RQP/RNC/113/2004/B

lease. However, during rainy reason, the water pumped out is allowed to course through the ETP provided for the F-quarry of the south Kaliapani lease and the clear discharge of the same will be allowed to go outside the lease.

In the present setup ferrous sulphate and alum solution is blended in the ratio of 5: 1 and the mixed solution is then allowed to fall over the incoming mine water. Thereafter the mine water is allowed to pass through a series of settling tanks in order to increase the retention time and ultimately discharged to the natural run off course. Approx. consumption of ferrous sulphate & alum per shift comes to around 10 kg and 50 kgs respectively. The existing schematic drawing of the ETP is enclosed as Annexure -36.

Now State Pollution Control Board have proposed establishment of common effluent treatment plant (CETP) in Sukinda Valley for which feasibility study has been completed by IIT, Kharagpur, A copy of the same is enclosed as Annexure -35.The same shall be established soon after we get the feasibility report as per the guide line of SPCB, Odisha Bhubaneswar.

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RQP/RNC/113/2004/B

10 ANY OTHER INFORMATION

10.1 Employment Potential

Considering the statutory requirement and requirement of various operational departments the estimated executive and non-executive manpower requirement is given in table 10.1.

(Table 10.1) Manpower requirement

Sl. No.	Manpower Category	Nos.
1	Graduate Mining Engineer	1
2	Diploma Mining Engineer	4
3	Geologist	1
4	Surveyor	1
5	Other technical supervisory staff	8
6	Foreman & Mining Mate	6
7	Other workmen deployed at O/c mine	11
8	Clerical & supervisory staff	10
9	Others deployed at above ground	58
	Total	**100**

Already one graduate mining engineer & one geologist has been appointed for the Sukrangi mines as Mining Engr. & Geologist under rule 42 of MCDR 1988 meeting the prescribed qualifications i.e. Graduation in Mining Engg. with 10 years of experience in supervisory capacity & Post graduation in Geology with 10 years of professional experience respectively.

10.2 Environmental Management Division

The jobs of monitoring the environmental parameter as per the norms is being carried out through a NABET certified lab. The details of the Ambient air quality (AAQ) monitoring stations, ground water quality, surface water quality, drinking water quality monitoring stations & soil quality monitoring stations are given in Table 10.2.

(Table 10.2) Environmental parameters monitoring stations

Sl. No.	Parameters	Name	Location
1	Ambient air quality	A1	Transit House
		A2	Sukrangi Hospital
		A3	Saruabil
		A4	Sukrangi Hat
		A5	Sukrangi school

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RQP/RNC/113/2004/B

Sl. No.	Parameters	Name	Location
		A6	Ostapal
2	Surface water	SW1	Damsal Nala (Before entering the lease)
		SW2	Damsal Nala (Inside the lease)
		SW3	Damsal Nala (After leaving the lease)
3	Ambient Noise	N1	Transit House
		N2	Sukrangi Hospital
		N3	Saruabil
		N4	Sukrangi Hat
		N5	Sukrangi school
		N6	Ostapal

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RQP/RNC/113/2004/B

PROGRESSIVE MINE CLOSURE PLAN

1.0 INTRODUCTION

Consequent upon introduction of progressive mine closure plan in the statutes mineral concession rules 1960 and MCDR 1988 vide GSR No. 329 (E) and 330 (E) both dated 10.4.2003, this report is being prepared in respect of Sukrangi lease of M/s OMC Ltd.

a) Name of the lessee	**The Odisha Mining Corporation Limited**
Address	OMC House, Post Box No. 34, Bhubaneswar- 751001
District	Khurda
State	Odisha
Pin Code	751001
Phone	0674-2393431, 2395689, 2393389
Fax	0674-2391629, 2396889, 2394772
Gram	-
Telex	-
e-mail	immcon_mine@yahoo.co.in
a) Details of area (with location map)	Sukrangi lease is located in Jajpur district of Odisha state. It is located between 21^0 02' 18.85056" & 21^0 03' 46.98288" North Latitude and between 85^0 47' 43.7708" & 85^0 49' 21.74412" East Longitude. The location map is shown as Drawing No. MEC/10G9/11/16/1. The lat./ long. Of all the boundary pillars are given below:-

PILLAR NO.	LONGITUDE	LATITUDE
1	85^0 47' 43.77048"	21^0 03' 25.10316"
2	85^0 47' 44.46060"	21^0 03' 29.04012"
3	85^0 47' 45.65472"	21^0 03' 34.76196"
4	85^0 47' 46.28184"	21^0 03' 39.69216"
5	85^0 47' 47.60844"	21^0 03' 46.98288"
6	85^0 47' 53.41168"	21^0 03' 45.98496"
7	85^0 47' 57.68268"	21^0 03' 45.29736"
8	85^0 48' 01.02888"	21^0 03' 44.80704"
9	85^0 48' 05.74416"	21^0 03' 43.98408"
10	85^0 48' 18.04068"	21^0 03' 41.95512"
14	85^0 48' 33.78312"	21^0 03' 32.30784"
15	85^0 48' 34.61580"	21^0 03' 31.41648"
16	85^0 48' 36.36000"	21^0 03' 28.98108"
17	85^0 48' 37.07532"	21^0 03' 28.09980"
18	85^0 48' 40.23864"	21^0 03' 24.29268"

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MECON LIMITED
RQP/RNC/113/2004/B

19	85° 48' 43.36884"	21° 03' 20.13408"
21	85° 48' 52.34220"	21° 03' 08.37684"
22	85° 48' 57.85164"	21° 03' 01.11924"
23	85° 49' 01.22052"	21° 02' 56.70456"
24	85° 49' 05.43324"	21° 02' 51.13212"
25	85° 49' 08.52276"	21° 02' 47.08068"
26	85° 49' 10.97184"	21° 02' 43.87920"
27	85° 49' 11.91432"	21° 02' 42.65484"
28	85° 49' 12.71856"	21° 02' 41.57448"
29	85° 49' 15.91248"	21° 02' 37.42260"
30	85° 49' 18.26328"	21° 02' 34.26720"
31	85° 49' 20.00892"	21° 02' 32.00964"
32	85° 49' 21.74412"	21° 02' 29.68440"
33	85° 49' 17.79348"	21° 02' 29.06592"
34	85° 49' 13.62468"	21° 02' 28.07232"
35	85° 49' 08.95368"	21° 02' 27.11220"
36	85° 49' 03.07416"	21° 02' 25.94580"
37	85° 48' 59.66604"	21° 02' 25.13688"
38	85° 48' 57.50460"	21° 02' 24.77472"
39	85° 48' 53.59212"	21° 02' 23.95644"
40	85° 48' 49.68180"	21° 02' 23.14176"
41	85° 48' 44.31384"	21° 02' 22.10352"
42	85° 48' 40.09860"	21° 03' 21.26472"
43	85° 48' 39.04056"	21° 02' 20.94324"
44	85° 48' 36.83880"	21° 02' 20.58324"
45	85° 48' 35.97876"	21° 02' 20.38524"
46	85° 48' 31.84056"	21° 02' 19.58928"
47	85° 48' 28.28844"	21° 02' 18.85056"
48	85° 48' 25.11072"	21° 03' 23.51328"
49	85° 48' 22.33512"	21° 02' 27.64464"
50	85° 48' 20.51172"	21° 02' 30.38136"
51	85° 48' 19.65276"	21° 02' 31.62012"
52	85° 48' 16.94988"	21° 02' 35.70648"
53	85° 48' 12.10248"	21° 02' 42.98820"
54	85° 48' 10.57968"	21° 02' 45.08232"
55	85° 48' 07.97328"	21° 02' 49.11576"
56	85° 48' 02.43036"	21° 02' 57.35076"
57	85° 47' 55.54340"	21° 03' 07.48944"
58	85° 47' 50.80416"	21° 03' 14.41620"
59	85° 47' 48.80580"	21° 03' 17.39340"
60	85° 47' 47.27580"	21° 03' 19.66068"

District and State	Jajpur, Odisha
Taluka	Sukinda
Police Station	Sukinda
Village	Kaliapani

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RQP/RNC/113/2004/B

Khasra No./ Plot No./ Block Range / Felling Series etc.	The plot details have been annexed in the approved mining plan.
Lease Area (hectares)	382.709 Hectares.
Whether the area is recorded to be in forest (please specify whether protected, reserved etc.)	A total of 179.385 Hectares of the lease area comes under forest. The details of the same are given below:- Village Forest - 1.62 Ha Protected Forest – 163.151 Ha. Reserved Forest – 14.609 Ha Total Forest area– 179.385 Ha.
Ownership / Occupancy	M/s OMC Ltd.
Existence of public road / railway line, if any nearby and approximate distance	Sukrangi chromite deposit is located on in Sukinda Tehsil of Jajpur district of Odisha state. The location map is shown as Drawing No. MEC/10G9/11/16/1.
Toposheet No. with latitude and longitude	Sukrangi lease is located in Jajpur district of Odisha state. It is located between 21^0 02' 18.85056" & 21^0 03' 46.98288" North Latitude and between 85^0 47' 43.7708" & 85^0 49' 21.74412" East Longitude as shown in Survey of India Topo-sheet No. 73 G/16.
Land Use Pattern (Forest, Agricultural, Grazing, Barren etc.)	**Type of land** / **Lease area** Forest / 179.385 Non Forest / 203.324 **Total** / **382.709**
Method of Mining & Mineral Processing	Mining is done by open cast method by drilling blasting of benches, mechanized excavation of ore/ sub grade minerals and waste. Processing of sub-grade minerals is being carried out to produce the saleable grade of chromite.

1.1 Reason for closure: At present the mine is in operation and supplies chromite to a number of users. The mine is going to last for more than 40 years keeping into consideration the quantity of proved reserves. Therefore, there is no reason for closure of mines.

1.2 Statutory Obligations:

No specific conditions were imposed on the lessee while executing the lease deed. The Sukrangi lease was executed on 20.9.1980 for a period of 20 years. A copy of the lease deed is enclosed as Annexure -8 . Application for renewal of the lease has been done on 19.9.1999 and currently the lease is under deemed renewal stage. A copy of the receipt of the

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RQP/RNC/113/2004/B

application is enclosed as Annexure-9. The last scheme of mining was approved by IBM for the period from 1.4.2009 to 31.3.2014 vide letter No. MS/OTF.MECH/33-ORI/BHU/2009-10 dated 18.12.2009. The mine has been accorded environment clearance vide letter No. J-11015/409/2008-IA.II(M) dated 18.2.2010 for a production capacity of 1.30 lakh tonnes per annum. A copy of the same is enclosed as Annexure -11. Consents to operate have also been granted by the state pollution control board, Odisha under the Air & Water (Prevent & Control of Pollution) Act, which is valid upto 31.3.2016. A copy of the same is also enclosed as Annexure -13. The mines have also been accorded permission for diversion of 104.79 Ha. of forest land vide letter dated 21.7.2011. Permission has also been accorded for dumping of waste from the adjoining & contiguous S/Kaliapani lease to Sukrangi lease by the state government. A copy of the same is enclosed as Annexure -22. Notice under section 19(b) of the EPA 1986 was issued by the Collector & Dist. Magistrate of Jajpur Distt. and the reply to this letter was sent by OMC to the concerned authority. A copy of the letter in this regard is enclosed as Annexure – 29. The total surface right area acquired by OMC inside the Sukrangi lease is for 549.96 acres. Copy of the same is enclosed as Annexure – 24.The current submission is therefore a scheme of mining for the period from 1.4.2014 to 31.3.2019, which also incorporates the provision of dumping of waste from South Kaliapani lease to Sukrangi lease.

Out of 3.25 million cubic meters of OB proposed to be generated from South Kaliapani lease during the year 2014-15, around 2.73 million cubic meters of OB is proposed to be dumped in the adjoining & contiguous Sukrangi lease of M/s OMC itself. The area where the OB is proposed to be dumped is not a private land but another contiguous lease of the same lessee i.e. OMC itself. Both the leases have been accorded environment clearance under the EP Rules. The area where the OB is proposed to be dumped is also a diverted forest land. As per rule 16 of MCDR, OB & waste material obtained during mining operations shall not be allowed to be mixed with sub grade minerals. Moreover the ground selected shall be away from the working pit. In this case, no area is presently available for safe & scientific dumping of OB within the South Kaliapani lease. Therefore, the OB generated to the tune of 2.73 million cubic meters during the year 2014-15 is proposed to be dumped at the adjoining & contiguous Sukrangi lease of M/s OMC itself which is away from the working pit and also outside the ultimate pit limits of both South Kaliapani & Sukrangi lease. The area has also been proved to be devoid of any underlying mineral deposits. Moreover, permission for dumping of OB from South Kaliapani lease to adjoining & contiguous Sukrangi lease of M/s OMC has also been obtained from the State government and accordingly modification has been sought in the existing approved scheme of mining of South Kaliapani lease and also in the ensuing SOM of Sukrangi lease.

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RQP/RNC/113/2004/B

1.3 Progressive mine closure plan preparation:

a) Name of the applicant	**The Odisha Mining Corporation Limited**
Address	OMC House, Post Box No. 34, Bhubaneswar- 751001
District	Khurda
State	Odisha
Pin Code	751001
Phone	0674-2393431, 2395689, 2393389
Fax	0674-2391629, 2396889, 2394772
Gram	-
Telex	-
e-mail	immcon_mine@yahoo.co.in
b) Name of the RQP preparing the progressive mine closure plan	MECON Limited Copy of the RQP certificate is enclosed as 7.
Address	P.O – Doranda, Ranchi – 834002 Jharkhand
Phone	0651 – 2483645, 2482189
Fax	0651 - 2482189, 2482214
e-mail	pkb@meconlimited.co.in
Telex	-
Registration No.	RQP/RNC/113/2004/B
Date of grant / renewal	17.12.2004
Valid upto	16.12.2014

2.0 Mines Description

2.1 Geology

The above have been described in detail in chapter 3.0 of this scheme of mining.

2.2 Reserves

The above have been described in detail in chapter 3.0 of this scheme of mining.

2.3 Mining Method

The above have been described in detail in chapter 4.0 of this scheme of mining.

2.4 Mineral Beneficiation

The above have been described in detail in chapter 10.0 of this scheme of mining.

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RQP/RNC/113/2004/B

3.0 Review of implementation of PMCP:

Mined out Land

Proposal: No mined out land was planned to be reclaimed.

Review: The review of the land use as per the proposed plan and the actual figures at the end of 5 years of the SOM period is given below:-

Parameters	Land use at the beginning of the approved SOM	Proposed land use at the end of 5 year of the approved SOM	Actual land use as on 1.3.14
Area under Mining	39.40 Ha.	49.4 Ha.	21.25 Ha.
Storage of top soil	NIL Ha.	2 Ha.	NIL Ha.
Overburden dump	30.5 Ha.	32.6 Ha.	12.57 Ha.
Mineral storage	37.61 Ha.	37.61 Ha.	126.68 Ha.
Infrastructure	9.08 Ha.	10.08 Ha.	41.80 Ha.
Roads	6.322 Ha.	6.322 Ha.	4.56 Ha.
Green belt	26.25 Ha.	26.25 Ha.	NIL Ha.
Township area	5.1 Ha.	5.1 Ha.	NIL Ha.
Total	154.262	169.362	206.86 Ha.

The reason for deviation in land use is non availability of forest clearance.

Water Quality Management

Proposal: Regular monitoring of ground water & surface water run-off quality to be monitored.

Review: Regular monitoring of the water quality is being carried out. A copy of the same is enclosed as Annexure -20.

Air Quality Management

Proposal: Regular monitoring of ambient air quality to be monitored. Besides, it was also proposed for wet drilling operations, limiting the charge per delay to control the ground vibrations, water sprinkling over the blasted mucks/ stocks/ haul roads & avoiding over loading of dumpers

Review: Regular monitoring of the ambient air quality is being carried out. A copy of the same is enclosed as Annexure -20. Wet drilling procedures, water sprinkling over the blasted muck/ haul roads/ ore stocks is being done to reduce the fugitive dust generation.

Waste Management

Proposal: Construction of retaining wall around the dump for a length of 1250 m.

Review: The same has been duly complied with.

Top soil Management

Proposal: No top soil was proposed to be generated.

Review: Complied with.

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RQP/RNC/113/2004/B

4.0 PROGRESSIVE MINE CLOSURE PLAN

4.1 Mine out land:

The land use pattern at the end of conceptual period for the total lease area of 382.709 Ha. is given below in Table 4.6. The conceptual plan is shown in drawing No. MEC/10G9/11/16/11 and the conceptual section is shown in drawing No. MEC/10G9/11/16/10A TO 10D.

(Table 4.6) Land use in stages upto conceptual stage

S.No	Heads	Area, (Ha.)		
		Existing land use	Land use at the end of 5 year	Conceptual land use
1	Excavated area (Ultimate Pit)	21.25	26.82	142.81
2	Waste Dump	12.57	65.08	95.29
3	Mineral storage/ Sub grade	126.68	124.425	19.61
4	Infrastructure	41.80	6.99	8.36
5	Roads	4.56	5.52	1.54
6	Safety Zone	(26.25) *	(26.25) *	26.25
7	Untouched land & Nala	-	-	88.849
8	Total	206.86	228.835	382.709

Note: Excluding * as shown in the above table.

4.2 Water Quality Management:

Depending upon the drainage pattern of the area where the dump is located, retaining walls, garland drain with settling tanks will be provided in all the dumps. The quantum of work envisaged for construction of drains, retaining walls and settling tanks are given in table 4.1.

(Table 4.1) Steps for water quality management

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits
2014-15	WD1	92 m	92 m	-
	WD1'	900 m	609 m	1 No.
2015-16	WD1	-	-	-
2016-17	WD2	900 m (common with WD1')	609 m (common with WD1')	1 No. (common with WD1')
2017-18	WD2	-	-	-
2018-19	WD2	-	-	-
	WD3	-	243 m	-

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RQP/RNC/113/2004/B

The measures as envisaged above will be strictly implemented alongwith continued monitoring of environmental parameter as per the statutes. . The results of the water quality monitoring reports as enclosed in Annexure – 20 indicates that the quality parameters are within the acceptable levels.

4.3 Air quality management:

Following measures were proposed for management of air quality:-

- Water sprinkling on haul roads.
- No overloading of tippers/ Dumpers.
- Provision of wet drilling in the drill machine.
- Provisions of dust masks to the persons exposed to dust.

Apart from the above, regular monitoring of the ambient air quality as per the statutes will be strictly followed. . The results of the ambient air quality / noise quality monitoring reports as enclosed in Annexure – 17 indicates that the quality parameters are within the acceptable levels.

4.4 Waste Management:

The mine waste and sub grade mineral generated during the course of mining operations will be handled separately. These materials will be dumped at their respective ear marked places inside Sukrangi lease. However, during the year 2014-15 some waste from South Kaliapani lease will also be dumped inside the Sukrangi lease. The dumps shall be formed by retreating method of dumping so as to facilitate early reclamation.

Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

Year	Waste generated, in cubic meters	Lease		Location where the waste will be disposed, along with its name & quantity disposed in cu.m
		From where it is generated	To where it is disposed	
2014-15	721954	Sukrangi	Sukrangi	WD1 – 721954
	2731963	South kaliapani	Sukrangi	WD1' -2731963
2015-16	561784	Sukrangi	Sukrangi	WD1-561784
2016-17	733888	Sukrangi	Sukrangi	WD2-733888
2017-18	670526	Sukrangi	Sukrangi	WD2-670526
2018-19	747714	Sukrangi	Sukrangi	WD2-453955 WD3-293759

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Year wise total quantity of sub grade proposed to be generated with their location of disposal is given below:-

Year	Sub grade generated, in tonnes	Lease		Location where the waste will be disposed, along with its name & quantity disposed in tonnes.
		From where it is generated	To where it is disposed	
2014-15	68740	Sukrangi	Sukrangi	SGD1-68740t
2015-16	82904	Sukrangi	Sukrangi	SGD1-82904t
2016-17	21958	Sukrangi	Sukrangi	SGD1-21958t
2017-18	75686	Sukrangi	Sukrangi	SGD1-75686t
2018-19	79781	Sukrangi	Sukrangi	SGD1-79781t

Rate of yearly generation of waste and proposal for disposal for next 5 year:

Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

Year	Waste generated, in cubic meters	Lease		Location where the waste will be disposed, along with its name & quantity disposed in cu.m
		From where it is generated	To where it is disposed	
2014-15	721954	Sukrangi	Sukrangi	WD1 – 721954
	2731963	South kaliapani	Sukrangi	WD1' -2731963
2015-16	561784	Sukrangi	Sukrangi	WD1-561784
2016-17	733888	Sukrangi	Sukrangi	WD2-733888
2017-18	670526	Sukrangi	Sukrangi	WD2-670526
2018-19	747714	Sukrangi	Sukrangi	WD2-453955 WD3-293759

The year-wise plan & sections of the waste dumps have been shown in drawing No. MEC/10G9/11/16/12.

Built up of dumps from year to year to be shown in yearly plans and sections with description of the method & manner of disposal of waste rock, designed capacity & height of individual dumps, and precautions envisaged for confinement of the dumps together with design details of the protective works.

All the dumps will be formed be retreating method of dumping, so as to facilitate early reclamation. The height of the individual terrace will be 20 m and the maximum height

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MECON LIMITED
RQP/RNC/113/2004/B

of the dump will be limited to 60 m. The bank slope angle considered for designing the dump is 37 degrees and the overall slope angle of the dumps are below 25 degrees. The details of the proposed waste dumps, their designed capacity, year-wise built with top/ bottom RL/ height attained with number of terraces are given in the table below:-

Year	Waste Dump No.	Designed cap. in cubic meters	Qty. to be dumped in cubic meters	Dump Bottom RL	Dump Top RL	Total height	Terrace height
2014-15	WD1	1283738	721954	170	197	27m	1st terrace- 20 m 2nd terrace – 7 m
	WD1'	4697239	2731963	140	166	26m	1st terrace- 20 m 2nd terrace – 6 m
2015-16	WD1	1283738	561784	170	210	40m	1st terrace- 20 m 2nd terrace – 20 m
2016-17	WD2	1858369	733888	142	162	20m	1st terrace- 20 m
2017-18	WD2	1858369	670526	142	174	32m	1st terrace- 20 m 2nd terrace – 12 m
2018-19	WD2	1858369	453955	142	202	60m	1st terrace- 20 m 2nd terrace – 20 m 3rd terrace-20m
	WD3	293759	293759	132	141	9m	1st terrace- 9 m

The details of the protective measures envisaged for the dump with year wise proposed reclamation/ rehabilitation measures are given below:-

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits	Proposed reclamation measures
2014-15	WD1	92 m	92 m	-	-
	WD1'	609 m	900 m	1 No.	-
2015-16	WD1	-	-	-	WD1 will be completely afforestated by the end of 2015-16.
2016-17	WD2	609 m (common with WD1')	900 m (common with WD1')	1 No. (common with WD1')	-
2017-18	WD2	-	-	-	-
2018-19	WD2	-	-	-	WD2 will be completely afforestated by the end of 2018-19.
	WD3	-	243 m	-	-

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MECON LIMITED
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Depending upon the drainage pattern of the area where the dump is located, retaining walls, garland drain with settling tanks will be provided in all the dumps. The year wise plans & sections of all the dumps are given in drawings No. MEC/10G9/11/16/12.

The garland drains will be dug around 1 m beneath the adjoining contour level at the lower peripheral areas of the dump. The width of the drains shall be around 1.5 m. The settling tanks will be located at the outlet of the garland drains. It will of around 3m length with three compartments of around 1m width to arrest the suspended solids followed with the chamber to arrest any oil particles. The last chamber shall contain the clean water which will be ultimately discharged. The retaining walls will be of 1m height and 1m width at the top and around 1.2m at the base. The material of construction shall be RCC.

4.5 Top soil management:

Approx. 5155 cubic meters of top soil will be generated during the next five years of mining operation. The same will be used for plantation purpose, due to its low shelf life.

4.6 Tailing Dam Management:

No tailing dam exists in the area.

4.7 Infrastructure:

Basic infrastructure is available in the mine to facilitate the workings. They are mine offices, workshop, garage, rest shelter, first aid station, site store, , Time office, Canteen, laboratory, etc. The Explosives magazine & V.T. centre of Kalarangi chromite mines are in common use.

Electric Supply

The actual power consumption during the year 2012-13 is 309920 kWh.

Magazine

The magazine is located within Kalarangi lease and is valid upto 31.3.2016 and is licensed to store the following quantities:-

(i) Explosives : 3 t
(ii) Detonating fuse : 10000 m
(iii) Safety fuse : 40000 m
(iv) Detonator : 44000 Nos.

The use of explosive is from this magazine by a tripartite agreement.

(PK Bhattacharjee, Key Person)
MECON LIMITED
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Following officers of the mines will be responsible for co-ordination in case emergency situated in any sections of the mine.	Responsibility
Head of Department / Mine Agent	Site Controller
Mines Manager / Shift in-charge	Accident Controller / Communication Officer
Employee who gives the first information about the incident / accident	Primary Controller
P & A Department (HOD)	Liaison Officer

Key Personnel and their responsibilities

Site Controller:

- The head of the department / mine agent shall have an overall responsibility for controlling the incident / accident and directing the personnel.
- To prepare a full proof plan for control of accident like, landsides, subsidence flood and other natural calamities.
- To inform statutory bodies of the State and Central Government.
- To inform communication officer about the emergency, control centre and assembly point.
- To provide all assistance and call for fire squad, security officer and other services required for removing / control of danger.
- To ensure that all necessary personnel assemble at assembly point.
- Make arrangement for medical treatment to the personnel injured seriously.

Accident Controller:

- Mines manager shall act as accident controller/ communication officer.
- Mock rehearsal of management plan prepared for accident.
- To withdraw men / machine from the affected area with priority for safety of personnel, minimize damage to the machines, environment and loss of material.
- To make a report based on the facts and figure and submit to the site controller.
- To communicate to the site in charge and make arrangement for first aid and transportation of the injured personnel.

Primary Controller:

- To inform the Accident Controller / shift in-charge from the nearest means of communication about the location and the nature of accident.
- To assist in clearing any obstruction in relief of accident.
- To carry out all instructions of accident controller.
- To provide first aid treatment and communicate to the shift in-charge.

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Capability of Lessee:

Following facilities are available at mine site:

- Public address system
- Telephone / Mobile handsets
- Runners / Messenger
- Firefighting equipment and accessories with trained manpower
- Hospital close to the mine.
- Training centre
- Ambulance van
- Jeeps

4.11 Care and Maintenance during temporary discontinuance:

When the mine is temporarily discontinued due to any unforeseen circumstances the following care and maintenance shall be carried out:

- Notice to be served to all the concerned authority.
- Temporary fencing shall cover the mining pit area.
- All access roads/openings to the pit / face shall be closed by parapet wall as per rule.
- Warning shall be displayed on the 'Notice Board' at appropriate places.
- Security personnel shall be posted at every danger point.
- No unauthorized person shall be allowed to enter into the mine without prior permission of the management.
- Mine benches shall be dressed and properly sloped for its stability.
- Garland drain shall be made all around the mine and dumps to prevent water flow towards mine for prevention of landslide/side fall and siltation etc.
- All men and machinery shall be withdrawn from the mine and shall be kept in a compound and safe place.
- All safety precautions shall be taken care of as per rule.

[PK Bhattacharjee, Key Person]
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5.0 Economic Repercussions of closure of mine and manpower retrenchments:

5.1 Number of local residents employed in the mine, status of the continuation family occupation and scope of joining the occupation back:

The manpower deployment is discussed in Chapter – 10.1 and local population will be engaged in workers category. The manpower provided for carrying out mining activity shall continue to be employed during this progressive mine closure stage.

5.2 Compensation given or to be given to the employees connecting with substance of himself and their family:

The mine is presently in operation and no closure is apprehended in near future. Hence there is no proposal for compensation to be given to the employees at the present stage.

5.2.1 Satellite occupations connected to the mining industry – Number of persons engaged therein – continuance of such business after mine close:

Presently, there is no proposal for mine closure; therefore, question of affecting satellite occupation does not arise.

5.4 Continued engagement of employees in the rehabilitated status of mining lease area and any other remnant activities:

At present, no rehabilitation of manpower has been planned due to continuing mining operation in the area. However, at the mine closure stage, manpower shall be suitably rehabilitated as per the prevalent site conditions and agreement.

5.5 Envisaged repercussion on the expectation of the society around due to closure of mine:

Continuance of mining activity in the area has resulted into overall improvement of society due to direct / indirect job opportunities, improved communication, education, medical facilities, transport, drinking water, road networking. This is likely to continue during future progressive mine closure plan also. During final closure plan expectation of society shall be taken care of on mutual basis.

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RQP/RNC/113/2004/B

6.0 Time Scheduling for abandonment:

A tentative time frame for completion of jobs for mine closure operation (in months) from date of cessation is shown in table 6.1

(Table 6.1) Time scheduling for abandonment

Activities	Tentative time frame for completion of jobs for the scheme period
Reclamation & Rehabilitation of mined out land.	No reclamation/ rehabilitation of land will be carried out during the scheme period.
Waste Management	All the dumps will be formed be retreating method of dumping, so as to facilitate early reclamation. The height of the individual terrace will be 20 m and the maximum height of the dump will be limited to 60 m. The bank slope angle considered for designing the dump is 37 degrees and the overall slope angle of the dumps are below 25 degrees. The details of the proposed waste dumps, their designed capacity, year-wise built with top/ bottom RL/ height attained with number of terraces are given in the table below:-

Year	Waste Dump No.	Designed cap. In cubic meters	Qty. to be dumped in cubic meters	Dump Bottom RL	Dump Top RL
2014-15	WD1	1283738	721954	170	197
	WD1'	2731963	2731963	140	166
2015-16	WD1	1283738	561784	170	210
2016-17	WD2	1858369	733888	142	162
2017-18	WD2	1858369	670526	142	174
2018-19	WD2	1858369	453955	142	202
	WD3	293759	293759	132	141

The details of the protective measures envisaged for the dump with year wise proposed reclamation/ rehabilitation measures are given below:-

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits	Proposed reclamation measures
2014-15	WD1	92 m	92 m	-	-
	WD1'	609 m	900 m	1 No.	-
2015-16	WD1	-	-	-	WD1 will be completely afforestated by

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7.0 Abandonment cost:

The tentative abandonment cost based on the activities required for implementing the protective and rehabilitation measures including their maintenance and monitoring for the 2014 – 15 is as given below:

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
A	Reclamation & Rehabilitation of Mined out Land area	(i) Backfilling (ii) Afforestation on the backfilled area, (iii) Other (please specify) e.g Afforestation on exhausted benches (iv) Pisciculture (v) Converting into water reservoir. (vi) picnic spot	Not Applicable		
B	Stabilization & Rehabilitation of Dumps (with lease)	(i) Terracing	-	-	
		(ii) Pitching	-	-	
		(iii) Construction of Parapet walls/ Retaining wall at toe of dumps.	Parapet wall	1235 m	
		(iv) Construction of Check Dams along slope of vallies etc.	-	-	
		(v) Construction of settling ponds, (Garland drain etc.)	Drain	701 m	510000
		(vi) Desilting of settling ponds, channels.	Settling tank	1 no.	
		(vii) Afforestation on dumps	Plantation over the dumps	500	
		(viii) Others (Please specify)	-	-	
	Rehabilitation of	(i) Afforestation (Green	-	-	-

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
C	Barrened Area within Lease	belt building) (ii) Others (Please specify).	-	-	-
D	Environmental Monitoring (Core zone & Buffer Zone separately)	(i) Ambient Air Quality (ii) Water Quality (iii) Noise Level Survey (iv) Ground Vibration (v) Others (Please Specify)	For the total lease	As per the statutes	12,50,000
	Total				17,60,000

The abandonment cost for the FY 2015 – 16 is as given below:

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
A	Reclamation & Rehabilitation of Mined out Land area	(i) Backfilling (ii) Afforestation on the backfilled area. (iii) Other (please specify) e.g Afforestation on exhausted benches (iv) Pisciculture (v) Converting into water reservoir. (vi) picnic spot	Not applicable		
B	Stabilization & Rehabilitation of	(i) Terracing (ii) Pitching (iii) Construction of Parapet walls/ Retaining wall at toe of dumps. (iv) Construction of	-	-	-

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
	Dumps (with lease)	Check Dams along slope of vallies etc.			
		(v) Construction of settling ponds, (Garland drain etc.)	-	-	-
		(vi) Desilting of settling ponds, channels.	-	-	-
		(vii) Afforestation on dumps	Plantation over the dumps	500	10000
		(viii) Others (Please specify)	-	-	-
C	Rehabilitation of Barrened Area within Lease	(i) Afforestation (Green belt building)	-	-	-
		(ii) Others (Please specify)	-	-	-
D	Environmental Monitoring (Core zone & Buffer Zone separately)	(i) Ambient Air Quality (ii) Water Quality (iii) Noise Level Survey (iv) Ground Vibration (v) Others (Please Specify)	For the total lease	As per the statutes	12,50,000
	Total				**12,60,000**

The abandonment cost for the FY 2016 – 17 is as given below:

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
A	Reclamation & Rehabilitation of	(i) Backfilling (ii) Afforestation on the backfilled area. (iii) Other (please	Not applicable		

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
	Mined out Land area	specify) e.g Afforestation on exhausted benches			
		(iv) Pisciculture (v) Converting into water reservoir.			
		(vi) picnic spot			
B	Stabilization & Rehabilitation of Dumps (with lease)	(i) Terracing	-	-	-
		(ii) Pitching	-	-	-
		(iii) Construction of Parapet walls/ Retaining wall at toe of dumps.	-	-	-
		(iv) Construction of Check Dams along slope of vallies etc.	-	-	-
		(v) Construction of settling ponds, (Garland drain etc.)	-	-	-
		(vi) Desilting of settling ponds, channels.	-	-	-
		(vii) Afforestation on dumps	Plantation over dumps	500	10000
		(viii) Others (Please specify)	-	-	-
C	Rehabilitation of Barrened Area within Lease	(i) Afforestation (Green belt building)	-	-	-
		(ii) Others (Please specify)	-	-	-
D	Environmental Monitoring (Core zone & Buffer Zone separately)	(i) Ambient Air Quality	For the total lease	As per the statutes	12,50,000
		(ii) Water Quality			
		(iii) Noise Level Survey			
		(iv) Ground Vibration			
		(v) Others (Please Specify)			
Total					12,60,000

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The abandonment cost for the FY 2017 – 18 is as given below:

Sl.No	Items	Details	Area (Hect.) Proposed	Quantity Proposed	Expenditure (Rs) Proposed
A	Reclamation & Rehabilitation of Mined out Land area	(i) Backfilling (ii) Afforestation on the backfilled area. (iii) Other (please specify) e.g Afforestation on exhausted benches (iv) Pisciculture (v) Converting into water reservoir. (vi) picnic spot	Not applicable		
B	Stabilization & Rehabilitation of Dumps (with lease)	(i) Terracing	-	-	-
		(ii) Pitching	-	-	-
		(iii) Construction of Parapet walls/ Retaining wall at toe of dumps.	-	-	-
		(iv) Construction of Check Dams along slope of vallies etc.	-	-	-
		(v) Construction of settling ponds, (Garland drain etc.)	-	-	-
		(vi) Desilting of settling ponds, channels.	-	-	-
		(vii) Afforestation on dumps	Plantation over the dumps	500	10000
		(viii) Others (Please specify)	-	-	-
C	Rehabilitation of Barrened Area within Lease	(i) Afforestation (Green belt building)	-	-	-
		(ii) Others (Please specify)	-	-	-

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Sl.No	Items	Details	Area (Hect.) Proposed	Quantity Proposed	Expenditure (Rs) Proposed
D	Environmental Monitoring (Core zone & Buffer Zone separately)	(i) Ambient Air Quality (ii) Water Quality (iii) Noise Level Survey (iv) Ground Vibration (v) Others (Please Specify)	For the total lease	As per the statutes	12,50,000
	Total				**12,60,000**

The abandonment cost for the FY 2018 – 19 is as given below:

Sl.No	Items	Details	Area (Hect.) Proposed	Quantity Proposed	Expenditure (Rs) Proposed
A	Reclamation & Rehabilitation of Mined out Land area	(i) Backfilling (ii) Afforestation on the backfilled area. (iii) Other (please specify) e.g Afforestation on exhausted benches (iv) Pisciculture (v) Converting into water reservoir. (vi) picnic spot	Not applicable		
B	Stabilization & Rehabilitation of Dumps (with lease)	(i) Terracing	-	-	-
		(ii) Pitching	-	-	-
		(iii) Construction of Parapet walls/ Retaining wall at toe of dumps.	-	-	-
		(iv) Construction of Check Dams along slope of vallies etc.	-	-	-
		(v) Construction of settling ponds, (Garland drain etc.)	-	-	-
		(vi) Desilting of settling	-	-	-

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

Sl.No	Items	Details	Area (Hect.)	Quantity	Expenditure (Rs)
			Proposed	Proposed	Proposed
		ponds, channels.			
		(vii) Afforestation on dumps	Plantation over the dumps	500	10000
		(viii) Others (Please specify)	-	-	-
C	Rehabilitation of Barrened Area within Lease	(i) Afforestation (Green belt building)	-	-	-
		(ii) Others (Please specify)	-	-	-
D	Environmental Monitoring (Core zone & Buffer Zone separately)	(i) Ambient Air Quality	For the total lease	As per the statutes	12,50,000
		(ii) Water Quality			
		(iii) Noise Level Survey			
		(iv) Ground Vibration			
		(v) Others (Please Specify)			
Total					**12,60,000**

(PK Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

8.0 Financial Assurance:

The financial assurance is given in the table below.

S N	Type of land use	Area of land use (in Ha)			The area considered as fully reclaimed and rehabilitated	Net area considered for calculation of financial assurance
		Area put into use at the start of plan period i.e. 1.3.14	Addl Area required During scheme period upto 31.3.19	Total Area at the end of the scheme period		
1	Excavated Area	21.25	5.57	26.82	0	26.82
2	Storage for top-soil	0	0	0	0	0
3	Overburden dump	12.57	52.51	65.08	0	65.08
4	Mineral storage	126.68	-6.415	120.265	0	120.265
5	Infrastructure (Rest shelter & pumping station)	41.8	-34.81	6.99	0	6.99
6	Roads	4.56	0.96	5.52	0	5.52
7	Railways	0	0	0	0	0
8	Green belt	0	0	0	0	0
9	Tailing pond	0	0	0	0	0
10	Effluent treatment plant	0	0	0	0	0
11	Mineral separation plant	0	0	0	0	0
12	Township area	0	0	0	0	0
13	Sub-grade storage	0	4.16	4.16	0	4.16
Total		206.86	21.975	228.835	0	228.835

The total financial assurance upto 2018-19 will be Rs. 57,20,875 /- @ Rs.25000/- per hectare on 228.835 Ha.. Financial assurance paid & valid upto 31.3.2014 is for Rs. 40,34,050/-. A copy of the same is enclosed as Annexure -16. A copy of the Financial assurance paid for an amount of Rs. 5720875/- and valid upto 31.3.19 is enclosed as Annexure-38.

9.0 Certificate:

A certificate in this effect is enclosed along with this report.

10.0 Plans/ Sections etc.

The PMCP for financial assurance is enclosed as Plate No. MEC/10G9/11/16/15.

अनुमोदित
APPROVED

(PR Bhattacharjee, Key Person)
MECON LIMITED
RQP/RNC/113/2004/B

क्षेत्रीय खान नियंत्रक
REGIONAL CONTROLLER OF MINES
भारतीय खान ब्यूरो
INDIN BUREAU OF MINES
भुवनेश्वर/BHUBANESWAR

Annex. 1

Odisha Mining Corporation Limited

(A GOLD CATEGORY STATE PSU)

DIRECTORS OF ODISHA MINING CORPORATION LIMITED. As on 6.1.'23

SL No	NAME
1	Sri Saswat Mishra, IAS Chairman-Cum-Managing Director, OMC Ltd., BBSR
2	Sri Rajesh Verma, IAS Principal Secretary to Govt. Steel & Mines Department, Odisha, BBSR
3	Sri C.J.Visnugopal, IAS, Principal Secretary to Govt., Public Enterprises Deptt, Odisha, BBSR
4	Sri B.K.Bath, OFS Special Secretary to Govt., Finance Department, Odisha, BBSR,
5	Sri Priyanath Padhy, I.F.S., Principal Chief Conservator of Forest, Odisha, Aranya Bhavan, C.S.Pur, BBSR.
6	Sri Deepak Kumar Mohanty, IFS Director of Mines, Odisha, BBSR
7	Sri Chittaranjan Das, Ex-CMD, Mahanadi Coal Field, Plot No. C/91, Palaspalli, BBSR
8	Sri D.K.Roy Former Chairman, OERC Plot No. N-2/63, IRC Village, BBSR.
9	Sri S.N.Padhi Retired Director General of Mines Safety Plot No. A/8, Pallaspalli, BBSR.
10	Dr. S. Acharya Former Vice-Chancellor, Utkal University Plot No. 155, VIP Colony, IRC Village, BBSR
11	Sri G.S. Khuntia Rtd. Executive Director, SAIL 21-B, Jui Durga Nagar, BBSR-751006.

Secretary
The Odisha Mining Corporation Ltd.
Bhubaneswar

Head Office : Post Box No: 34, Bhubaneswar-751001, India. Tel : 0674-2393431, 2396216, Fax : 0674-2396869, 2391629, www.orissamining.com

6.5

Annex-2 ANNEXURE-22

Cable: ORIAINCORP, Bhubaneswar Tel. +0674 2393431, 2396689, 2393369 (EPABX) 2392747(DN)
Fax: 0674-2391629, 2396880, 2394772

The Orissa Mining Corporation Ltd.
(A Government of Orissa Undertaking)
OMC HOUSE, BHUBANESWAR -751001

RESOLUTION OF THE BOARD OF DIRECTORS

Resolved that the Managing Director be and is hereby authorised to sign, execute and modify the document, Contract, Power of Attorney, Statutory Declaration, etc. furnished/to be furnished to the different authorities for and on behalf of Orissa Mining Corporation Ltd.

The Managing Director is further authorised to delegate this authority given to him by the Board of Director of O.M.C.Ltd. through this resolution, to any of the officers of OMC Ltd. To file the same before the IBM and the M.O.E.F authorities.

(J.B.Das)
Company Secretary
Orissa Mining Corporation

22/1

Annex-3.

NOTARISED 07/02/14

भारतीय गैर न्यायिक

भारत

पचास रुपये

FIFTY RUPEES

₹.50

Rs.50

INDIA

INDIA NON JUDICIAL

ओड़ीसा ORISSA

BIBEKANANDA BISWAL
CITY NO. 12835
BHUBANESWAR
REGD. NO.-ON-01/2000

NOTARY* GOVT. OF ODISHA* BIBEKANANDA PISWAL BHUBANESWAR REGD. NO. ON-01/2000

POWER OF ATTORNEY

BE IT KNOWN TO ALL THAT on behalf of the Odisha Mining Corporation, Bhubaneswar, I Shri Saswat Mishra, IAS, Chairman-cum-Managing Director, OMC Ltd., Bhubaneswar aged about 40 years, son of Dr. Basanta Kumar Mishra hereby appoint Shri Sudhansu Kumar Das, aged about 56 years, son of Shri Prahallad Chandra Das of Jajpur at present residing at Quarter No.C-8, OMC Colony, Unit-8, Nayapalli, Bhubaneswar, Dist: Khurda and presently working as

Contd.P/2





Annex. 3.

Y 629

26. 2. 14

S.O.

O-M-C LTD

Pernambucum mycetica

Annex.2.

भारतीय गैर न्यायिक

बीस रुपये Rs.20

₹.20 TWENTY RUPEES

INDIA

INDIA NON JUDICIAL

ORISSA

BIBEKANANDA BISWAL
CITY NOTARY
BHUBANESWAR
REGD. NO.-ON-01/2000

NOTARY * BISWAL * OF ODISHA(INDIA)
BIBEKANANDA BISWAL
BHUBANESWAR
REGD. NO.
ON-01/2000

By General Manager (Geo), Odisha Mining Corporation Limited, Bhubaneswar as the Attorney to act in the name of the Corporation and on its behalf to sign for filing applications for all Reconnaissance Permits, Prospecting Licences, Mining Leases, Quarry Leases and Surface Right permission and to execute all Reconnaissance Permits, Prospecting Licences, Mining Leases and Quarry Lease deeds.

The Nominated Owner Shri Saswat Mishra, IAS also authorizes Shri S.K.Das to sign in all matters regarding Mining Plan, Scheme of Mining, Modification to Mining Plan, Modification to Scheme of Mining,

Contd.P/3

Chairman-Cum-Managing Director
Odisha Mining Corporation Ltd.
Bhubaneswar-751 001

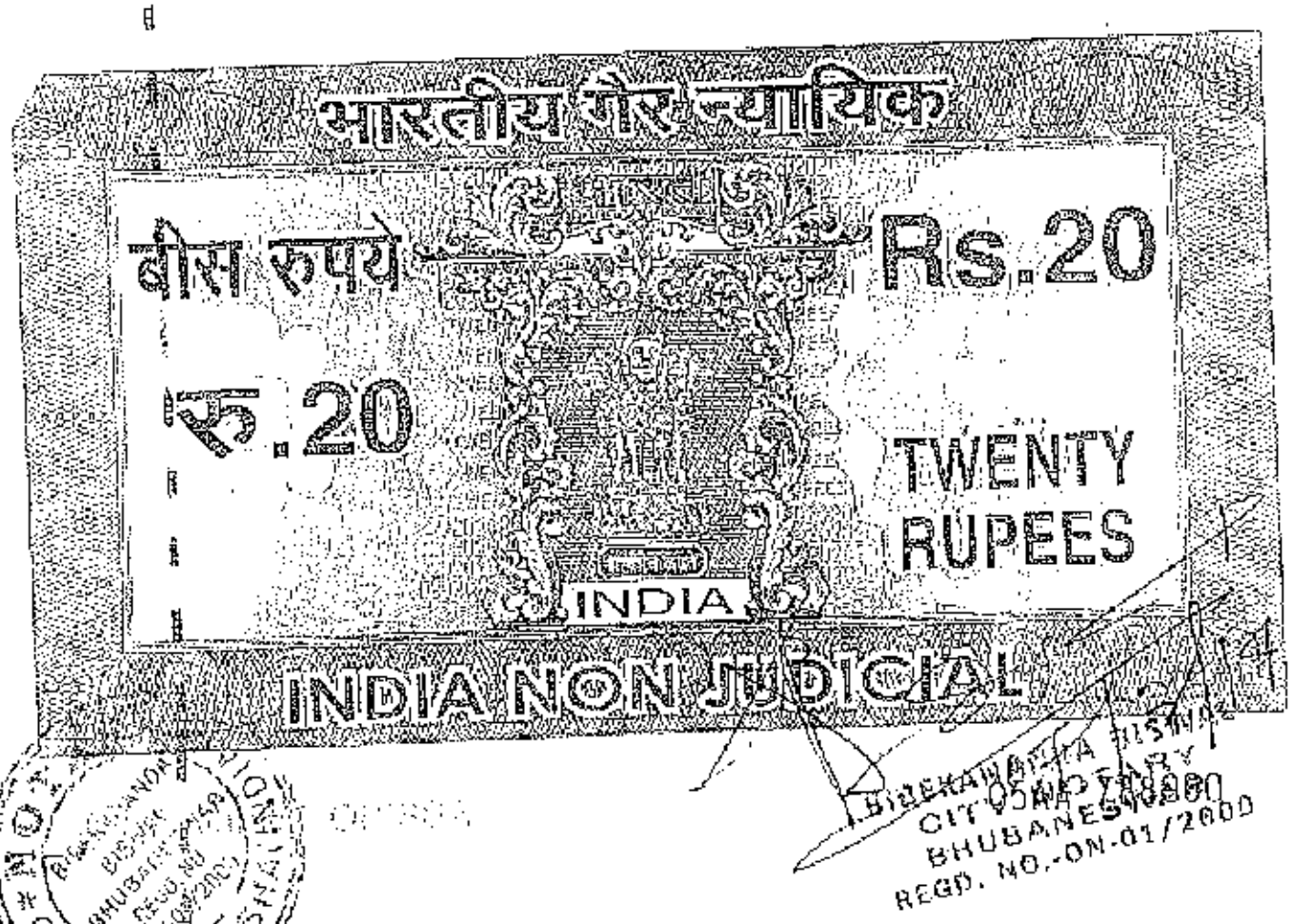
Annex. 3.

4051 26-3-14 27

O M-C WTP

Pending matter

Annexure-3.



Progressive Mine Closure Plan, Final Mine Closure Plan and any other matter with Indian Bureau of Mines, Govt. of India & Directorate of Mines, Govt. of Odisha.

AND the Corporation do hereby agree to ratify all acts, deeds, instruments done or made by the above named Dy. General Manager(Geology) which shall be deemed to be done or made by the Corporation and shall be binding on the Corporation with full force and effect.

Contd.P/4

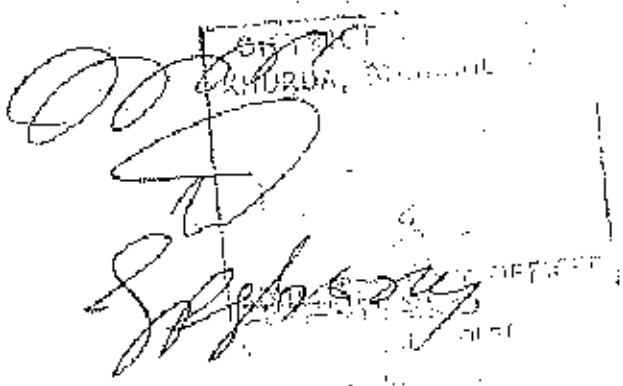
Executive Director-cum-Managing Director
Odisha Mining Corporation Ltd.
Bhubaneswar-751 001

Annex 3.

4030

28-04 20

O M: CLP



Parliament Hansard

Annex-B.



In witness whereof, this power of attorney is signed in the presence of the witnesses hereinafter mentioned this day of 2014.

(S. Mishra)
Chairman-cum- Managing Director
Odisha Mining Corporation Ltd.
Bhubaneswar

Witnesses:

1. Purnendu Sarangi
Dy. Manager (
OMC Ltd, Bbsr

2. Purnachandra Mo
Asst Mgr (L)
OMC Ltd, Bbsr

Chairman-Cum-Managing Director
Odisha Mining Corporation Ltd.
Bhubaneswar-751 001

BIBEKANANDA BISWAL
CITY NOTARY
BHUBANESWAR
REGD. NO.-ON-01/2000

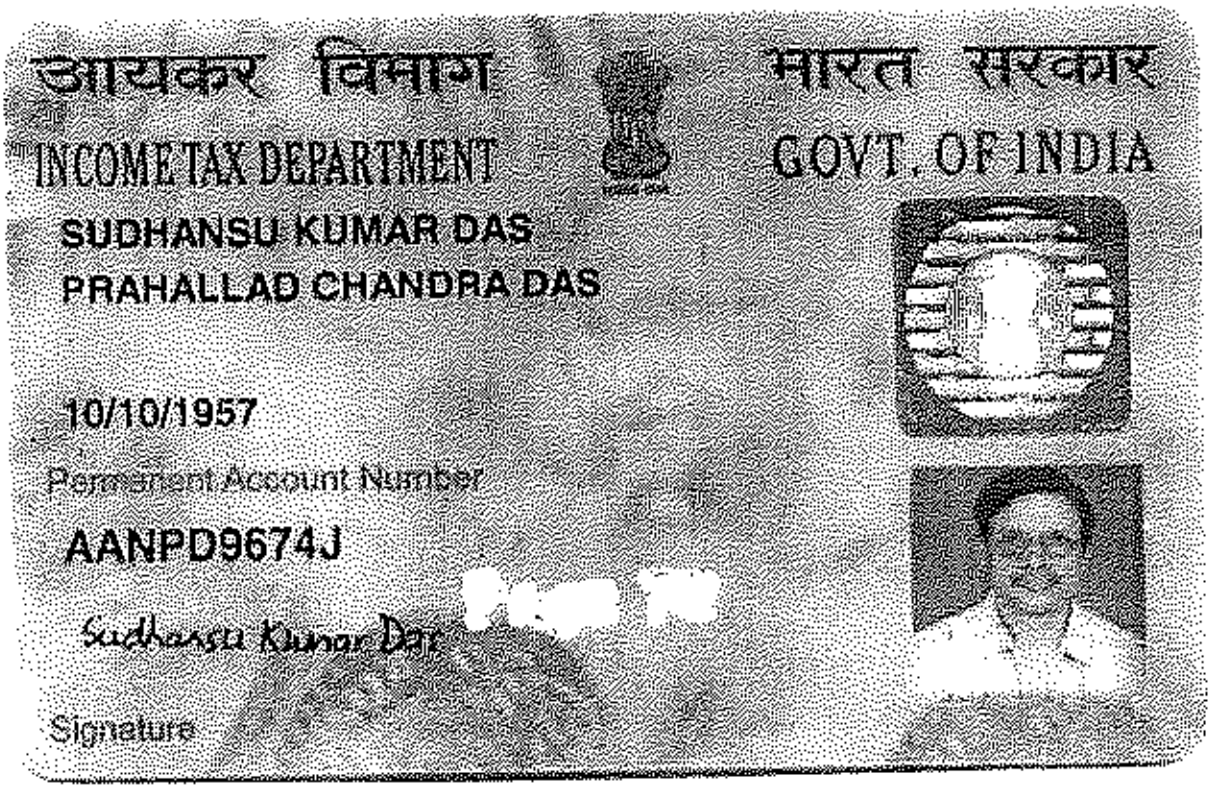
Certified that the executant is my client and the documents has been typed by my typist according to my dictation

Advocate, Bhubaneswar

Annex B.

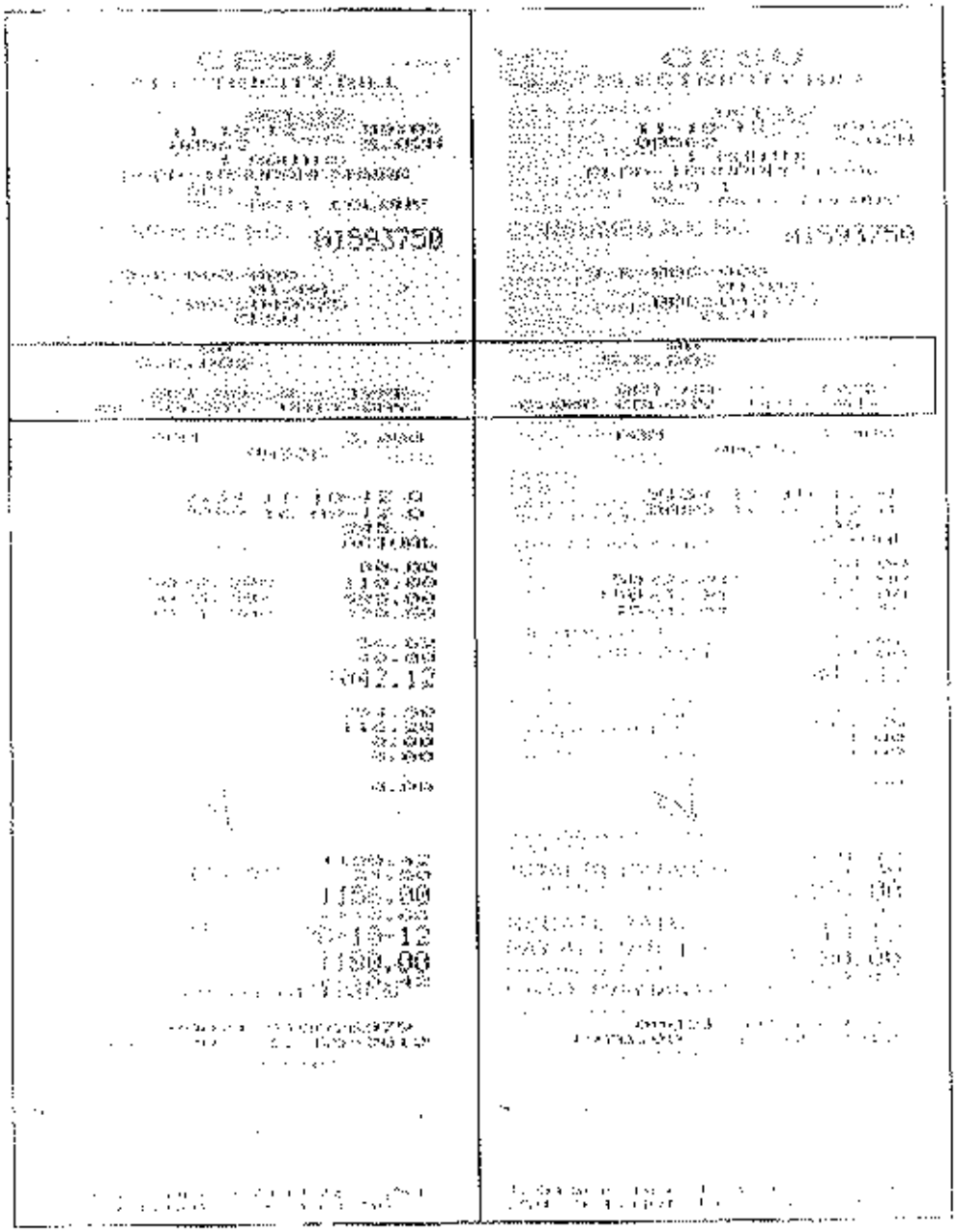
4632 28.2.14 127

ANNEX. - 4


आयकर विभाग
INCOME TAX DEPARTMENT
भारत सरकार
GOVT. OF INDIA
SUDHANSU KUMAR DAS
PRAHALLAD CHANDRA DAS
10/10/1957
Permanent Account Number
AANPD9674J
Sudhansu Kumar Das
Signature

ANNEX. - 4

Address proof of Power of Attorney holder Sri S.K.Das



Annex - 5

From I. R.

Certificate of Incorporation

No ..... 2 ..... of 1956-57

I hereby certify that THE ORISSA MINING CORPORATION (PRIVATE) LIMITED is this day incorporated under the Companies Act 1956 (No 1 of 1956) and that the Company is limited

Given under my hand at Sambalpur this sixteenth day of May one thousand nine hundred fiftysix

Sd. B. K. CHATTERJI
Register of Companies, Orissa

* The word (PRIVATE) was deleted in pursuance of order No. 11/2/56-C.L. (VI) 59 dated the 14th March, 1959, Ministry of Finance Department of Company Law Administration New Delhi

ANNEX. -6

LIST OF LEASES OF THE APPLICANT

Sl. No	Name of M.L area	Mineral	Area (ha)	District	Date of grant	Date of renewal	Period (years)
1	SGBK	Iron	1011.500	Keonjhar			
2	Tiringpahar	Iron	79.300	-do-	24.08.64	24.08.94	30
3	Kurmitar	Iron	1212.470	Sundergarh	29.04.65	29.04.85	20
4	Rantha	Iron	409.870	-do-	-do-	31.12.98	30
5	Gandhamardan (A)	Iron	618.576	Keonjhar	21.05.63	21.05.03	30
6	Gandhamardan (B)	Iron	1590.867	-do-	11.07.70	11.07.70	30
7	Banspani	Iron	380.400	-do-	21.05.66	21.05.66	30
8	Khandbandha	Iron	966.310	-do-	30.11.63	30.11.93	30
9	BPJ	Iron	861.521	-do-	27.02.70	27.02.2002	30
10	Koira-Kalara	Iron	418.360	Sundergarh	13.10.76	13.10.96	20
11	Koira-Bhanjpali	Iron	141.240	-do-	07.05.92	07.05.2012	30
12	Dhitari	Iron	190.200	Keonjhar & Jajpur	27.01.66	27.01.96	30
13	Balda-palsa	Iron	861.521	Keonjhar	27.02.70	27.02.2000	30
14	Tomka	Iron	1225.027	Jajpur	--	--	--
15	Sekradihi	Iron	189.63	Keonjhar	28.12.59	28.12.89	30
16	Soromdo-Bhadrashi	Iron & manganese	1734.570	-do-	30.08.86	30.08.2006	20
17	Dubna-Sekradihi	Iron & manganese	1332.019	-do-	28.12.59	28.12.89	30
18	Daiki	Iron & manganese	265.290	-do-	07.08.76	07.08.96	20
19	Nishikhal	Manganese	501.67	Koraput	28.09.87	28.09.2007	20
20	Parlipada	Manganese	104.86	Keonjhar	25.04.81	25.04.2001	20
21	Roida	Manganese	78.711	-do-	25.04.81	25.04.2001	20
22	Dubna	Manganese	1136.419	-do-	08.09.71	08.09.91	20
23	Koilha-Roida	Manganese	192.81	-do-	08.02.77	08.02.77	20
24	Kallapani	Chromite	971.245	Jajpur	08.07.67	08.07.87	20
25	South-kallapani	Chromite	562.457	-do-	22.01.80	22.01.2000	20
26	Sukragi	Chromite	382.709	-do-	20.09.80	20.09.2000	20
27	Sanipank (Boula-B)	Chromite	1582.683	-do-	--	--	20
28	Bangur	Chromite	145.850	-do-	0.09.75	0.09.75	20
29	Boula	Chromite	207.360	-do-	07.08.65	07.08.65	20
30	Base of mahagiri	Chromite	185.810	-do-	09.09.70	09.09.70	20
31	Sarubili-Sukarangi	Chromite	23.243	-do-	29.01.81	29.01.81	15
32	Kathapal	Chromite	264.466	Dhenkanal	10.02.69	10.02.69	20
33	Birsal	Chromite	583.21	-do-	04.11.76	04.11.76	20
34	Kalarangi	Chromite	936.220	Jajpur	09.12.66	09.12.86	20
35	Baphlimali	Bauxite	1388.74	Rayagada & Kalahandi	--	--	--
36	Unpavalley	Limestone	859.990	Koraput	20.08.75	20.08.95	20
37	Jilingdhar	Gemstone	35.686	Kalahandi	01.10.92	01.10.2002	10
38	Ninjilbahal	Gemstone	57.465	-do-	14.06.2003	14.06.2003	10

4.1

ANNEX. - 6

Sl. No	Name of M.L area	Mineral	Area (ha)	District	Date of grant	Date of renewal	Period (years)
39	Budhapara	Gemstone	38.950	Nuapara	14.00.93	14.06.2003	10
40	Kumardubi	Titanium bearing vanadiferous magnetite	289.852	Mayurbhanj	--	--	--
41	Dumurla	China clay	142.70	Mayurbhanj	09.08.78	09.08.98	20

4.1

ANNEX. -7

CERTIFICATE OF RECOGNITION AS QUALIFIED PERSON TO PREPARE MINING PLANS

(Under Rule 22 (c) of Mineral Concession Rules 1960)

M/s ..... MECON Limited ..... having registered office at Doranda, Ranchi - 834002 (JHK) ....., and having given satisfactory evidence of the qualifications and experience of their key persons is hereby granted recognition under Rule 22 (c) of the Mineral Concession Rules 1960 as a Qualified Person to prepare Mining Plans.

The registration number is RQP/RNC/113/2004/B

This recognition is valid for a period of ten years ending ..... 16.12.2014 .....

Place: Ranchi
Date : 17.12.2004.

Regional Controller of Mines
Indian Bureau of Mines
.....Ranchi.....

Regional Controller of Mines
Indian Bureau of Mines

ANNEX. - I

Name of the recorded Key Persons:

1. Sh. Abhijit Bhattacharya, B.Tech. (Mining), M.Tech.
2. Sh. H.K. Bhanj Deo, M.Tech. (Applied Geology)
3. Sh. Sanjay Kumar, M.Sc. Tech. (Applied Geology)
4. Sh. Rajesh Thakur, B.E. (Mining Engg.)

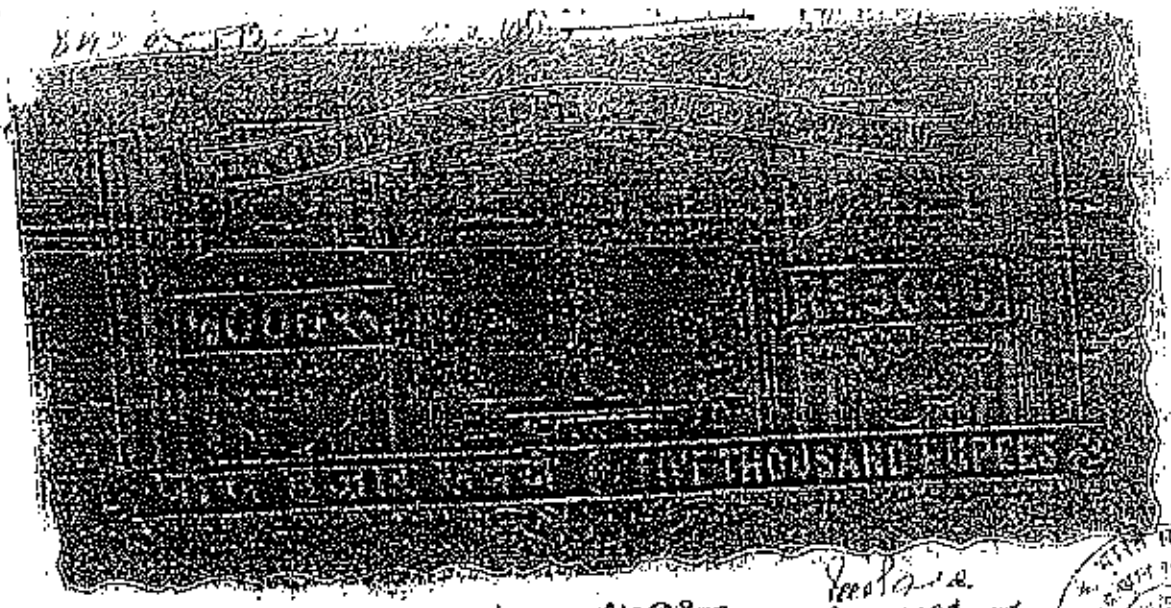
Name of the recorded Key Persons (As on 19/07/2006):

1. Sh. H.K. Bhanj Deo, M.Tech. (Applied Geology)
2. Sh. Sanjay Kumar, M.Sc. Tech. (Applied Geology)
3. Sh. Rajesh Thakur, B.E. (Mining Engg.)
4. Sh. Pranil Kumar Bhattacharjee, B.E. (Mining Engg.)

19.7.06

Regional Controller of Mines
Indian Bureau of Mines

Annex. 8



FORM-K

MINING LEASE

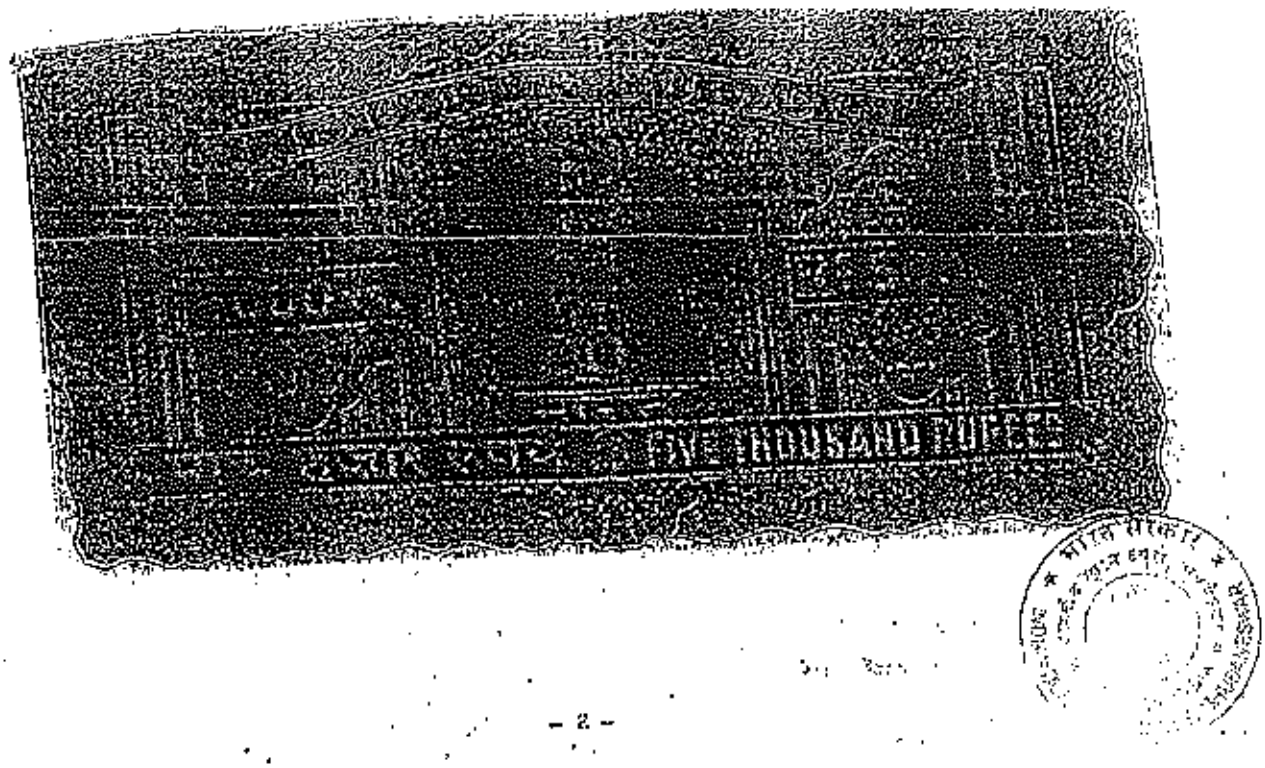
(See Rule 31)

THIS INDENTURE made this ... day of ... 19 ... between the Governor of Orissa (hereinafter referred to as the "State Government" which expression shall where the context so admits be deemed to include the successors and assigns) of the one party and

contd ...

Deputy Mamlatdar and
Collector

Annex. 8



Where the lessee is a registered company.

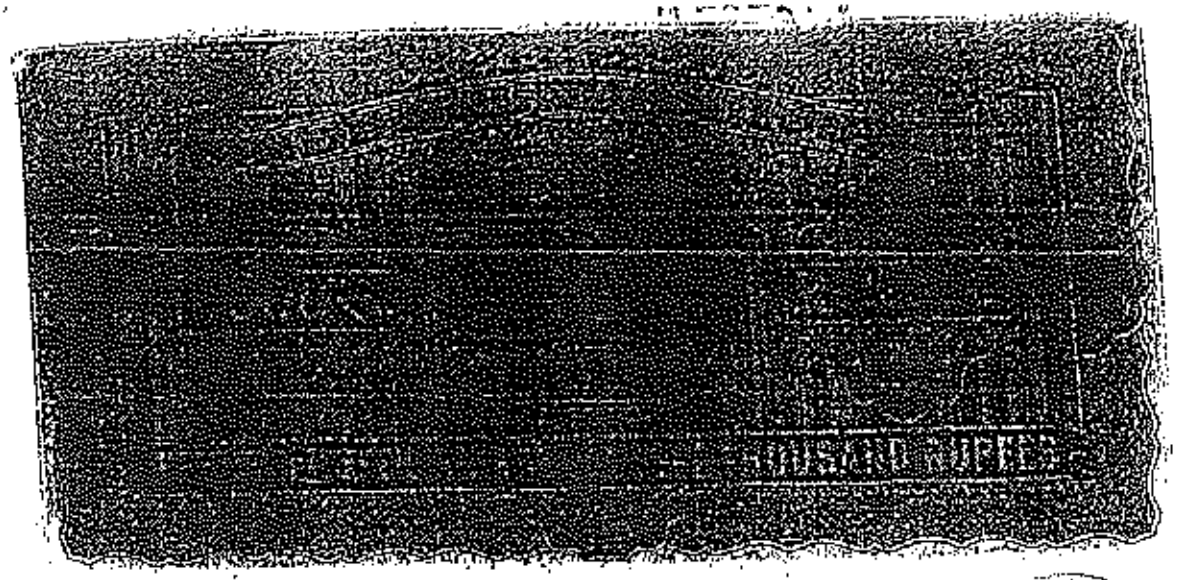
M/s. Orissa Mining Corporation Ltd. (name of company) a company registered under the Companies Act, 1956 (hereinafter which incorporated) and having its registered office at Bhubaneswar (Address)' (hereinafter referred to as the lessee) which expression shall where the context so admits be deemed to include its successors and permitted assigns) of the other part.

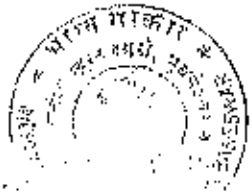
WHEREAS the lessee have applied to the State Government in accordance with the Mineral Concession Rules, 1960 (hereinafter referred to as the said Rules), for a mining lease for minerals

until ...

1/2

Annex. 3





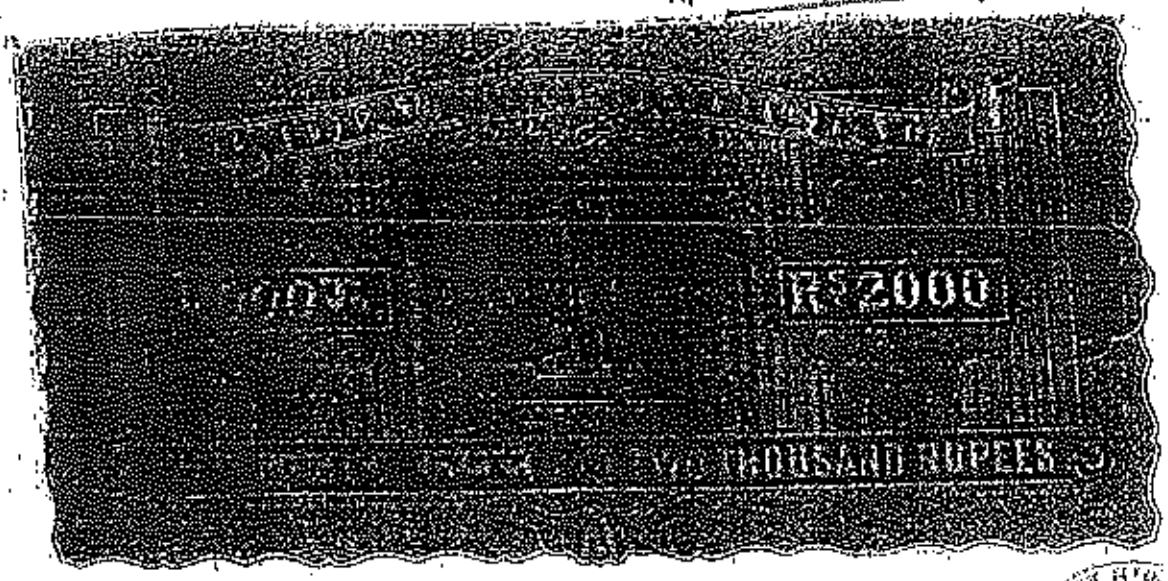
in respect of the land described in Part I of the Schedule hereunder written and have deposited with the State Government the sum of Rs.7000/- as security and the sum of Rs.2000/- for meeting the preliminary expenses for a mining lease (and whereas the Central Government has approved the grant of the lease *)

NOW THEREBY THIS in consideration of the rents and royalties covenants and agreements by which these presents and the Schedule hereunder written reserved and contained and on the part of the Lessee to be paid observed and performed, the State Government (with the approval of the Central Government) hereby grants and demises unto the Lessee

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* In case of minerals included in the First Schedule of the Mines and Minerals (Regulation and Development) Act, 1957.

Annexure 2



- 4 -

ALL those the mines beds/veins seams of minerals (hereinafter called the mineral or minerals) situated lying and being in or under the lands which are referred to in Part I of the said schedule, together with the liberties, powers and privileges to be exercised or enjoyed in connection therewith which are mentioned in Part II of the said Schedule subject to the restrictions and conditions as to the exercise and enjoyment of such liberties, powers and privileges which are mentioned in Part III of the said Schedule EXCEPT and reserving out of this demise unto the Lessor

1/4

Annex. B

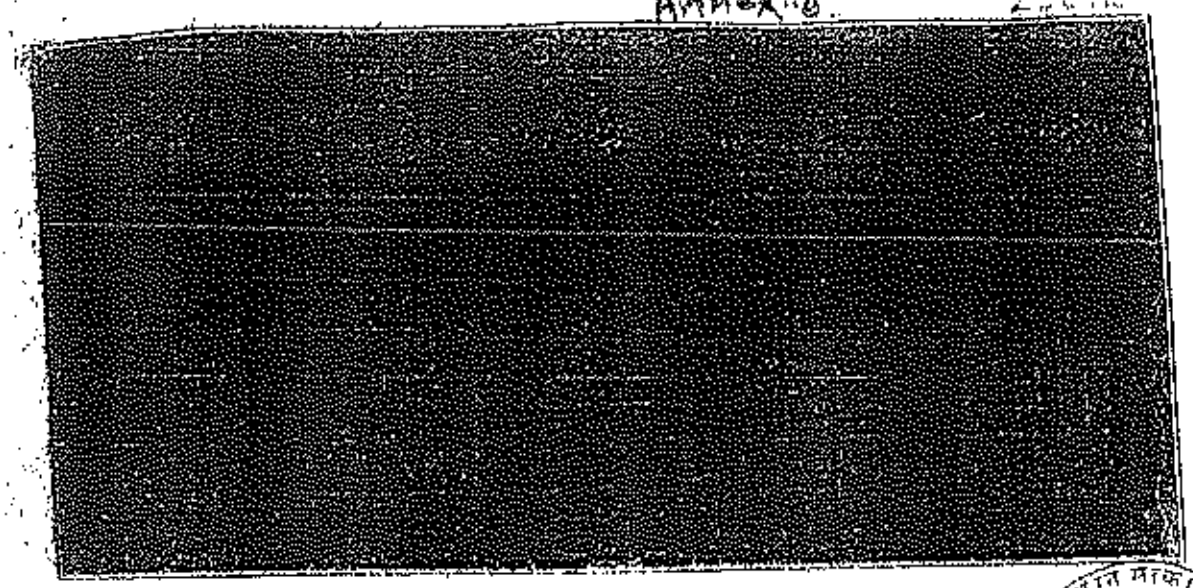


Government the liberties, powers, and privileges mentioned in Part IV of the said Schedule TO HOLD the premises hereby granted and demised unto the lessees from the 20th day Sept. 1987 for the term of 20 (twenty) years thence next ensuing YIELDING AND PAYING therefore unto the State Government the several rents and royalties mentioned in part V of the said Schedule at the respective times therein specified subject to the provisions contained in Part VI of the said Schedule and the lessees hereby covenants / covenant with the State Government as in Part VII of the said Schedule is expressed and the State Government hereby covenants with the lessees as in Part VIII of the said Schedule is expressed and it is hereby mutually agreed between the parties hereto as in Part IX of the said Schedule is expressed.

contd ...

1/5

Annex-8



IN WITNESS WHEREOF these presents have been executed in manner hereinafter appearing the day and year first above written.

The Schedule above referred to -

PART I

THE AREA OF THIS LEASE

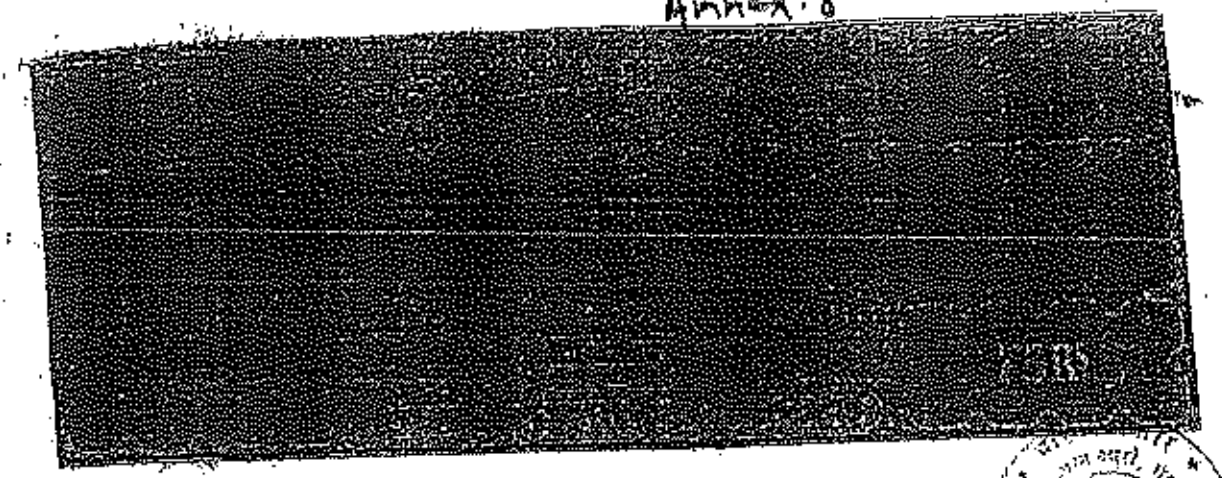
Location and area of the lease.

All that tract of lands situated at :

Village Ontagod	..	123.99 Hect.
Sunabeda	..	478.78 "
Sigrigi	..	246.77 "
Kendal	..	5.48 "
Kamakhya	..	58.25 "
Forest Block 27 jungle	..	38.10 "
		945.77 Acres.
	or	382.709 Hectares.

1/6

Annex. 8





- 7 -

(Description of area of areas) Surveyed in (Pargana) in Sublocale P.S. the Registration district of Buttevak Sub-District Jellow and known Sublocale bearing Cadastral Survey Nos.73 G/16 containing an area of 388.709 hect. or thereabouts delineated on the plan hereto annexed and thereon coloured in blue and bounded as follows :-

On the North by -

On the South by -

On the East by -

and

On the West by -

hereinafter referred to as " the said Lands "

Page 121

Annex 3

[illegible] Lessee [illegible] and which the Lessee [illegible] bound to deliver to the State Government under clause 20 of part of this Schedule and which the State Government shall not desire to purchase.

forfeiture of property left more than six months after determination of lease.

6. If at the end of six calendar months after the expiration or sooner determination of the said term under the provision contained in clause 4 of part VIII of this Schedule hereto effective there shall remain in or upon the said land any engines, machinery plant, buildings, structures, tramways, railways and other works, erections and conveniences or other property which are not required by the lessees in connection with operations in any other lands held by them under prospecting licence or mining lease the same shall if not removed by the lessees within one calendar month after notice in writing requiring their removal has been given to the lessees by the State Government be deemed to become the property of the State Government and may be sold or disposed of in such manner as the State Government shall deem fit without liability to pay any compensation or to account to the lessees in respect thereof.

Notice

7. Every notice by these presents required to be given to lessees shall be given in writing to such person resident on the said lands as the lessees may appoint for the purpose of receiving such notices and if there shall have been no such appointment then every such notice shall be sent to the lessees by registered post addressed to the lessees at the address recorded in this lease or at such other address in India as the lessees may from time to time in writing to the State Government designate for the receipt of notices and every such service shall be deemed to be proper and valid service upon the lessees and shall not be questioned or challenged by them.

...29

1/8

Annex-8

Issued by the Government
Attested by
Company's

compensation for any loss sustained by the lessee by reason of the powers and privileges conferred upon him by these presents.

9. For the purpose of stamp duty the anticipated royalty from the demised land is Rs.3,20,000/-(Three lakh twenty thousand) per year.

IN WITNESS WHEREOF these presents have been executed in the manner hereunder appearing the day and year first above written.

District Magistrate and
Collector, Cuttack.
Signed by the Collector, Cuttack
for and on behalf of
Governor of Orissa

In presence of:

1) [illegible]
O.C. Mining Section, Cuttack, LDC.

2) [illegible]
Dept. Mining Section, Cuttack Collr.

If the lease is executed by constituted attorney of the Company.

Signed by Chief Geologist,
for and on behalf of the
Orissa Mining Corporation Ltd,
Bhubaneswar's

In presence of:

Chief Geologist
Orissa Mining Corporation Ltd.
Bhubaneswar.

1) [illegible]

1/9

Annex.B

M/s. D.M. Quarry.

NORTHERN BOUNDARY The boundary line starts from point 'A' station No.1 and runs with a bearing of 77°-30' for a distance of 680 metres or 2230.55 feet upto point 'B' i.e. station No.5 through the intermediate station No.2 to 4. The A B line is common with C D line of Kaliapani M.Lease. Then the line runs making an interior angle of 90°-00' at point 'B' with A B for a distance of 1086.62 metres 3565.60 feet upto point 'C' i.e. station No.1 through the intermediate station No.6 to 10.

EASTERN BOUNDARY The boundary line starts from point 'C' and runs making an interior angle of 137°-00' at point 'C' with B C for a distance of 2124.69 metres or 6939.35 feet upto point 'D' i.e. station No.32 through the intermediate station No.12 to 31. From station point 15 to 27 is common with the recorded Sarnahil M.L. area of Mistilal Mines (P) Ltd.

SOUTHERN BOUNDARY The boundary line starts from point 'D' and runs making an interior angle of 65°-30' at point 'D' with C D for a distance of 1527.55 metres or 5110 feet upto point 'E' i.e. station 47 through the intermediate station No.33 to 46. The point 'E' is the common with point 'C' pillar of south Kaliapani M.Lease of M/s. O.M.C.Limited.

WESTERN BOUNDARY The boundary line of the area starts from point 'E' and runs making an interior angle of 110°-00' at point 'E' with D E for a distance of 7950' or 2433.16 metres and meets the starting point 'A' through the intermediate station No.48 to 60. The western boundary line is common with South Kaliapani M.L. area of M/s.O.M.C.Limited.

Sd/-M.Chinnaraj
25.2.80
Senior Surveyor.

1/10

Annex-8

22	19	[illegible]			
23	11	[illegible]			
[illegible]	14	[illegible]			
P 47	10	-do-	[illegible]	[illegible]	
48	21	Ratia Dehuri and Bewa Dehuri s/o Kuna Dehuri	Guava	0.01	
49	10	Padjala Dehuri	-do-	0.04	
50	20	Bewa Bisra Dehuri Gurubaria Dehuri	Pani/2	0.10	
51	20	-do-	Bernda/4	0.22	
P 52	2	Abhi Dehuri	Malla	0.06	part
P 52	10	Padajala Dehuri	Bernda/6	0.08	part
P 63	13	Dulla Dehuri, Tirla Dehuri s/o Bhagabata Dehuri	Pani/2	0.11	part
P 64	12	Tirtha Dehuri s/o Natha Dehuri	Bernda/9	0.12	part
65	7	Chaitan Dehuri s/o Sindhu Dehuri	Cahida/4	0.34	
66	10	Padjala Dehuri	Cahida/3	0.56	
67	10	-do-	K.Padia	0.04	
68	5	Kanja Dehuri, Sindhu Dehuri s/o Khetra Dehuri	-do-	0.09	
69	5	Kanja Dehuri, Sindhu Dehuri s/o Khetra Dehuri	Cahida	0.44	
70	5	-do-	K.Padia	0.05	
71	5	-do-	-do-	0.09	
72	5	-do-	Pani/2	3.27	
73	14	Karan Nayak s/o Jayadev Nayak	-do-	0.21	
74	19	Bewa Pradhan & others	Pani/2	0.42	
75	5	Kanja Dehuri & Sindhu Dehuri	Ban padia	0.43	
76	19	Bewa Pradhan & others	Pani/2	0.64	
77	11	Samajal Dehuri	-do-	0.24	
78	26	Sukanti Dehuri s/o Aparti Dehuri	Ban padia	0.23	
79	16	Bidya Dehuri s/o Kuna Dehuri	Ban padia	0.21	
80	26	Sukanti Dehuri s/o Aparti Dehuri	-do-	0.29	
81	13	Dulia Dehuri, Tirla Dehuri	Pani/2	1.03	
82	25	Bhagabat Dehuri s/o Bidia Dehuri	-do-	0.38	

1/11

Annex 3

P 93	22	Bano Dehuri, Lochan Dehuri	-do-	0.10	
P 94	22	-do-	-do-	0.34	
95	22	-do-	K.Pedia	0.30	
96	22	Bano. Dehuri, Lochan Dehuri	-do-	0.10	
97	10	Dadajala Dehuri	Pani/2	0.09	
98	10	-do-	-do-	1.90	
99	10	-do-	-do-	0.82	
100	5	Kunja Dehuri, Sindhu Dehuri	-do-	0.42	
101	4	Kalia Dehuri, Karia Dehuri	-do-	0.74	
102	10	Dadajala Dehuri	-do-	0.43	
103	11	Sana Jai Dehuri s/o Chaita Dehuri	-do-	0.36	
104	9	Jalandra Dehuri s/o Chagi Dehuri	Pani/2	0.07	
105	9	Jalandra Dehuri s/o Chagi Dehuri	-do-	0.06	
106	9	-do-	K.Pedia	0.60	Part
P 107	4	Kali Dehuri, Kari Dehuri	Pani/2	0.23	part
P 108	4	-do-	-do-	0.91	part
P 110	5	Kunja Dehuri, Sindhu Dehuri	Sal jungle	96.87	part
P 147	27	Ambadi Govt.	Bala	1.00	part
P 148/150	27	Ambadi Government	Sal jungle	4.07	part
P 150/151	27	-do-	Bala	2.85	
148	27	-do-			

VILLAGE : TAILANI NO. 21

P 351	30	Ambadi Government	Sal jungle	3.42	part

KHASPA NO.22

P 5	1	Ambadi Government	Sal jungle	58.25	part
				26.10	part

DUMURI BLOCK NO. 27

VILLAGE : DARUGHIA NO. 12

1	36	Ambadi	Bala	3.5	
P 2	34	-do-	Sal jungle	135.04	part
3	13	Pathani Padhan s/o Ambradha Padhan	P.Pedia	0.77	
4	33	-do-	-do-	0.66	
5	34	Ambadi	-do-	0.44	
	34	-do-	-do-	0.11	

1/12

Annex-B

	31	-do-		
	32	"		
	33	"		
15	34	-do-	-do-	
16	34	-do-	-do-	0.42
17	34	-do-	-do-	0.39
18	34	-do-	-do-	0.43
19	34	-do-	-do-	0.40
20	34	-do-	-do-	0.39
21	34	-do-	-do-	0.40
22	34	-do-	-do-	0.43
23	34	-do-	-do-	0.23
24	34	-do-	-do-	0.29
25	14	Dalka Padhan s/o Bhagabat Padhan	M.Padia Pani/2	1.77
26	14	Balaia Padhan s/o Bhagabat padhan	Pani/2	0.41
27	23	Sabar Dehuri s/o Tanu Dehuri Jena Mena w/o Jaiga Dehuri	P.Padia	2.97
28	23	-do-	Pani/1	3.25
29	23	-do-	Padia	0.05
30	23	-do-	P.Padia	0.05
31	5	Kandara Padhan	-do-	0.07
32	14	Baluka Padhan s/o Bhagabat Padhan	Pani/2	0.23
33	11	Naria Dehuri	-do-	0.31
34	4	Kapila Dehuri s/o Ganga Dehuri	-do-	0.45
35	7	Champatra Dehuri s/o Govinda Dehuri	-do-	0.44
36	7	-do-	Pani/2	0.30
37	18	Bhadra Dehuri s/o Bodai Dehuri	Pani/2	1.01
38	27	Sana Lakhsana Dehuri s/oSiduha Dehuri	-do-	0.51
39	15	Nikram Dehuri s/o Sada Dehuri	Pani/2	0.74
40	15	-do-	-do-	0.30
41	16	Bhagabat Padhan s/o Paban Padhan	Pani/1	1.16
42	13	Pathani Padhan s/oAbhimanyu Padhan & others	Pani/2	0.10
43	13	-do-	E.Padia Pani/2	0.09
44	13	-do-	Pani/2	0.18
45	13	-do-	M.Padia Pani/2	0.18
46	13	Pathani Padhan s/o Abhimanyu Padhan and others		

1/13

Annex-8

54	12	Bilu Padhan s/o Sarina Padhan	[illegible]	[illegible]
55	15	Sadharan Dehuri s/o Sada Dehuri	-do-	[illegible]
56	17	Sada Sadhikara Padhan s/o Sarina Padhan	Pasi/2	[illegible]
57	5	Kedra Padhan	-do-	[illegible]
58	24	Sabara Dehuri s/o Pani Dehuri	M.Padia Pasi/2	0.44
59	13	Pathani Padhan s/o Anirudha Padhan & others	M.Padia Pasi/2	0.08
60	13	-do-	-do-	0.54
61	9	Bandhu Dehuri s/o Sarana Dehuri s/o Sindhu Dehuri	Pasi/2	0.41
62	13	Pathani Padhan s/o Anirudha Padhan & others	Talia	0.41
63	34	Asutosh	Pala	1.46 part
64	34	-do-	P.Padia	0.35
65	35	Sarba Sadharana	Banta	1.67
66	24	Balka Padhan s/o Bhagabata Padhan	Pasi/2	0.41
67	20	Rabhia Dehuri s/o Kantha Dehuri	-do-	0.22
68	10	Barka Dehuri s/o Padka Dehuri	-do-	0.30
69	8	Ananta Padhan s/o Aparti Padhan	Pasi/2	0.52
70	22	Sapana Dehuri s/o Jaga Dehuri	-do-	0.40
71	17	Rudra Padhan s/o Bhagata Padhan	Pasi/2	1.02
72	19	-do-	Talia	0.40
73	17	Sada Sadhikara Padhan s/o Sarina Padhan	Talia	0.27
74	21	Sona Lakhsman Dehuri s/o Sindhu Dehuri	Pasi/2	0.28
75	22	Sajani Dehuri s/o Jaga Dehuri	Talia	0.18
76	15	Bhagabat Padhan s/o Puben Padhan	Talia	0.20
77	14	Balka Padhan s/o Bhagabat Padhan	Talia	0.34
78	13	Pathani Padhan s/o Anirudha Padhan & others	-do-	0.22
79	35	Sarba Sadharana	Bagadhi S Dhan	0.17
80	2	Ananta Padhan s/o Aparti Padhan	M.Padia Pasi/2	0.47
81	12	Bilu Padhan s/o Sarina Padhan	-do-	0.08
82	12	-do-	Talia	0.15
83	34	Asutosh	Ghar Sali	0.15
P 84	4	Lalita Dehuri	Talia	0.08

1/14

Annex-8

54	12	Bila Pathan s/o Barima Padhan	[illegible]	[illegible]	
55	15	Baikantha Deburi s/o Sada Deburi	[illegible]	[illegible]	
56	77	Bada Bhaktatra Padhan s/o Barima Padhan	Pasi/2	0.37	
57	2	Kabra Padhan	[illegible]	[illegible]	
58	24	Sabara Deburi s/o Pani Deburi	N.Padia Pasi/2	0.64	
59	13	Pathani Padhan s/o Aniruddha Padhan & others	N.Padia Pasi/2	0.68	
60	13	-do-	-do-	0.54	
61	9	Bandhu Deburi s/o Barima Deburi s/o Singhro Deburi	Pasi/2	0.41	
62	13	Pathani Padhan s/o Aniruddha Padhan & others	Talia	0.41	
63	34	Ambadi	Kala	1.15	part
64	34	-do-	P.Padia	0.35	
65	35	Barba Sadhuram	Pasta	1.67	
66	14	Malka Padhan s/o Bhagabata Padhan	Pasi/2	0.41	
67	20	Buchia Deburi s/o Kantha Deburi	-do-	0.23	
68	10	Suria Deburi s/o Paika Deburi	-do-	0.50	
69	2	Ananta Padhan s/o Aparti Padhan	Pasi/2	0.32	
70	23	Sajana Deburi s/o Jaga Deburi	-do-	0.40	
71	19	Nuaha Padhan s/o Bhagata Padhan	Pasi/2	1.08	
72	19	-do-	Talia	0.40	
73	17	Bada Bhaktatra Padhan s/o Barima Padhan	Talia	0.27	
74	21	Sana Lakhsman Deburi s/o Singhro Deburi	Pasi/2	0.23	
75	22	Sajani Deburi s/o Jaga Deburi	Talia	0.10	
76	14	Bhagabat Padhan s/o Paban Padhan	Talia	0.20	
77	14	Malka Padhan s/o Bhagabat Padhan	Talia	0.34	
78	19	Pathani Padhan s/o Aniruddha Padhan & others	-do-	0.22	
79	35	Barba Sadhuram	Bagadi 5 Gion	0.10	
80	7	Ananta Padhan s/o Aparti Padhan	N.Padia Pasi/2	0.27	
81	12	Bila Padhan s/o Barima Padhan	-do-	0.03	
82	12	-do-	Talia	0.15	
83	34	Ambadi	Uttar Pasi	0.15	
84	1	Kapila Deburi	Talia	0.32	

1/15

Annex-8

92	23	-do-	[illegible]	[illegible]
93	1	Sri Khamrud Thakuriyal s/o Sabar Deburi s/o Prem Deburi	Pasi/2	0.47
94	7	Chaitdhan Deburi, s/o Gobinda Deburi	S.Padia	0.67
95	7	-do-	Pasi/2	0.31
96	15	Bikram Deburi s/o Ram Deburi	Pasi/2	1.31
97	1	Khagdevad Thakuriyal s/o Sabar Deburi	Pasi/2	2.04
98	23	Sabar Deburi s/o Pasu Deburi	Pasi/2	0.96
99	23	-do-	Gehida	1.19
100	21	Sapani Deburi & Prasani Deburi s/o Jaga Deburi	Pasi/2	2.09
101	13	Pathani Padhan s/o Anirudha Padhan & others	P.Padia	0.21
102	13	-do-	Pasi/2	0.81
103	13	-do-	-do-	0.65
104	14	-do-	-do-	0.64
105	39	Sankar Patra s/o Hadi Patra	-do-	1.12
106	16	Bhagabat Padhan s/o Fakeer Padhan	Pasi/2	0.13
107	13	Pathani Padhan s/o Anirudha Padhan and others	Pasi/2	0.26
108	14	Dalka Padhan s/o Bhagabat Padhan	-do-	0.68
109	5	Indra Padhan	-do-	0.34
110	11	Karia Deburi s/o Dada Deburi	-do-	0.59
111	24	Nagara Deburi	Pasi/2	0.38
112	12	Nila Padhan s/o Karina Padhan	Pasi/2	0.77
113	34	Ambadi.	P.Padia	0.04
114	14	Dalka Padhan s/o Bhagabat Padhan	Pasi/2	2.45
115	34	Ambadi	P.Padia	0.01
116	32	Sushil Deburi s/o Kanhu Deburi (Minor)	Pasi/2	0.17
117	34	Ambadi	P.Padia	0.01
118	5	Yadav Padhan	Pasi/2	0.79
119	34	Ambadi	P.Padia	0.01
120	34	Ambadi	P.Padia	0.02
121	5	Padra Padhan	Gehida	1.06
122	21	Sana Pathuma Deburi s/o Kanhu Deburi	P.Padia	0.06
123	21	-do-	Pasi/2	0.19
124	34	Ambadi	P.Padia	0.02
125	23	Sabar Deburi s/o Pasu Deburi	Pasi/2	0.34

1/16

Annex-8

134	35	Sabara Dehuri s/o Panu Dehuri	Pasl/2
135	35	Balia Padhan s/o Bhagaban Padhan	Pasl/2
136	34	Anabadi	P.Padia
137	34	Balia Padhan s/o Bhagaban Padhan	Pasl/1
138	34	Anabadi	P.Padia
139	13	Pathani Padhan s/o Aniruddha Padhan & others	Pasl/2
140	13	-do-	-do-
141	13	-do-	H.Padia Pasl/2
142	23	Sabara Dehuri s/o Panu Dehuri	Pasl/2
143	13	Pathani Padhan s/o Aniruddha Padhan & others	Pasl/2
144	7	Champitra Dehuri s/o Gobinda Dehuri	H.Padia
145	7	-do-	Pasl/2
146	34	Anabadi	P.Padia
147	34	-do-	-do-
148	5	Kutra Padhan	Gobida
149	34	Anabadi	P.Padia
150	34	-do-	-do-
151	16	Bhagaban Padhan s/o Paben Padhan	Pasl/2
152	15	Sabara Dehuri s/o Sata Dehuri	Pasl/2
153	13	Pathani Padhan s/o Aniruddha Padhan & others	Pasl/2
154	2	Ananta Padhan s/o Aparti Padhan	Gobida
155	2	Ananta Padhan s/o Aparti Padhan	Gobida
156	10	Sarita Dehuri s/o Palia Dehuri	H.Padia
157	10	-do-	-do-
158	12	Bila Padhan s/o Narina Padhan	Gobida
159	12	-do-	Pasl/2
160	4	Kapila Dehuri s/o Ganga Dehuri	Pasl/2
161	19	Bhalu Padhan s/o Bhagata Padhan	P.Padia
162	34	Anabadi	Tpila
163	19	Bhalu Padhan s/o Bhagata Padhan	Pasl/2
164	32	Bachi Dehuri s/o Kantha Dehuri	Pasl/2
165	17	Bada Bachhitra Padhan s/o Narina Padhan	

1/17

Annex-8

174		[illegible]	[illegible]	[illegible]
175	[illegible]	[illegible]	[illegible]	[illegible]
176	[illegible]	[illegible]	[illegible]	[illegible]
175	[illegible]	English Cultivated s/o Ganga Prasad	[illegible]	[illegible]
176	[illegible]	-do-	Pasal/2	[illegible]
176	14	Balbir Pathan s/o Bhagabata Pathan	K.Padia Pasl/2	0,30
177	14	-do-	Pasl/2	0.91
178	13	Fatharl Pathan s/o Anirudha Pathan & others	Pasl/2	0.24
179	13	-do-	P.Padia	0.14
180	13	-do-	Pasl/2	0.44
181	13	-do-	P.Padia	0.29
182	13	-do-	Pasl/2	0.15
183	13	-do-	-do-	0.12
184	13	-do-	K.Padia Pasl/2	0.38
185	13	-do-	Pasl/2	0.30
186	24	Khaboli	Bariha	0.62
187	24	-do-	Pathari	0.70
188	24	-do-	Bariha	0.84
187	23	Sabar Dehuri s/o Pasu Dehuri	K.Padia Pasl/2	0.43
190	23	-do-	Pasl/2	2.35
191	18	Nila Pathan s/o Bariha Pathan	Kutan Padia Pasl/2	0.10
192	18	-do-	Pasl/2	0.04
193	18	-do-	P.Padia	1.18
194	18	-do-	K.Padia Pasl/2	1.34
195	23	Babar Dehuri s/o Pasu Dehuri	Gahida	0.87
196	23	-do-	P.Padia	0.01
197	19	Nathia Pathan s/o Bhagat Pathan	P.Padia	0.69
198	18	-do-	Pasl/2	1.35
199	19	-do-	Gahida	0.44
200	6	Krushna Dehuri s/o Kshetra Dehuri	Pasl/2	0.75
201	6	-do-	Gahida	0.74
202	5	Kudra Pathan s/o Akhra Khalkendra	Pasl/2	0.03
203	5	-do-	P.Padia	0.01
204	5	Kuira Pathan s/o Akhra Khalkendra	K.Padia	0.98
205	5	-do-	Pasl/2	0.45
206	24	Sabara Dehuri s/o Pasu Dehuri	Pasl/2	0.72

1/18

Annex-B

213	4	[illegible]	[illegible]
214	17	Bada Barbitra Padhan s/o [illegible]	[illegible]
215	17	-do-	[illegible]
216	11	Kuni Dehuri s/o Sadai Dehuri	[illegible]
217	18	Bhaiga Dehuri s/o Bidei Dehuri	[illegible]
218	12	Bila Padhan s/o Narina Padhan	[illegible]
219	35	Garba Sadharana	[illegible]
220	34	Anabadi	[illegible]
221	8	Jadu Dehuri s/o Gulabba Dehuri	[illegible]
222	34	Anabadi	[illegible]
223	11	Maria Dehuri s/o Sadai Dehuri	[illegible]
224	10	Maria Dehuri s/o Peika Dehuri	[illegible]
225	10	-do-	[illegible]
226	7	Champitra Dehuri s/o Sohinda Dehuri	[illegible]
227	7	-do-	[illegible]
228	8	Jadu Dehuri s/o Sulbha Dehuri	[illegible]
229	34	Anabadi	[illegible]
230	17	Bada Bhabitra Padhan s/o Narina Padhan	[illegible]
231	34	Anabadi	[illegible]
232	17	Bada Bhabitra Padhan s/o Narina Padhan	[illegible]
233	17	-do-	[illegible]
234	21	Bana Lakhman Dehuri s/o Hinda Dehuri	[illegible]
235	34	Anabadi	[illegible]
236	21	Bana Lakhman Dehuri s/o Bindha Dehuri	[illegible]
237	21	-do-	[illegible]
238	11	Karia Dehuri s/o Sadai Dehuri	[illegible]
239	11	-do-	[illegible]
240	22	Nagpal Dehuri & Prasard Dehuri s/o Raga Dehuri	[illegible]
241	20	Sahid Dehuri s/o Sardha Dehuri	[illegible]
242	20	-do-	[illegible]
243	20	-do-	[illegible]
244	20	-do-	[illegible]
245	16	Bangbasa Padhan s/o Puban Padhan	[illegible]
246	16	-do-	[illegible]
247	16	-do-	[illegible]
248	4	Anabadi	[illegible]

[illegible]	[illegible]
Pasl/2	[illegible]
-do-	0.60
-do-	0.78
Pasl/2	[illegible]
Pasl/2	0.51
Bijulibhali	0.24
P.Padia	1.56
Pasl/2	0.94
P.Padia	0.04
Pasl/2	1.07
Pasl/2	0.56
M.Padia	0.10
Pasl/2	0.30
M.Padia	1.05
Pasl/1	1.62
P.Padia	0.01
Pasl/2	1.81
P.Padia	0.02
Pasl/2	0.06
-do-	0.13
Pasl/1	0.23
P.Padia	0.01
Pasl/2	0.50
Pasl/2	0.69
M.Padia	0.39
Pasl	1.50
Pasl/2	[illegible]
Pasl/2	0.13
-do-	0.40
-do-	0.19
-do-	0.08
P.Padia	0.31
Pasl/2	5.63
Tadia	0.21
P.Padia	[illegible]

1/819

47

Annex-B

255	10	-do-	P.Padia		
256	10	-do-	Pasl/2	0.[illegible]	
257	10	-do-	Taila	0.31	
258	24	Gagri Dahuri s/o Paru Dahuri	P.Padia	[illegible]	
259	24	-do-	P.Padia	1.89	
260	24	-do-	P.Padia	1.01	
261	34	Ambedi	-do-	1.96	
262	24	Sagar Dahuri s/o Paru Dahuri	-do-	2.77	
263	34	Ambedi	Sal jungle	4.91	
264	34	-do-	P.Padia	2.66	
265	34	-do-	-do-	0.61	
266	34	-do-	-do-	1.78	
267	34	-do-	Taila	0.82	
268	23	Sahora Dahuri s/o Paru Dahuri	P.Padia	4.24	
269	34	Ambedi	-do-	2.12	
270	34	-do-	-do-	10.72	
271	34	-do-	-do-	3.95	
272	34	-do-	-do-	1.39	
273	34	-do-	-do-	3.87	
274	34	-do-	-do-	0.75	
275	34	-do-	-do-	0.69	
276	34	-do-	-do-	1.00	
277	34	-do-	-do-	2.14	
278	34	-do-	-do-	1.80	
279	34	-do-	-do-	0.89	
280	34	-do-	-do-	0.31	part
P 281	34	-do-	-do-	3.15	
282	34	-do-	-do-	1.88	
283	34	-do-	-do-	2.75	
284	34	-do-	-do-	3.15	part
P 285	34	-do-	-do-	2.25	part
P 286	34	-do-	-do-	0.60	
287	34	-do-	-do-	1.65	
288	34	-do-	sal jungle	1.15	
289	34	-do-	Taila	[illegible]	
290	34	Gatha Padam s/o Bhagwati Padam	-do-	[illegible]	
291	[illegible]	Sajila Rahman s/o Bhaga Dahuri			
[illegible]		-do-			
		Ambedi			

1/20

4-4

Annex: B

	9	-do-	P.Padia	
	9	-do-	P.Padia Pasl/2	0.5
	16	Bhagbata Pathan s/o Fatan Pathan	Sabta	1.2 1.24
	35	Sarba Sadharan	P.Padia	1.0
P 306	34	Arabadi	-do-	1.12
307	34	-do-	-do-	0.53
308	34	-do-	-do-	1.30 part
P 309	34	-do-	-do-	0.15 part
P 310	34	-do-	-do-	1.00 part
P 316	34	-do-	-do-	3.35 part
P 317	34	-do-	Sal Jungle	9.46 part
P 318	34	-do-	P.Padia	0.68 part
P 319	34	-do-	-do-	0.26 part
P 320	34	-do-	Jungle	0.01 part
P 321	34	-do-	Tolla	0.02
101/419	22	Sripati Dehuri s/o Jaga Dehuri	Tolla	0.09
101/420	13	Pathani Pathan s/shridhrakha Pathan & others	Khola Bari	0.30
101/421	13	-do-	P.Padia	0.22
165/128	34	Arabadi	Sal jungle	16.36
418	34	-do-	Total	672.76

SUKHANI - 18

P 1	24	Arabadi	Sal Jungal	1.53 part
P 52	4	Krushna Dehuri s/o Bana Dehuri	N.Padia Pasl/2	0.23 part
50	24	Arabadi	P.Padia	0.61
53	3	Kebuta Dehuri s/o Jali Dehuri	Pasl/2	0.65
54	26	Bolia Dehuri s/o Kalia Dehuri	Pasl/2	0.05
55	11	-do-	-do-	1.61
56	7	Chandrakan Dehuri s/o Sibadan Dehuri	N.Padia Pasl/2	0.30
57	7	-do-	Pasl/2	0.16
58	6	Chakra Dehuri s/o Ashrudha Dehuri	Pasl/2	0.65
59	23	Mangali Patra s/o Bhola Patra	Pasl/2	1.33
60	24	Arabadi	P.Padia	0.03
61	4	Hrushna Dehuri s/o Bana Dehuri	Pasl/2	0.1

1/2.1

Annex-B

		24	Anabadi	
68		9	Jaga Deburi s/o Sripati Deburi	P.Padia 0.03
70		9	-do-	K.Padia 0.07
71		9	-do-	Gahida 0.57
72		24	Anabadi	P.Padia 0.08
73		9	Jaga Deburi s/o Sripati Deburi	Gahida 0.12
74		9	-do-	K.Padia 0.52
75		24	Anabadi	Sal Jungle 0.49
76		9	Jaga Deburi s/o Sripati Deburi	Gahida 0.24
77		12	Bhikari Padhan s/o Naikhan Deburi	Gahida 0.05
78		5	Khetra Deburi s/o Gui Baliarsingh	K.Padia Pasi/2 0.15
79		12	Bhikari Padhan s/o Naikhan Deburi	P.Padia 0.11
80		12	-do-	Bandha 0.02
81		12	-do-	Gahida 0.14 part
P 82		12	-do-	Pasi/2 3.15 part
P 84		5	Khetra Deburi s/o Gui Baliarsingh	Pasi/2 0.33
85		12	Bhikari Padhan s/o Naikhan Deburi	Bandha 0.06
86		12	-do-	Gahida 0.67
87		12	Bhikari Padhan s/o Naikhan Deburi	Bandha 0.02
88		12	-do-	Gahida 0.17
89		23	Anabadi	K.Padia 0.43
90		1	Bhaskar Bhuinsuni s/o Jaga Deburi s/o Sripati Deburi	Pasi/2 0.31
91		7	Chemplira Deburi s/o Sindha Deburi	Padia 0.17
92		12	Bhikari Padhan s/o Naikhan Deburi	P.Padia 0.05
93		24	Anabadi	-do- 0.36 part
P124		12	Bhikari Padhan s/o Naikhan Deburi	Pasi/2 0.35
125		24	Anabadi	P.Padia 0.34
126		12	Bhikari Padhan s/o Naikhan Deburi	Padia 1.07
127		24	Anabadi	P.Padia 0.24
128		12	Bhikari Padhan s/o Naikhan Deburi	Gahida 0.47
129		24	Anabadi	P.Padia 0.05
130		12	Bhikari Padhan s/o Naikhan Deburi	-do- 0.80
131		12	-do-	Bandha 0.13
132		24	Anabadi	P.Padia 0.06
133		13	Bhagabat Bhuinsuni	K.Padia 0.21
134		24	Anabadi	P.Padia 0.06
135			Jaga Deburi s/o Sripati Deburi	Pasi/2 0.14

1/22

Annex-8

	24	Arabadi			
145	24	-do-			
146	12	Bhikari Padhan s/o Naikhan Dehuri	Pwd/2	8.42	
147	24	Arabadi	P.Fodia	0.01	
148	24	-do-	-do-	0.07	
149	12	Bhikari Padhan s/o Naikhan Dehuri	Gobida	0.09	
150	12	-do-	P.Fodia	0.50	
151	24	Arabadi	-do-	0.06	
152	6	Chakra Dehuri s/o Andrudha Dehuri	Tsila	1.21	
153	12	Bhikari Padhan s/o Naikhan Dehuri	-do-	5.48	
154	9	Jaga Dehuri s/o Sripati Dehuri	Tsila	3.67	
155	15	Pasu Dehuri s/o Bidhi Dehuri	-do-	0.41	
156	5	Khetra Dehuri s/o Gul Baliarsing	-do-	0.44	
157	4	Krushna Dehuri s/o Basu Dehuri	-do-	1.56	
158	17	Nanu Dehuri s/o Nal Dehuri	-do-	0.67	
159	12	Bhikari Padhan s/o Naikhan Dehuri	-do-	3.54	
160	2	Kapila Dehuri s/o Akula Dehuri	-do-	0.45	
161	16	Kaloka Dehuri s/o Paikara Dehuri	-do-	0.12	
162	7	Chandra Dehuri s/o Sindha Dehuri	-do-	1.03	
163	11	Baluka Dehuri s/o Kalia	-do-	1.58	
164	10	Baidhar Dehuri s/o Bhubu Dehuri	-do-	1.82	
165	3	Kabuta Dehuri s/o Jali Dehuri	-do-	1.07	
166	14	Bidhi Dehuri s/o Krushna Dehuri	-do-	0.41	
167	6	Chakra Dehuri s/o Andrudha Dehuri	-do-	1.65	
168	15	Pasu Dehuri s/o Bidhi Dehuri	-do-	0.53	
169	24	Arabadi	P.Fodia	175.47	
F 170	25	Surya Sethiaram	Bailabhuma	0.09	part
P 105	3	Kabuta Dehuri s/o Jali Dehuri	Gair Mal	0.01	part
P 106	4	Krushna Dehuri s/o Basu Dehuri	-do-	0.02	part
P 107	3	Kabuta Dehuri s/o Jali Dehuri	-do-	0.10	
108	42	Raikari Padhan s/o Naikhan Dehuri	Kadi	0.37	
109	17	Nanu Dehuri s/o Nal Dehuri	Gair	0.01	
110	5	Khetra Dehuri s/o Gul Baliarsing	Gair	0.01	
111	7	Chandra Dehuri s/o Sindha Dehuri	Gair Mal	0.01	
P 112	12	Bhikari Padhan s/o Naikhan Dehuri-Padhan	-do-	0.04	
P 113	25	Surya Sethiaram	Kadi	0.01	part
P 114	19	Baldeb Pradhan	Gair		
115	10	Baidhar Dehuri s/o Bhubu Dehuri Dehuri	Gair Mal		
P 116					

1/23

04

ANNEX-B

Quar part
Quar part
Land.

ABSTRACT

1.	Village -	Ostapal	126.99 Acres
2.		Sarsahil	472.78 Acres
3.		Dukrangi	246.77 Acres
4.		Tailangi	5.42 Acres
5.		Kusarda	58.25 Acres
6.	Forest Block 27		36.10 Acres
			945.71 Acres
		or	382.709 Hectares

Deputy Director (Commercial)
Collieries, Cuttack.

Asstt. Geologist,
[illegible]

Typed by: B. Sahu
Typist
M/S. [illegible]
BBSR.

1/2y

Annexure-2

No. 4906 dt. 28.9.99.

FORM-D

RECEIPT OF APPLICATION FOR PROSPECTING LICENCE/MINING LEASE OR RENEWALS.

(See Rules-10(4) and 23 (4).

GOVERNMENT OF ORISSA

Regd.No. 249 Dated- 19.9.99

Received the application with the following enclosures for prospecting licence/Mining lease/Renewal of prospecting licence/renewal of mining lease of Shri/Sm/Kumari M/s OMC Ltd Bhubaneswar on 19.9.99 for about 382.709 hects of land located in village/Government Forest/Patta Sukhurangi, Bhapal, Sarankul, Tehsil Dist. Jajpur for prospecting/mining Chromite mineral thereof.

Enclosures

1. Application for renewal of ML. in form J
2. Treasury Challan of Rs.500/-
3. Boundary description & Land Schedule.
4. Half mile plan along with location plan in 1:50,000 scale
5. Xerox copy of power of Attorney
6. —do— of affidavit showing list of proposed grant but not executed and applied area for ML.
7. Xerox copy of the up to date TCC.
8. —do— of the MDCC exemption certificate
9. —do— of certificate of incorporation
10. List of Technical personnel.
11. Copy of Letter from IBM communicating the approval of mining plan
12. Copy of the Letter forwarding the DRP for Sukurangi ML. under Hiking or consent from Private lands.

Place:- Jajpur Road
Date:- 28.9.99

Deputy Director Mines,
Jajpur Road.

Sri Upadhaya, SA

Page 139

Annex. 10

No. 29985/OML/99 Date 4.9.99

To

The Collector,
Jaipur.

Sub:- Application for 1st renewal of M.L.over an area of 302.709 hects. for chrome ore in village Kherni of Jaipur Dist.

Sir,

Enclosed please find herewith 6(six) sets of application for the 1st renewal of M.L.in form-'J' as per Rule-24(1) of M.C.Rules,1960 amended 1994 alongwith necessary documents as mentioned below in respect of an area over 302.709 hects. for chrome ore in village Kherni of Jaipur Dist.

We would therefore, request that the application may please be forwarded to the State Govt. with your esteemed recommendations for grant of 1st renewal of the above M.L. In this context, a treasury challan in original for an amount of Rs.500/- (Rupees five hundred only) bearing challan No.83 dt.24.9.99 deposited towards application fee is also enclosed herewith for needful.

The receipt of the application may kindly be acknowledged.

Yours faithfully,

[signature]
SECTION (M.M.Act(Cgn))

Encl:- Six sets of application for renewal of M.L. Each set consisting of:

1. Duly filled form-'J'
2. Treasury chalan bearing No.83 dt.24.9.99 for Rs.500/- in original.
3. Boundary description
4. Land schedule
5. Xerox copy of power of Attorney
6. Xerox copy of Affidavit showing list of executed, granted but not executed and applied M.L.application by OMC.
7. Xerox copy of the upto date ITCC
8. Xerox copy of the MOEF exemption certificate

...2/-

Annex. 10

- 2 -

9. Xerox copy of certificate of incorporation.

10. List of technical personnel.

11. Photo copy of the letter from IBM communicating the approval of Mining Plan.

12. Photo copy of the letter forwarding the EMP for Sukrangi R.L.area.

13. Undertaking on consent from private tenants.

14. 16" & 1 Mile Plan along with location Plan in 1:50,000 scale.

Memo No. 27986 /OMC/99 Dt. 30.9.99

Copy with one set of application forwarded to the Principal Secretary, Government of Orissa, Department of Steel & Mines, Bhubaneswar for favour of information and necessary action.

Copy forwarded to the Director of Mines, Orissa, Bhubaneswar for favour of information and necessary action.

Copy to the Dy. General Manager (Mining), OMC Ltd., Jajpur Road for information and necessary action.

Copy to the Manager (Geo), OMC Ltd., J.K. Road for information and necessary action.

30.9.99
SENIOR MANAGER (GEO)

Annex. 10

FORM-G

(To be submitted in duplicate)

GOVERNMENT OF ORISSA
MODEL FORM

Application for Renewal of Mining Lease
(See Rule-24 A(1))

Dated Day of 19

Received _____

at _____ (Place)

on _____ (Date)

Initial of

Receiving Officer

To

The Principal Secretary to Government,
Department of Steel and Mines,
Orissa, Bhubaneswar.

Through the Collector, Jajpur.

Sir,

I/We request for renewal of my/our mining lease under the Mineral Concession Rules, 1960.

A sum of (Rs.500/-) being the application fee payable under sub-rule (3)(1)(a) of Rule-22 of the said rules has been deposited (No. MII-152(37)/62, dated 22.07.63) Treasury Challan No. 80 dt. 24.8.99

2. The required particulars are given below:

(i)	Name of the applicant with complete address:	The Orissa Mining Corporation Ltd. Post Box No.34, Bhubaneswar-751001.
(ii)	Is the applicant a private individual/private company/ public company/firm or association ?	Public Sector Undertaking.
(iii)	In case applicant is,	
a)	an individual, his nationality,	Case does not arise.
b)	a private company, the nationality of all members of the company alongwith place of registration;	Case does not arise.
c)	a firm or association, the nationality of all the partners of the firm or members of the association,	Indian 100% share held by Govt. of Orissa

Contd...2/-

(1)

Annex. 10

-: 2 :-

(iv)	Profession or nature of business of applicant.	Exploration, exploitation & marketing of ores/minerals.
(v)	2 (x x x x)	
(vi)	2 (x x x x)	
(vi-a)	No and date of valid clearance Certificate of payment of Mining dues.	Copy of exemption of mining dues clearance certificate no.8102, dt.19.6.[illegible] is enclosed.
(vii)	an affidavit, that up-to-date Income Tax returns, as prescribed under the Income Tax Act, 1961, have been filed, and the tax due, including the tax on account of self-assessment has been paid.)	
(vii-a)	No and date of income tax clearance certificate from the Income tax Officer (attached).	Copy of valid ITCC is enclosed. NO.31 dt 31.3.2000.
(viii) (a)	Particulars of the Mining lease of which renewal is desired:	1st renewal is required over an area of 382.709 hects. for chrome ore in village Sukarangi of Jajpur Dist.
(b)	Details of previous renewal granted, if any.	Not applicable.
(ix)	Period for which renewal of mining lease is required.	20 years.
(x)	Whether renewal is applied for the whole or part of the leased hold ?	Whole lease hold area.
(x-A) (a)	Does the applicant continue to have surface rights over the area of the land for which he requires renewal of the mining lease.	Yes.
(b)	If not, has he obtained the consent of the owner and occupier for undertaking mining operations. If so, the consent of the owner and occupier of the land obtained in writing be filed.	Necessary undertaking in this respect is enclosed.
(x-B)	Particulars of the areas mineral-wise in each State duly supported by affidavit for which the applicant or any person joint in interest with him.	Copy of the affidavit is enclosed.
(a)	already holds under mining leases;	-do-
(b)	has already applied for but no granted, or	-do-
(c)	being applied for simultaneously;	-do-
(x-C)		

Annex. I D

-: 2 :-

(iv)	Profession or nature of business of applicant.	Exploration,exploitation & marketing of ores/minerals.
(v)	2 (x x x x)	
(vi)	2 (x x x x)	
(vi-a)	No and date of valid clearance Certificate of payment of Mining dues.	Copy of exemption of mining dues clearance certificate no.8102,dt.19.6.79 is enclosed.
(vii)	an affidavit, that up-to-date Income Tax returns, as prescribed under the Income Tax Act, 1961, have been filed, and the tax due, including the tax on account of self-assessment has been paid.)	
(vii-a)	No and date of income tax clearance certificate from the Income tax Officer (attached).	Copy of valid ITCC is enclosed. NO.31 dt 31.3.2000
(viii) (a)	Particulars of the Mining lease of which renewal is desired;	1st renewal is required over an area of 382.709 hects. for chrome ore in village Sukarangi of Jajpur Dist.
(b)	Details of previous renewal granted, if any.	Not applicable.
(ix)	Period for which renewal of mining lease is required.	20 years.
(x)	Whether renewal is applied for the whole or part of the lease hold ?	Whole lease hold area.
(x-A) (a)	Does the applicant continue to have surface rights over the area of the land for which he requires renewal of the mining lease.	Yes.
(b)	If not, has he obtained the consent of the owner and occupier for undertaking mining operations. If so, the consent of the owner and occupier of the land obtained in writing be filed.	Necessary undertaking in this respect is enclosed.
(x-B)	Particulars of the areas mineral-wise in each State duly supported by affidavit for which the applicant or any person joint in interest with him.	Copy of the affidavit is enclosed.
(a)	already holds under mining lease;	-do-
(b)	has already applied for but no granted, or	-do-
(c)	being applied for simultaneously;	-do-
(x-C)		

Annex. 10

-: 2 :-

(iv)	Profession or nature of business of applicant.	Exploration, exploitation & marketing of ores/minerals.
(v)	2 (x x x x)	
(vi)	2 (x x x x)	
(vi-a)	No and date of valid clearance Certificate of payment of Mining dues.	Copy of exemption of mining dues clearance certificate no.8102, dt.19.6.70 is enclosed.
(vii)	an affidavit, that up-to-date Income Tax returns, as prescribed under the Income Tax Act, 1961, have been filed, and the tax due, including the tax on account of self-assessment has been paid.)	
(vii-a)	No and date of income tax clearance certificate from the Income tax Officer (attached).	Copy of valid ITCC is enclosed. NO.31 dt 31.3.2000.
(viii) (a)	Particulars of the Mining lease of which renewal is desired:	1st renewal is required over an area of 382.709 hects. for chrome ore in village Sukarangi of Jajpur Dist.
(b)	Details of previous renewal granted, if any.	Not applicable.
(ix)	Period for which renewal of mining lease is required.	20 years.
(x)	Whether renewal is applied for the whole or part of the lease hold ?	Whole lease hold area.
(x-A) (a)	Does the applicant continue to have surface rights over the area of the land for which he requires renewal of the mining lease.	Yes.
(b)	If not, has he obtained the consent of the owner and occupier for undertaking mining operations. If so, the consent of the owner and occupier of the land obtained in writing be filed.	Necessary undertaking in this respect is enclosed.
(x-B)	Particulars of the ores mineralise in each State duly supported by affidavit for which the applicant or any person joint in interest with him.	Copy of the affidavit is enclosed.
(a)	already holds under mining lease;	-do-
(b)	has already applied for but no granted, or	-do-
(c)	being applied for simultaneously	-do-
(x-C)		

Annex. 10

(X-C)	A mining plan which shall include:-		
	(a)	the plan of the area showing the nature and extent of the mineral body, spot or spots where the excavation is to be done in the first year and its extent, a detailed cross-sections and detailed plan of spot(s) of excavation based on prospecting data gathered by the applicant a tentative scheme of mining for the period of the lease.	Mining Plan with all these details have been prepared and duly approv by IBM vide letter no.Cal/Jaj/Cr/MP-370, dt.5.9.95,copy of the letter is enclosed.
	(b)	the details of geology and lithology of the area, the extent of manual mining and through machines :	-do-
	(c)	annual programme and plan for excavation from year to year:	-do-
	(d)	the plan of the area showing natural water courses; limit of reserved and other forest area and density of trees, assessment of impact of mining activity on Forest, Land surface and Environment including air and water pollution, and details of the scheme for restoration of the same by afforestation, land reclamation, use of pollution control devices.	-do-
(X-D)	Is the mineral going to be used in his own industry? If so, give full details.(For own industry Ex-planation under rule 24-D)		The ore containing less than 33% Cr_2O_3 will be beneficiated in OMC's COB Plant. Ore containing more than 33% Cr_2O_3 will be sold out after blending.
(xi)	In case the renewal applied for is only part of the lease hold		
	(a)	the area applied for renewal	
	(b)	description of the area applied for renewal (description should be adequate for the purpose of demarcating the plot.	—
	(c)	particulars of map of the lease hold with area applied for renewal clearly marked on it (attached)	—
	(d)	particulars of existing or created dumps of ore, if any (No. MII-169 (44)/61 dated 07.09.61).	
(xii)	means by which the mineral is to be raised i.e. by hand labour or mechanical or electric power.		Manual method.
(xiii)	Manner in which the mineral raised is to be utilised :		Both domestic sale and export purpose.
	(a)	For manufacture in India	
	(b)	exports to foreign countries	

Contd...4/-

Annex. 10

(xiv)	In case either case the industries in connection with which it is required, should be specified. In the latter case, the countries to which the mineral will be exported and whether the mineral is to be exported after processing or in raw form should be stated.	Chromite will be supplied to chrome based industries in the country and exported mostly to China. However, low grade ore will be exported after beneficiation as concentrates.
(xiv)	Details of output during the last three years and phased programme for production during the next three years alongwith a layout plan for development, if any.	Year — Chrome ore production. 1996-97 — 4207 MT (all grade) 1997-98 — Nil 1998-99 — 1098 MT 1999-2000 — 5000 MT 2000-2001 — 5000 MT 2001-2002 — 5000 MT
(xv)	In case of coal, details of existing railway transport facility, available and additional transport facility, if any, required.	Case does not arise.
(xvi)	Any other particulars which the applicant wishes to furnish.	Will be furnished on demand.

I/We do hereby declare that the particulars furnished above are correct and am/are ready to furnish any other details, including accurate plan as required by you before the grant of renewal of the lease.

Yours faithfully,

Date: 9.9.02

Place: Bhubaneswar.

Signature and designation of the
SR. MANAGER (GEO.)
Orissa Mining Corporation Ltd.
Bhubaneswar.

N.B: If the application is signed by an authorised agent of the applicant, Power of Attorney should be attached.

ad/70497

No. J-11015/409/2008-IA.II(M)
Government of India
Ministry of Environment and Forests
IA Division

Annex-19

Paryavaran Bhawan
CGO Complex, Lodhi Road,
New Delhi-110 003

Dated the 18th February, 2010

To

M/s The Orissa Mining Corporation Ltd,
P.O. Jajpur Road,
District Jajpur,
Orissa-758 036
E-mail) info@orissamining.com

Subject: Expansion of Sukurangi Chromite Mining Project of M/s The Orissa Mining Corporation Ltd. located in Village(s) Sukrangi, Sarubili and village limits of Ostapal, Kamarda and Talangi, Tehsil Sukinda, District Jajpur, Orissa- environmental clearance regarding.

Sir,

This has reference to your letter No. 18924/OMC/F&E/09 dated 31.10.2009 and subsequent letters dated 10.12.2009 and 23.12.2009 on the subject mentioned above. The Ministry of Environment and Forests had prescribed additional Terms of Reference(TORs) to the project on 22.12.2009 for incorporating in the already prepared EIA report. The proposal is for renewal of mine lease, which fall due since 2000 and enhancement of production of chrome ore to 1,30,000 tonnes per annum(TPA). The total mine lease area of the project is 382.709ha, out of which 47.02ha is an agricultural land, 177.76ha is forestland; 106.92ha is wasteland, 26.569ha is grazing land, 0.19ha is surface water bodies and 15.35ha is others(settlements). Area proposed for mining is 73.10ha, an area of 76.48ha is kept for OB dumps, 61.46ha for mineral storage, 8.26ha for roads, 26.25ha for green belt, 19.96ha for township and 117.199ha is others. The Damsal Nalla flows through the Northern part of the lease. In addition, there are few additional seasonal drainage channels in the lease which drain into the Damsal Nallah. No national park/wildlife sanctuary/biosphere reserve/tiger reserve/elephant reserve etc. are reported to be located in the core and buffer zone of the mine. In support of this a letter from the DFO Cum Wildlife Warden, Cuttack dated 04.11.2008 provided along with a duly authenticated map. According to the Wildlife Warden, the lease area adjoins the elephant movement area (elephant corridor) of Mahagiri DPF, which is about 3km towards East from the mine lease. The mine working will be opencast by semi-mechanized method involving drilling and blasting. The targetted production capacity of the mine is 1,30,000TPA of chromite and the life of mine is 30years. Approximately 400TPD of mineral will be transported through the road. The mine lease is located at the foot of the Mahagiri hill range and slopes from South-East to

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Annexure II

2. The Ministry of Environment and Forests has examined the application in accordance with the EIA Notification, 2006 and hereby accords environmental clearance under the provisions thereof to the above mentioned Sukurangi Chromite Mining Project of M/s The Orissa Mining Corporation Ltd. for an annual production capacity of 1,30,000 tonnes of chrome ore by the opencast semi-mechanised method involving total mining lease area of 382.709ha, subject to implementation of the following conditions and environmental safeguards.

A. Specific conditions

(i) The project proponent shall obtain fresh Consent to Establish for envisaged production capacity of 1,30,000TPA of chrome ore and Consent to Operate from the State Pollution Control Board, Orissa and effectively implement all the conditions stipulated therein.

(ii) Necessary forestry clearance under the Forest (Conservation) Act, 1980 for an area of 177.76ha forestland involved in the project shall be obtained before starting mining operation in that area. Till such time mining activities shall be restricted to an area of 41.34ha already broken up forestland for which approval under Section-2 of the Forest (Conservation) Act, 1980 was granted by the Ministry of Environment and Forests on 05.02.2001. Environmental clearance is subject to grant of forestry clearance.

(iii) The environmental clearance is subject to approval of the State Land Use Department, Government of Orissa for diversion of agricultural land for non-agricultural use.

(iv) The project proponent shall develop fodder plots in the non-mineralised area in lieu of use of grazing land.

(v) Environmental clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No. 460 of 2004, as may be applicable to this project.

(vi) Environmental clearance is subject to obtaining clearance under the Wildlife (Protection) Act, 1972 from the competent authority, as may be applicable to this project.

(vii) The project proponent shall obtain prior clearance from the Chief Wildlife Warden due to proximity of mine to the elephant corridor.

(viii) The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations. The first order streams, the seasonal nallahs and Dalnisal Nallah passing through the mine lease shall not be disturbed and these shall be protected by providing garland drains.

6/2

Annexure II

(xiii) Mine water discharge and/or any waste water shall be properly treated to meet the prescribed standards before reuse/discharge. The run off from OB dumps and other surface run off should be analyzed for Cr^{+6} and in case its concentration is found higher than the permissible limit, the waste water should be treated before discharge/reuse.

(xiv) Effluents containing Cr^{+6} shall be treated to meet the prescribed standards before reuse/discharge. Effluent Treatment Plant shall be provided for treatment of mine water discharge and wastewater generated from the workshop and mineral separation plant.

(xv) Separate impervious concrete pits for disposal of sludge shall be provided for the safe disposal of sludge generated from the mining operations.

(xvi) Regular monitoring of water quality upstream and downstream of Damsal nallah shall be carried out and record of monitoring data should be maintained and submitted to Ministry of Environment and Forests, its Regional Office, Bhubneswar, Central Groundwater Authority, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.

(xvii) The project proponent shall ensure that the quality of decanted effluents from the tailing pond, if any, conform to the prescribed standards before discharge. The decanted water from the tailing pond shall be re-circulated within the mine and there shall be zero discharge from the mine.

(xviii) The project proponent shall explore the possibility to reduce concentration of Cr^{+6} in the tailing pond, if any, in consultation with an expert scientific institution like NEERI.

(xix) Plantation shall be raised in an area of 204.7ha including a 7 km wide green belt in the safety zone around the mining lease by planting the native species around ML area, over burden dumps, mine benches, roads etc, in consultation with the local DFO/Agriculture Department. The tree density should be two thousands trees per hectare. At least 1500 trees per year shall be planted. Greenbelt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.

(xx) The void left unfilled in an area of 57.2ha shall be converted into the water body. The higher benches of excavated void/mining pit shall be terraced and plantation done to stabilize the slopes. The slope of higher benches shall be made gentler for easy accessibility by local people to use the water body. Peripheral fencing shall be carried out all along the excavated area.

6/3

(xxix) Digital processing of the entire lease area using remote sensing technique should be done regularly once in three years for monitoring land use pattern and report submitted to the Ministry of Environment and Forests and its Regional Office located at Bhubaneswar.

(xxx) Drills shall either be operated with dust extractors or equipped with water injection system.

(xxxi) Mineral handling area shall be provided with adequate number of high efficiency dust extraction system. Loading and unloading areas including all the transfer points should also have efficient dust control arrangements. These should be properly maintained and operated.

(xxxii) Sewage treatment plant shall be installed for the colony. ETP shall also be provided for the workshop and wastewater generated during the mining operation.

(xxxiii) Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly.

(xxxiv) The critical parameters such as RSPM (Particulate matter with size less than 10micron i.e., PM_{10}), NO_x in the ambient air within the impact zone, peak particle velocity at 300m distance or within the nearest habitation, whichever is closer shall be monitored periodically. Further, quality of discharged water shall also be monitored ((TDS, DO, pH and Total Suspended Solids (TSS)). The monitored data shall be uploaded on the website of the company as well as displayed on a display board at the project site at a suitable location near the main gate of the Company in public domain. The Circular No. J-20012/1/2006-IA(I)(M) dated 27.05.2009 issued by Ministry of Environment and Forests, which is available on the website of the Ministry www.envfor.nic.in shall also be referred in this regard for its compliance.

(xxxv) A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.

B. General conditions

(i) No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forests.

(ii) No change in the calendar plan including excavation, quantum of mineral chrome ore and waste should be made.

(iii) Conservation measures for protection of flora and fauna in the core & buffer zone should be drawn up in consultation with the local forest and wildlife department and effectively implemented.

Annexure II

(xiii) The Regional Office of this Ministry located at Bhubneswar shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports.

(xiv) The project proponent shall submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the Ministry of Environment and Forests, its Regional Office Bhubneswar, the respective Zonal Office of Central Pollution Control Board the State Pollution Control Board. The proponent shall upload the status of compliance of the EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of the Ministry of Environment and Forests, Bhubneswar, the respective Zonal Office of Central Pollution Control Board and the State Pollution Control Board.

(xv) A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad/ Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.

(xvi) The State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Centre and the Collector's office/ Tehsildar's Office for 30 days.

(xvii) The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the Regional Office of the Ministry of Environment and Forests, Bhubneswar by e-mail.

(xviii) The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment and Forests at http://envfor.nic.in and a copy of the same should be forwarded to the Regional Office of this Ministry located at Bhubneswar.

3. The Ministry or any other competent authority may alter/modify the above conditions or stipulate any further condition in the interest of environment protection.

Contd/-

6/5

Annexure II

(x) The District Collector, Jajpur District, Orissa.

(xi) EI Division, Ministry of Environment & Forests, CI Division, New Delhi.

(xii) Monitoring File.

(xiii) Guard File.

(xiv) Record File.

6/6

Annexure - 12

BY REGD POST

OFFICE OF THE
STATE POLLUTION CONTROL BOARD, ORISSA
Paryavesh Bhawan, A/118, Nilakantha Nagar, Unit-VIII,
Bhubaneswar - 751 012

No 2214 /Ind II-NOC- 4700 Date 5/11/08

OFFICE MEMORANDUM

In consideration of the application for obtaining Consent to Establish for M/s. Sukrangi Chromite Mine of the Orissa Mining Corporation Ltd the State Pollution Control Board has been pleased to convey its Consent to Establish under section 25 of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act 1981 for increase in production of Chromite ore of quantity 36000 Ton/Annum to 127,000 Ton/Annum (over mine lease hold area of 382.709 Ha.) At - Sukrangi, PO - Kalarangitta in the district of Jajpur with the following conditions

GENERAL CONDITIONS.

1. This Consent to establish is valid for the product, quantity manufacturing process and raw materials as mentioned above & for a period of five years from the date of issue of this letter, provided commencement of production of the proposed project has not taken place in the meantime.
2. If the proponent fails to start operation of the project but substantial physical progress has been made then a renewal of this consent shall be sought by the proponent
3. Adequate effluent treatment facilities are to be provided such that the quality of sewage and trade effluent satisfies the standards as prescribed under EP Rule or as prescribed by the Central Pollution Control Board and/or State Pollution Control Board or otherwise stipulated in the special conditions
4. All emission from the industry as well as the ambient air quality and noise are to conform to the standards as laid down under EP Rule/Central Pollution Control Board/State Pollution Control Board of otherwise stipulated in the special conditions
5. Adequate method of disposal of solid waste is to be adopted to avoid environmental pollution
6. The industry is to comply to the provisions of EP Act, 1986 and the rules made thereunder with their amendments from time to time such as the Hazardous Chemical/Manufacture, Storage and Import Rule, 1989 etc.. The industry is also to comply to the provisions of Public Liability Insurance Act, 1991, if applicable
7. The industry is to apply for grant of Consent to operate under section 25/26 of Water(Prevention & Control of Pollution)Act 1974 & Air (Prevention & Control of

Annexure-12

Pollution)Act, 1981 (if coming under air pollution control area) at least 3 (three) months before the commercial production and obtain Consent to Operate

8 **This consent to establish is subject to statutory and other clearances from Govt. of Orissa and / or Govt. of India as and when applicable.**

SPECIAL CONDITIONS

1. **The mine has to seek environmental clearance as per the EIA notification 2006 or as recommended by EAC/SEAC. However, commencement of mining activity for proposed expansion shall be done after obtaining environmental clearance or as recommended by EIAA/SEIAA**

2. The increase in production will be achieved through following equipment & machineries

Sl. No.	Type of machinery	Capacity	Numbers	HP
1.	Tractor	8 kg/sq.m.	2	55 & 100
2.	Jackhammer	7 kg	5	-
3.	Hydraulic shovel	0.9 m3	-	-
4.	Water tanker (1210SE)	10 t	1	55
5.	Explosive van (FC 16°)	-	1	100
6	Truck (1210 SE)	10 t	1	40
7.	Ambulance jeep	-	1	3.5
8.	Submersible pump (Electric)	-	2	7.5 & 15
9	Electric pump (Electric)	-	2	7.5 & 15
10	Tulu pump (Electric)	-	1	5
11.	Diesel pump (Non-electric)	-	1	10

3. No change in mining technology and scope of working shall be made without prior approval of the Board

4. Top soil should be stacked properly with proper slope at earmarked site(s) with adequate measures and shall be used for reclamation and rehabilitation of mined out areas

5. Concurrent back-filling should be started from the fourth year of operation Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining Compliance status should be submitted to the Ministry of Environment & Forests with a copy to the Board on yearly basis

6. Dimension of the retaining wall at the toe of dumps and OB benches within the mine to check run-off and siltation shall be based on the rainfall data. The detail specification shall be worked out and submitted to the Board.

7. A green belt of adequate width shall be raised for suppression of dust by planting the native species around to ML area, roads, OB dump sites, etc., in consultation with the local DFO/Agriculture Department.

8 Reclamation programme along with the post closure plan is to be submitted within 06 months from the date of issue of this order

9. Catch drains, and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The drains

Annex - 12

should be regularly de-silted and maintained properly. The garland drains (size, gradient and length) and sump capacity should be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material.

10. Regular monitoring of ground water level and quality should be carried out by establishing a net work of existing wells. The monitoring should be done four times a year in pre-monsoon (April/May), Monsoon (August), Post-monsoon(November) and winter (January) seasons. Data thus collected should be submitted to the Board quarterly. Following heavy metals need to be monitored at least once during post monsoon period whose values shall not exceed as per following standard.

i)	Oil	-	2.0 mg/l
ii)	Cr+6	-	0.10 mg/l
iii)	Copper	-	3.0 mg/l
iv)	Lead	-	0.10 mg/l
v)	Mercury	-	0.01 mg/l
vi)	Nickel	-	0.50 mg/l
vii)	Zinc	-	5.0 mg/l

11. Domestic effluent shall be discharged to soak pit via septic tank constructed as per BIS specification.

12. Wastewater (workshop, wastewater from the mine i.e. pit water, check dams or any other discharge leaving lease boundary of the mine) should be properly collected, treated so as to conform the prescribed standard i.e. pH = 6 – 9.0, SS = 50 mg/l, & O & G = 5 mg/l Cr^{+6} = 0.1 mg/l as amended from time to time. Oil and grease trap should be installed before discharge of effluents from workshop. Domestic effluent shall be discharged to soak pit via septic tank.

13. Mine drainage water, if any has to be treated in a full fledged effluent treatment plant and disposed of after conforming to the standard prescribed by the Board i.e. pH = 5 – 9.0; Total SS = 50 mg/l & O & G = 5 mg/l and Cr^{+6} = 0.1 mg/l.

14. Drill should be wet operated or with dust extractors and controlled blasting should be practices.

15. Six ambient air quality monitoring stations for 24 hours operation should be established in the core zone as well as in the buffer zone for RPM, SPM, SO_2, NO_x and CO monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board (I). Data on ambient air quality (RPM, SPM, SO_2, NO_x and CO) should be regularly submitted to the State Pollution Control Board once in six months.

16. Adequate measures to control fugitive emission shall be taken during loading and transportation of minerals, haul roads, drilling, excavation, ore stack, pile and truck loading areas.

17. The haulage roads and arterial roads shall be made black topped / concrete with avenue plantation. Appropriate plan to this effect shall be submitted to the board within a month. Initially 50% of haul road shall be black topped/concrete surfaced. The speed of dumpers / trucks on haul roads shall be controlled as

A-1

increased speed increases dust emission. Overloading of transport vehicles shall be avoided.

18. Drilling operation need to be conducted as per the recommendations of the manufacturer using sharp drill bits. Applying sufficient thrust on the drill bit and providing dust hood at the mouth of drill hole collar to prevent the generation of dust to be air-borne.

19. The operator's cabin in the drills shall be provided with dust proof enclosure and the persons working at high dust prone areas shall be provided with dust mask.

20. Air blast level resulting from blasting on any premises or public place must not exceed 90 dB linear, peak at any other premises outside the period between 7 AM and 6 PM on any day.

21. Pre-wetting of Blasting site shall be practiced.

22. Avoid Blasting when temperature inversion is likely to occur and strong wind blows towards the residential areas.

23. Use site specific scientific blast design using modern software.

24. Optimized blasting methods shall be practiced i.e matching the explosive to the drilling pattern, rock characteristics and proper stemming of the holes.

25. Site specific drilling pattern, optimum charging of explosives, adequate stemming and introduction of delays shall be practiced.

26. During transportation of ore by trucks through public roads, the truck shall be properly covered with tarpaulin sheets / leak proof coverings and shall ply at safe speed.

27. Dust suppression on mine haul roads, active OB dumps and mine working benches shall be done by spraying water through water sprinklers along with chemical binders/wetting agents at frequent interval in order to reduce water consumption and to improve retention and re-absorption capacity of water. The additive chemicals should not have any adverse impact on the environment. Water sprinklers of fixed type shall also be provided at the mine HEMM maintenance shop, other service centers and approach roads from mines to raw material handling & product handling area to prevent the generation of dust to be air borne.

28. Regular collection of spilled over raw material from haul roads shall be practiced to prevent the generation of dust due to movement of dumpers /truck.

29. At stockpile and loading plant area, a net work of drains with concrete bottom shall be constructed at a depth of 1.5 meter below the lowest level on the sites parallel to the stockpile area with interconnected box culverts. The sloping of surface shall be given inward to the stockpiles so that surface water will only infiltrate in to the drain.

30. To arrest the slimes/suspended solid fine particles flowing through the streams a no. of check dams shall be constructed across the original course of the stream along with wire mesh and boulders. De-silting of check dams shall be done at regular interval during non-monsoon period.

Annex-12

32. Sedimentation ponds shall be constructed at strategic points in order to guide all surface run-off water containing sediments for settlement of suspended solids before discharge of water in to natural stream/water courses during monsoon

32. Riverine afforestation shall be practiced to prevent soil erosion during monsoon

33. Noise is best abated at source by selecting right machinery and equipment by proper mounting of equipment by providing noise insulating enclosures or padding as far as possible

34. Noise barriers shall be constructed between sources and affected areas (thick belt of trees around mine boundaries, waste dumps, hills and mountainous land forms can act as such barries)

35. Safety fuse shall be covered with sand layer of 15 cm thick in order to reduce noise level during blasting operation.

36. Occupational exposure limit of noise limit for ground vibration at the foundation level and permissible peak particle velocity (PPV) at the foundation level of structures in the mining areas as specified by DGMS shall be complied with by the chromite mines

37. Adequate measures shall be taken for control of noise levels in the work environment of mine area so that noise levels at the boundary line of M L area shall not exceed 75 dB(A) during day time (6 AM to 10 AM) and 70 dB(A) during night time (10, PM to 6 AM)

38. The top soil (20-30 cm) shall be removed separately utilize for restoration or rehabilitation of land or store it in a separate heap for future use duly covered with grass and vegetal cover to preserve its fertility / biomass

39. Overburden/waste rock should be back filled into main excavations to the maximum extent possible in order to restore the land

40. The waste dumps shall be located away from the natural nalls, rivers in the area and on an impervious & non-mineralised area to minimize the water pollution

41. The OB/waste dumps shall be properly dressed benched stopped at low angle with terracing and bamboo barricades in the slopes making retaining walls stone barriers at the toe of the dumps gully plugging etc to prevent the solid erosion during monsoon, besides establishing vegetation on dump top as well as its slope surface. In difficult cases, hydro-seeding technique or use of geotiles mat embedded with seeds shall be adopted.

42. The completed out slope of the waste dumps should not exceed 20 degrees from horizontal to avoid excessive erosion and easy vegetation

43. Consent to operate shall be obtained from this Board before commencing the mining activities of proposed expansion project.

44. Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board

45. A separate environmental management cell with suitable qualified personnel should be set up under the control of a Senior Executive, who will report directly to the Head of the organization

Annexure - 2a

46 The above conditions will be enforced, inter-alia, under the provisions of the water (Prevention & Control of pollution)Act. 1974 and Air(Prevention & Control of Prevention)Act 1981 and Environment(Protection)Act, 1986 and the Public Liability Insurance Act 1991 along with their amendments and rule

47 All efforts shall be taken to protect the existing water bodies in the surrounding A definite plan in this regard shall be submitted to the Board within 06 month from the date of issue of this order

48. This consent to establish is granted subject to grant of Explosive License from competent Authority The valid Explosive License must be submitted to this Board while applying for consent to operate to this Board

49. The Board may impose further conditions or modify the conditions stipulated in this order during installation and/or at the time of obtaining consent to operate and may revoke this clearance in case the stipulated conditions are not implemented

50. The mine shall abide by all the provisions of Environment (Protection) Act, 1986 and rules framed thereunder

51. The mine shall obtain forest clearance under Forest (Conservation) Act 1980 if there is involvement of forest land in the mining lease area

MEMBER SECRETARY

To

Sri Janardan Mista, Deputy General Manager (Geo),
M/s Sukranga Chromite Mine of the Orissa Mining Corporation Ltd
OMC House PO Box No 34, Bhubaneswar – 751001

Memo No ...../Dt

Copy forwarded to

1 Secretary Steels & Mines , Govt of Orissa, Bhubaneswar
2 Collector, Jajpur
3 District Industries Centre, Jajpur
4 Sr. Env Engineer (C).
5 Director, Factories & Boiler, Bhubaneswar
6 Regional Officer, O S P C Board, Cuttack
7 DFO, Jajpur
8 Copy to Guard file

SR. ENV. ENGINEER (N)

Annexure. 13

BY REGD. POST WITH AD

STATE POLLUTION CONTROL BOARD, ORISSA

A/118, Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012
Phone-2561909, Fax: 2562622, 2560956

CONSENT ORDER

No. 7326 /IND-I-CON-388 Dt. 30.05.11

CONSENT ORDER NO. 365

Sub : **Consent for discharge of sewage and trade effluent under section 26/26 of Water (PCP) Act, 1974 and for existing / new operation of the plant under section 21 of Air (PCP) Act, 1981.**

Ref : Your application No. 7058/OMC/JJKR/PLANN/10., Dt. 17/12/2010

Consent to operate is hereby granted under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 and under section 21 of Air (Prevention & Control of Pollution) Act, 1981 and rules framed thereunder to

Name of the Industry Sukrangi Chromite Mines (OMC Ltd)

Name of the Occupier & Designation Prasant Ku. Sahoo, Manager (Mining)

Address At/Po – Kaliapani, Dist – Jajpur

This consent order is valid for the period up to 31.03.2016

This consent order is valid for the product quantity, specified outlets, discharge quantity and quality, specified chimney/stack, emission quantity and quality of emissions as specified below. This consent is granted subject to the general and special conditions stipulated herein

A. Details of Products Manufactured

Sl.No.	Product	Quantity
1.	Chrome Ore	0.13 MTPA

B. Discharge permitted through the following outlet subject to the standard

Outlet No.	Description of outlet	Point of discharge	Quantity of discharge KLD or KL/hr	Pre-scribed Standard						
				pH	TSS (mg/l)	Oil & Grease (mg/l)	BOD (mg/l)	COD (mg/l)	Cr^{+6} (mg/l)	Total Cr (mg/l)
01.	*Domestic effluent*	*Septic tank and soak pit*	*6 KLD*	*5.5 to 9.0*	*200*	--	*100*	--	--	--
02.	*Mine drainage water / surface run offs / other wastewater*	*Nearby land / inland surface water*	--	*5.5 to 9.0*	*100*	*10*	*30*	*25*	*0.1*	*2.0*

C. Emission permitted through the following stack subject to the prescribed standard

Chimney Stack No.	Description of Stack	Stack height (m)	Quantity of emission	Prescribed Standard				
				PM	SO_2	NO_x		
1.								

D. Disposal of solid waste permitted in the following manner

Sl.No.	Type of Solid waste	Quantity generated (TPD)	Quantity to be reused on site(TPD)	Quantity to be reused off site(TPD)	Quantity disposed off (TPD)	Description of disposal site.
01	Top soil / overburden	As per approved mining plan	--	--	--	As per approved mining plan

P.T.O

Annex - 13

E. GENERAL CONDITIONS FOR ALL UNITS

1 The consent is given by the Board in consideration of the particulars given in the application. Any change or alteration or deviation made or actual practice from the particulars contained in the application will also be the ground liable for revocation/cancellation of the consent order under section 27 of the Act of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 and to make such variations as deemed fit for the purpose of the Acts.

2 The industry would immediately submit revised application for consent to operate to this Board in the event of any change in the quantity & or quality of raw material / end products / manufacturing process or quantity /quality of the effluent /site of disposal / air pollution control equipment / system etc.

3 The applicant shall not change or alter either the quality or quantity or the rate of discharge or temperature or the route of discharge without the previous written permission of the Board.

4 The application shall comply with and carry out the directive/orders issued by the Board in this consent order and all subsequent times without any negligence on his part. In case of non-compliance of any order/directives issued at any time and/or violation of the terms and conditions of this consent order, the applicant shall be liable for legal action as per the provisions of the Act cited.

5 The applicant shall make an application for grant of fresh consent at least 60 days before the date of expiry of this consent order.

6 The issuance of this consent does not convey any property right in either real or personal property or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central, State laws or regulations.

7 This consent does not authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any natural water course.

8. The applicant shall display this consent granted to him in a prominent place for perusal of the public and respecting officers of the Board.

9 An inspection book shall be opened and made available to Board's Officers during the visit to the factory.

10 The applicant shall furnish to the visiting officer of the Board any information regarding the construction, installation or operation of the plant or effluent treatment system / air pollution control system / stack monitoring system and any other particulars as may be considered to preventing and controlling pollution of Water / Air.

11 Meters must be affixed at the entrance of the water supply connection so that such meter are easily accessible for inspection and maintenance and for other purposes of the Act provided that the place where it is affixed shall in no case be at a point before which water has been taped by the consumer for utilization for any purposes whatsoever.

12 Separate meters with necessary pipeline for assessing the quantity of water used for each of the purposes mentioned below:

a) Industrial cooling, spraying in mine pits or boiler feed

b) Domestic purposes

c) Process

13 The applicant shall display suitable caution board at the place where the effluent is entering into any water body or any other place as indicated by the Board indicating therein that the area into which the effluents are being discharged is not fit for any domestic use/bathing.

14 Storm water shall not be allowed to mix with the trade and/or domestic effluent on the upstream of the effluent treatment system by any means. Necessary devices will be installed.

15 The applicant shall maintain good house-keeping both within the factory and the premises. All pipes, drains, sewers and drainage shall be kept clean. Floor washings shall be admitted into the effluent collection system only and shall not be allowed to find their way into storm drains or open areas.

16 The applicant shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by him to achieve with the terms) and conditions of the consent.

17 Care should be taken to keep the anaerobic lagoons, if any, adequately active and not utilized as mere storage tanks/ponds. The anaerobic lagoons should be fed with the required nutrients for effective digestion. Lagoons should be constructed with sides and bottom pucca masonries.

18 The utilization of treated effluent on factory's own land, if any, should be completed and there should be no possibility of the effluent or pollutants getting into any drainage channel or other water courses either directly or by overflow.

19 The effluent disposal on land, if any, should be done without causing any nuisance to the surroundings or deterioration of the land at any time.

20 If at any time the disposal of treated effluent on land becomes incomplete or unsatisfactory or create any problem or becomes a matter of dispute, the industry must adopt alternate satisfactory treatment and disposal measures.

21 The sludge from treatment units shall be dried in sludge drying beds and the drained liquid shall be taken to equalization tank.

22 The effluent treatment units and disposal measures shall become operative at the time of commencement of production.

23 The applicant shall provide inspection holes for sampling the treatment and process platform for carrying out stack sampling and provide electrical outlet points and other arrangements for other systems/stacks and other points of emissions as to collect samples of emission by the Board or the applicant at any time in accordance with the provisions of the Act or Rules made thereof.

24 The applicant shall provide all facilities and render required assistance to the Board's staff for collection of samples / stack monitoring / inspection.

25 The applicant shall not change or alter either the quality or quantity or rate of discharge or outlet location of the air pollution control

P.T.O.

Annex - 13

equipment or change the raw material or manufacturing process resulting in any change in quality and/or quantity of emissions, without the previous written permission of the Board

26 No control equipments or chimney shall be altered or repaired or as the case may be erected or re-erected except with the previous approval of the Board.

27 The liquid effluent arising out of the operation of the air pollution control equipment shall be treated in the manner and to an of standards prescribed by the Board in accordance with the provisions of Water (Prevention and Control of Pollution) Act, 1974 (As amended).

28. The stack monitoring system employed by the applicant shall be opened for inspection to the Board at any time.

29 There shall not be any fugitive or episodal discharge from the premises.

30 In case of such episodal discharge/emissions the industry shall take immediate action to bring down the emission within the limits prescribed by the Board in conditions/stop the operation of the plant. Report of such accidental discharge /emission shall be brought to the notice of the Board within 24 hours of occurrence.

31 The applicant shall keep the premises of the industrial plant and air pollution control equipments clean and make all joints, pipes, valves, stacks/chimneys leak proof. The air pollution control equipments, location, manholes/chambers, sampling portholes shall be made easily approachable at all times.

32. Any upset condition in any of the plants/units of the factory which is likely to result in increased effluent discharge/emission of its pollutants and / or result in violation of the standards mentioned above shall be reported to the Headquarters and Regional Office of the Board by fax / speed post within 24 hours of its occurrence.

33 The industry has to ensure that minimum three varieties of trees are planted at the density of not less than 1600 trees per acre. The trees may be planted along boundaries of the industries or industrial premises. This plantation is stipulated over and above the soil plantation of crops in that area.

34 The solid waste such as sweeping, wastage packages, empty containers residues, sludge including that from air pollution control equipments collected within the premises of the industrial plants shall be disposed off scientifically to the satisfaction of the Board so as to as to gauge fugitive emission dust problems through leaching etc., of any kind

35 All solid wastes arising in the premises shall be properly classified and disposed off to the satisfaction of the Board by
- i) Land fill in case of inert material, care being taken to ensure that the material does not give rise to leachate which may percolate into ground water or carried away with storm run-off
- ii) Controlled incineration, wherever possible in case of combustible organic material
- iii) Composting, in case of bio-degradable material

36 Any toxic material shall be detoxicated if possible, otherwise be sealed in steel drums and buried in protected areas after obtaining approval of this Board in writing. The detoxification or sealing and burying shall be carried out in the presence of Board's authorised persons, any letter of authorization shall be produced for handling and disposal of hazardous wastes.

37 If due to any technological improvement or otherwise this Board is of opinion that all or any of the conditions referred to above requires variation (including the change of any control equipment either in whole or in part) this Board shall after giving the applicant an opportunity of being heard, vary all or any of such condition and thereupon the applicant shall be bound to comply with the conditions so varied

38. The applicant, its/his/its/legal representatives or assignees shall have no claim whatsoever to the continuation or renewal of this consent after the expiry period of this consent

39. The Board reserves the right to review, impose additional conditions or condition, revoke change or alter its terms and conditions of this consent.

40 Notwithstanding anything contained in this conditional letter of consent, the Board also reserves to it the right and power under section 27(2) of the Water (Prevention & Control of Pollution) Act 1974 to review any and/or all the conditions/aspects herein above and to make such variations as deemed fit for the purpose of the Act by the Board

41 The conditions imposed by Board shall continue to be in force until revoked under section 27(3) of the Water (Prevention & Control of Pollution) Act 1974 and section 21 A of Air (Prevention & Control of Pollution) Act 1981

42 In case the consent fee is revised upward during this period the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the amount within the period stipulated by the Board the consent order will be revoked without prior notice

43 The Board reserves the right to revoke/withdraw consent to operate at any time during period for which consent is granted in case any violations is observed and to modify/ stipulate additional conditions as deemed appropriate

GENERAL CONDITIONS FOR UNITS WITH INVESTMENT OF MORE THAN Rs 50 CRORES, AND 17 CATEGORIES OF HIGHLY POLLUTING INDUSTRIES (RED A).

1. The applicant shall analyse the emissions every month for the parameters indicated in TABLE B & C as mentioned in the order and shall furnish the report thereof to the Board by the 10th of the succeeding month

2. The applicant shall prepare and maintain at his own cost three ambient air quality monitoring stations for monitoring Suspended Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Hydro-Carbon, Carbon-Monoxide and metals for three days in a week/fortnight/month. The data collected shall be maintained in a register and a monthly report be furnished to the Board

P.T.O

Annex - 13

4 The applicant shall provide and maintain at his own cost a meteorological station to collect the data on wind velocity, direction, temperature, humidity, rainfall, etc. and the daily readings shall be recorded and the original sent to the Board once in a month.

5 The applicant shall forward the following information to the Member Secretary, State Pollution Control Board, Orissa, Bhubaneswar regularly.

a. Report of analysis of stack monitoring, ambient air quality monitoring, meteorological data as required every month.
b. Progress on planting of trees quarterly.

6 The applicant shall install mechanical composite sampling equipment and continuous flow measuring / recording devices on the effluent drains of trade as well as domestic effluent. A record of daily discharge shall be maintained.

7 The following information shall be forwarded to the Member Secretary on or before 10th of every month.

a Performance / progress of the treatment plant.
b Monthly statement of daily discharge of domestic sewage trade effluent.

7 Non-compliance with effluent limitations

a) If for any reason the applicant does not comply with or is unable to comply with any effluent limitations specified in this consent, the applicant shall immediately notify the consent issuing authority by telephone and provide the consent issuing authority with the following information in writing within 5 days of such notification.

i) Cause of non-compliance

ii) A description of the non-compliance discharge including its impact on the receiving waters

iii) Anticipated time of continuance of non-compliance if expected to continue or if such condition has been corrected the duration or period of non-compliance.

iv) Steps taken by the applicant to reduce and eliminate the non-complying discharge and

v) Steps to be taken by the applicant to prevent the condition of non-compliance

b) The applicant shall take all reasonable steps to minimise any adverse impact on natural waters resulting from non-compliance with any effluent limitation specified in this consent including such accelerated or additional monitoring as necessary to determine the nature and impact of the non complying discharge.

c) Nothing in this consent shall be construed to relieve the applicant from civil or criminal penalties for non-compliance whether or not such non-compliance is due to factors beyond his control, such as breakdown, electric failure, strikes or natural disaster.

8 The applicant shall at his own cost get the effluent samples collected both before and after treatment and get them analysed at an approved laboratory every month for the parameters indicated in Para-6 and shall submit in duplicate the report thereof to the Board.

9 The addition of various treatment chemicals should be done only with mechanical dosers and proper equipment for regulation of correct dosages determined duly and for proper mixing / feeding. Crude practices such as dumping of chemicals in drains or sumps or lifting acids or alkalis arbitrarily and utilizing poles for stirring etc. should not be resorted to.

10 In the disposal of treated effluent on land for irrigation, the industry shall keep in view of the need for,

Rotation of crops

Change of point of application of effluent on land

A period of land fallow.

11 The adoption of these would avoid soil becoming sick or sterile, the industry may consult this in consultation with the Agriculture Department.

12 It is the sole responsibility of the industry to ensure that there are no complaints at any time from the people in the surrounding areas as a result of discharge of sewage or trade effluent if any.

13 Proper house keeping shall be maintained by a dedicated team.

14 The industry must constitute a team of responsible and technically qualified personnel who will ensure continuous monitoring of pollution control devices round the clock (including night hours) and should be in a position to explain the status of operation of the pollution control measures to the inspecting officials of the Board at any point of time. The name of these persons with their round the clock telephone numbers shall be intimated to the concerned Regional Officer and Head Office of the Board and in case of any change in the same it shall be intimated to the Board immediately.

P.T.O.

61

F. SPECIAL CONDITIONS :

1. Grant of this consent to operate order is subject to forest clearance under the provisions of Forest (Conservation) Act, 1980. No mining shall be undertaken in the forest area without obtaining forest clearance.
2. A copy of the annual return (submitted to IBM) shall be submitted to the Board every year. The environmental statement report shall be submitted to the Board every year latest by 30th September in prescribed format
3. Wet drilling shall be practiced or suitably designed dust extractor shall be provided for dry drilling to mitigate the effect of dust on the work environment.
4. Pre-wetting of blasting site shall be practiced.
5. Water sprinkling through tankers / fixed sprinklers shall be carried out on the haulage roads to always keep them in wet condition, so as to prevent generation of dust. Water sprinkling at suitable intervals shall be carried out for this purpose.
6. Spillage of materials on haulage roads shall be prevented. Regular collection of spilled over material from haul roads shall be practiced to prevent the generation of dust due to movement of dumpers / tippers / trucks etc.
7. All haulage roads shall be maintained properly to avoid creation of ruts and pot holes.
8. Fixed type water sprinklers shall be provided at ore stockpile areas, loading, unloading points and other strategic dust generating areas to prevent generation of fugitive dusts.
9. Adequate measures shall be taken for control of noise levels below the prescribed standards :

Time	Standard in dB(A)
Day (6.00 AM – 10.00 PM)	75
Night (10.00 PM – 6.00 AM)	70

10. Regular monitoring of ambient air quality shall be carried out at the appropriate places and monitoring report shall be furnished to the Board once in six months. The permanent monitoring stations shall be fixed in consultation with the Regional Officer of the Board.
11. Ambient air quality of the mine shall meet the prescribed standards of the Board.
12. Water generated during the process of dewatering of mine shall be treated properly and used for sprinkling purposes on haulage roads / wet beneficiation of sub grade ore instead of discharging to outside. Excess water if any, shall be discharged into surface water body after meeting the prescribed standards.
13. Check dams and sedimentation ponds shall be constructed at strategic points in order to guide all surface run-off water containing sediments for settlement of suspended solids before discharge of water into surface water body during monsoon after meeting the prescribed standards. Quantity of surface run offs generated in the mine shall be estimated and data shall be submitted to the Board.
14. The top soil shall be removed and stored separately for future use, duly covered with grass and vegetation. It shall be utilized for restoration of rehabilitation of land.
15. Overburden / waste rock shall be properly stacked in the earmarked areas approved by IBM and shall be suitably terraced and stabilized through vegetative cover.
16. Garland drains of adequate dimensions shall be provided all around the waste dump terminating with sedimentation ponds to prevent direct disposal of water to outside environment. The treated wastewater shall either be reused or shall be discharged after meeting the prescribed standards.

P.T.O

42

Annexure-13

17. Restoration and rehabilitation of the mine shall be done in accordance with approved mine closure plan. A copy of mine closure plan shall be submitted to the Board
18. Seasonal monitoring of ground water level and its quality shall be carried out four times a year and report shall be submitted to the Board.
19. Domestic effluent of the township shall be treated in suitable and well designed sewage treatment plant or shall be discharged to soak pit via septic tank constructed as BIS specifications.
20. Service centers i.e. auto shops, HEMM shops, and other areas, wherein, water pollution due to wash outs of oil and grease and suspended solids are expected, effluent treatment plant shall be provided. The treated effluent shall be reused or shall be discharged to out side after meeting the prescribed standards.
21. Rainwater harvesting shall be practiced as a measure of conservation of water.
22. The mine shall abide – by the provisions of Environment (Protection) Act, 1986 and Rules framed there under.
23. The mine shall submit a declaration by 30th April every year that all pollution control systems are in good condition, are operated efficiently and ambient air quality as well as wastewater quality are conforming to the prescribed standards.
24. Failure to comply with any of the conditions mentioned above may result withdrawal of this consent to operate order.

To,

The Manager, (Mines),
M/s. Sukrangi Chromite Mines, OMC Ltd.,
Po - Kaliapani,
Dist - Jajpur

MEMBER SECRETARY
STATE POLLUTION CONTROL BOARD, ORISSA

Memo No. _____ /Dt.

i) Regional Officer, State Pollution Control Board, Cuttack
ii) District Collector Jajpur
iii) D.F.O Jajpur
iv) Deputy Director of Mines Jajpur Road
(For Mines and Minerals Processing Unit only)
v) Cess Section (Head Office)
vi) Consent Register

ENV. SCIENTIST
STATE POLLUTION CONTROL BOARD, ORISSA

P.T.O

Annex-13

GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENT POLLUTANTS

P.T.O

GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART –A : EFFLUENTS

Sl.No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Costal Areas
		(a)	(b)	(c)	(d)
1.	Colour & odour	Colourless/Odourless as far as practible	-----	See 6 of Annex-1	See 6 of Annex-1
2	Suspended Solids (mg/l)	100	600	200	For process wastewater – 100 b. For cooling water effluent 10% above total suspended matter of influent
3.	Particular size of SS	Shall pass 850	----	——	
5	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6	Temperature	Shall not exceed 5°C above the receiving water temperature	-------	-------	Shall not exceed 5°C above the receiving water temperature
7.	Oil & Grease mg/l max.	10	20	10	20
8.	Total residual chlorine	1.0	----	-----	1.0
9.	Ammonical nitrogen (as N) mg/l max.	50	50	----	50
10	Total Kejeldahl nitrogen (as NH_3) mg/l max.	100	----	------	100
11.	Free ammonia (as NH_3) mg/l max.	6.0	----	-----	6.0
12.	Biochemical Oxygen Demand (5 days at (20°C) mg/l max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/l max	250	----	------	250
14.	Arsenic (as As) mg/l max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg) mg/l max.	0.01	0.01	-----	0.001
16	Lead (as pb) mg/l max.	01.	1.0	----	2.0

P.T.O

17.	Cadmium (as Cd) mg/1 max.	2.0	1.0	------	2.0
18.	Hexavalent Chromium (as Cr + 6) mg/l max.	0.1	2.0	-------	1.0
19.	Total Chromium (as Cr) mg/l max.	2.0	2.0	---------	2.0
20.	Copper (as Cu) mg/l max.	3.0	3.0	---------	3.0
21.	Zinic (as Zn) mg/l max.	5.0	15	-------	15
22	Selenium (as Se) mg/l max.	0.05	0.05	-------	0.05
23.	Nickel (as Ni) mg/l max.	3.0	3.0	-------	5.0
24.	Cyanide (as CN) mg/l max	0.2	2.0	0.2	0.02
25.	Fluoride (as F) mg/l max.	2.0	15	-------	15
26	Dissolved Phosphates (as P) mg/l max.	5.0	------	---------	-------
27	Sulphide (as S) mg/l max.	2.0	--------	---------	5.0
28.	Phennolic compounds as (C_6H_5OH) mg/l max.	1.0	5.0	-------	5.0
29	Radioactive materials a. Alpha emitter micro curie/ml. b. Beta emitter micro curie/ml	10^7 10^6	10^7 10^6	10^6 10^7	10^7 10^6
30.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
31	Manganese (as Mn)	2 mg/l	2 mg/l	---------	2 mg/l
32	Iron (Fe)	3 mg/l	3 mg/l	-------	3 mg/l
33	Vanadium (as V)	0.2 mg/l	0.2 mg/l	---------	0.2 mg/l
34.	Nitrate Nitrogen	10 mg/l	--------	---------	20 mg/l

P.T.O.

NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutants	Time Weighed Average	Concentrate of Ambient Air		Methods of Measurement
			Industrial Residential, Rural and other Area	Ecologically Sensitive Area (notified by Central Government)	
(1)	(2)	(3)	(4)	(5)	(6)
1.	Sulphur Dioxide (SO2), µg/m3	Annual *	50	20	- Improved west and Gake - Ultraviolet fluorescence
		24 Hours **	80	80	
2.	Nitrogen Dioxide (NO2), µg/m3	Annual *	40	30	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
		24 Hours **	80	80	
3.	Particulate Matter (size less than 10µm) or PM10µg/m3	Annual *	60	60	- Gravimetric - TOEM - Beta Attenuation
		24 Hours **	100	100	
4.	Particulate Matter (size less than 2.5µm) or PM2.5 µg/m3	Annual *	40	40	-Gravimetric - TOEM - Beta Attenuation
		24 Hours **	60	60	
5.	Ozone (O3) µg/m3	8 Hours **	100	100	- UV Photometric - Chemiluminescence - Chemical Method
		1 Hours **	180	180	
6.	Lead (Pb) µg/m3	Annual *	0.50	0.50	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper. - ED-XRF using Teflon filter
		24 Hours **	1.0	1.0	
7.	Carbon Monoxide (CO) mg/m3	8 Hours **	02	02	- Non Dispersive Infra Red (NDIR) Spectroscopy
		1 Hours **	04	04	
8.	Ammonia (NH3) µg/m3	Annual*	100	100	-Chemiluminescence - Indophenol Blue Method
		24 Hours**	400	400	
9.	Benzene (C6H6) µg/m3	Annual *	05	05	-Gas Chromatography based continuous analyzer -Adsorption and Desorption followed by GC analysis -Solvent extraction followed by HPLC/GC analysis
10	Benzo (a) Pyrene (BaP) Particulate phase only, ng/m3	Annual*	01	01	
11.	Arsenic (As), ng/m3	Annual*	06	06	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni) ng/m3	Annual*	20	20	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Annexure 14

F. No. 8-104/2004-FC
Government of India
Ministry of Environment and Forests
(F.C. Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi – 110 030.
Dated: 21st July, 2011

To

The Principal Secretary (Forests),
Government of Orissa,
Bhubaneshwar.

Sub: Diversion of 104.79 ha. (originally proposed 132.94 ha.) of forest land for Chromite Mining in Sukrangi Chromite Mines of Orissa Mining Corporation (OMC) Limited in District Jajpur, Orissa.

Sir,

I am directed to refer to State Government of Orissa's letter No. 10F (Cons.) 83/2000-15014/ F&E dated 18.09.2000 and subsequent letter No. 10F(Cons)83/2000/8473 dated 22.05.2002, a copy of which was forwarded by M/s. OMC vide letter dated 20.01.2006, where-under the above mentioned proposal was submitted seeking prior approval of the Central Government in accordance with Section-2 of the Forest (Conservation) Act, 1980. After careful consideration of the proposal by the Forest Advisory Committee constituted by the Central Government under Section-3 of the said Act, in-principle approval for the diversion of 104.79 ha. forest land was granted vide this Ministry's letter of even number dated 29th March 2006, subject to fulfilment of certain conditions. The State Government of Orissa has furnished compliance report in respect of the conditions stipulated in the in-principle approval and has requested the Central Government to grant final approval.

2. In this connection, I am directed to say that on the basis of the compliance report furnished by the State Government of Orissa vide letter No. 10F(Cons)-377/2010- 6766/ F & F dated 19.04.2011, approval of the Central Government is hereby granted under Section-2 of the Forest (Conservation) Act, 1980 for diversion of 104.79 ha. (originally proposed 132.94 ha.) of forest land for Chromite Mining in Sukrangi Chromite Mines of Orissa Mining Corporation (OMC) Limited in District Jajpur, Orissa, subject to fulfillment of the following conditions:-

(i) Legal status of forest land shall remain unchanged;

(ii) The compensatory afforestation shall be raised and maintained by the State Forest Department over non-forest land equal in extent to the fresh forest land being diverted from the funds received from the user agency;

5/1

Annexure - 14

(iii) In case the rates of NPV are revised upwards, the additional/differential amount shall be obtained from the user agency;

(iv) The permission granted under FC Act shall be co-terminus with the mining lease granted under MMRD Act or for 20 years, whichever is less.

(v) The User Agency shall undertake mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan shall be executed by the user agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, Government of Orissa and the Chief Conservator of Forests (Central), Ministry of Environment & Forests, Regional Office (Eastern Zone), Bhubaneswar. If it is found from the annual report that the activities indicated in the concurrent reclamation plan are not being executed by the User Agency, the Nodal Officer or the Chief Conservator of Forests (Central) may direct that the mining activities shall remain suspended till such time, such reclamation activities are satisfactorily executed

(vi) The user agency shall submit self monitoring on compliance of stipulated conditions annually to the Nodal Officer (FCA) of the State and Eastern Regional Office of this Ministry regularly

(vii) Other standard conditions as applicable to proposals related to mining shall apply in the instant case also.

Yours faithfully,

(H. C. Choudhary)
Assistant Inspector General of Forests

Copy to:

1. The PCCF, Government of Orissa, Bhubaneswar.
2. The Nodal Officer, O/o PCCF, Bhubaneswar.
3. The Chief Conservator of Forests (Central), Regional Office, Bhubaneswar.
4. The User Agency.
5. The Monitoring Cell, FC Division, MoEF, New Delhi.
6. Guard File.

(H. C. Choudhary)
Assistant Inspector General of Forests

Annex-III 15

VIOLATION CUM SHOW CAUSE NOTICE

REGD A D

भारत सरकार
खान मंत्रालय
भारतीय खनन ब्यूरो
क्षेत्रीय खनन नियंत्रक का कार्यालय
bmbbsr@dataone.in

Government of India
Ministry of Mines
Indian Bureau of Mines
Office of the Regional Controller of Mines,
Ph:-(0674) 2742463 / Fax-0674 2744430
Mahuni Complex, 2nd Floor
308, District Centre, Chandrasekharpur
Bhubaneswar-751 016

File No. ORI/CR/JJP/MCDR-08/BBS

Dated: - 10.12.2010

To,

The Managing Director
& Nominated Owner (Sukrangi Chromite mine)
M/s Orissa Mining Corporation Ltd
OMC HOUSE,BHUBNESHWAR
PIN - 751001

Sub: **Violation of provisions of MCDR, 1988 in respect of your Sukrangi Chromite Mine of M/s OMC Ltd over an area of 382.709 ha in Jajpur district of Odisha.**

Sir

The following provisions of Mineral Conservation & Development Rules, 1988 are found violated in your above mine during inspection on 24.11.2010 by the Task Force Team headed by Shri K S Yadav, Deputy Controller of Mines and shri Raja Singh, Assistant Mining Geologist accompanied by Shri G D Lenka, Mining Officer,Shri B D Nayak, Sr Inspector of mines, Shri R C Panda, Sr Inspector of mines DMG, Government of Orissa and Shri S N Patnaik,Regional Manager,Shri P K Sahoo Manager mines of your mine.

Rule No.	Nature of Violation
13(1)	**Mining operations were being carried out in violation of following provisions of Approved Scheme of Mining.** **i) As per the proposal made on page no 23 of the Approved Scheme of Mining for the year 2009-10, 03 bore holes with total meterage of 600 meter were to be drilled. It has been observed that exploration proposal has not been implemented.** **ii) As per the proposal made on page no 26 of the Approved Scheme of Mining for the year 2009-10 , mine waste of 05 lakh cubic meter was to be excavated for production of 124200 tonnes of mineral. But during the year 2009-10 only 4579 tonnes of mineral has been produced without undertaking any proportionate mine development work .** **iii) As per the proposal made on page no 40 of the Approved Scheme of Mining, mine waste lying in close vicinity of Quarry AC was to be handled and shifted away from the ultimate pit limit. But progress in this aspect is insignificant.**

12/11

Annex-15

	iv) As per the proposal made on page no 46 of the Approved Scheme of Mining arrangement for coursing the rain water through ETP has not been made.
16 (1)	Nickeliferrous limonite has not been disposed / stacked separately.
16(3)	Mine waste is found dumped in close proximate of hang wall and foot wall side of the Quarry AC. It is falling within the ultimate pit limit.
24(3)	Mining operations are carried out on intermittent basis in Quarry AC. But other excavation i.e. 'Quarry D' where mining operations are discontinued since last five years have not been made safe by setting suitable prohibitive measures to restrict the unauthorized /inadvertent accesses to the mine.

It is brought to your notice that these violations constitute an offence punishable under Rule 58 of MCDR 1988. The relevant extract of the rule 58 is given below:

"58 Penalty: - Whoever contravenes any of the provisions of these rule shall be punishable with imprisonment for a term which may extend up to two years, or with fine extending to fifty thousand rupees or with both, and in the case of continuing contravention with an additional fine which may extend up to five thousand rupees for every day during which such contravention continues, after conviction for the first such contravention. Provided that for repeated contravention the punishment should be in the form of imprisonment only."

You are therefore, directed to show cause within a period of 30 (thirty) days from the date of issue of this letter, as to why mining operations should not be suspended under the provisions of Rule 13(2) of MCDR, 1988 in the mine till compliance of the aforesaid violation of rule 13(1) as above and prosecuted for the other offences.

Please note that no further notice will be given to you in this regard.

Yours faithfully,

(S.TIU)
Regional Controller of Mines.

Copy to Shri S N Patnaik,Regional Manager, Sukuangi Chromite Mines, M/s OMC Ltd, AT/PO-Kaliapani, Dist - Jajpur, PIN- 755047 Orissa for necessary action.

(S.TIU)
Regional Controller of Mines.

12/2

Annex - 15

Orissa Mining Corporation Ltd.

(A Government of Orissa Undertaking)
BHUBANESWAR - 751 001
ISO 9001 & 14001 Certified

OMC

SPEED POST

No. 2507 /OMC/P&T/2010.

Date.28/12/2010.

To

The Regional Controller of Mines,
Indian Bureau of Mines (IBM),
Chandrasekhar,
Bhubaneswar-751 019.

Sub.- Violation-cum-Show Cause Notice in respect of Sukrangi Chromite Mines of M/s OMC Ltd, over an area of 382.709 ha. in Jajpur district of Odisha state.

Ref - ORI/CR/JJP/MCDR-06/BBS, DTD.10.12.2010.

Sir,

In pursuance to the above order dtd.10.12.2010, this is to kindly inform you that we are submitting herewith the point-wise compliance to the observations made during the inspection of task force to our Sukrangi Chromite Mines on 24.11.2010 which are as under:-

Rule No.	Nature of Violation Observed by IBM	Compliance by OMC
13(1)	i) As per the proposal made on page No 23 of the approved scheme of mining for the year 2009-10, 03 bore holes with total meterage of 600 meter were to be drilled. It has been observed that exploration proposal has not been implemented.	Due to want of Forest clearance the drilling of bore holes could not be executed during 2009-10. It is proposed to execute drilling of 3 bore holes after obtaining forest permission.
	ii) As per the proposal made on page No.26 of the approved scheme of mining for the year 2009-10, mine waste of 05 lakh cubic meter was to be excavated for production of 124200 tonnes of mineral. But during the year 2009-10 only 4679 tonnes of mineral has been produced without undertaking any proportionate mine development work.	Due to forest restriction the mine working was stopped at Sukrangi Chromite Mines since 10.09.2010. Now we are excavating the O.B which is well within the specified ratio of O.B: Ore. Mining is confined to non forest area only.

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Annex-15

	iii) As per the proposal made on page No.40 of the approved scheme of mining, mine waste lying in close vicinity of Quarry AC was to be handled & shifted away from the ultimate pit limit. But progress in this aspect is insignificant.	At present we have commenced shifting the dump from both foot wall & hang wall side.
	iv) As per the proposal made on page No.40 of the approved scheme of mining arrangement for coursing the rain water through ETP has not been made.	Action is being taken for coursing the surface run off during the rainy season through the ETP.
16(1)	Nickeliferrous limonite has not been disposed/ stacked separately.	As the OB excavation and development work could not be done due to want of forest permission, Limonite horizon containing economical nickel content has not been excavated yet.
16(3)	Mine waste is found dumped in close proximate of hang wall & foot wall side of the Quarry AC. It is falling within the ultimate pit limit	At present we are shifting the dump from both foot wall & hang wall side
24(3)	Mining opera-ions are carried out on intermittent basis in Qu rry AC. But other excavation i.e 'Quarry-D' where mining operations are discontinued since last five years have not been made safe by setting suitable prohibitive measures to restrict the unauthorized/inadvertent accesses to the mine.	By providing one embankment we have already prohibited un-authorised / inadvertent accesses to DE Quarry, alongwith appropriate round the clock Security arrangement to check unauthorized access to the mine.

In view of the facts & circumstances stated above, it is kindly requested not to suspend any mining operation & request no action under Rule-58 of MCDR'1988 may be taken.

Yours faithfully

13/12

MANAGING DIRECTOR

13/12

Annexure-14 Annex: 15

VIOLATION LETTER RECORD

भारत सरकार
खान मंत्रालय
भारतीय खान ब्यूरो
क्षेत्रीय कार्यालय: भुवनेश्वर
ओडिशा

Government of India
Ministry of Mines
Indian Bureau of Mines
Office of the Regional Controller of Mines
Ph-(0674)2742403 / Fax-0674-2744830

File No: ORSMCR/AJP/MCDR-6/1685 Vol.II

Mahani Complex, 2nd Floor
Plot No-308, District Centre, Chandrasekharpur
Bhubaneswar-751 016
Dated: 4.11.2011

To
The Managing Director & Nominated Owner
M/s OMC Ltd.,
P.B. No-44, Bhubaneswar-751 001

Sub: Violation of provisions of MCDR, 1988 in respect of your Sukrangi Chromite Mine, over an area of 382.709 Ha in Jajpur district of Odisha State.

Sir,

On the following provisions of Mineral Conservation and Development Rules, 1988 were found violated in your above said mine during inspection on 24.09.2011 by the undersigned accompanied by Sri P.K. Sahu Manager of your mine:

Rule No	Nature of Violation
	Mining operations are not being carried out in accordance with the approved Scheme of Mining dated 18.12.2009 to the extent indicated below :-
13(1)	(a) Proposal made on page 25 for Exploration by drilling 01 more Holes (390 mrs.) in the year 2010-11 and also backlog of the previous year 2009-10 of drilling 03 Bore holes (600 mts.) were not carried out
	(b) Proposal made on page 29 for Construction of Retaining wall (1250 mts. length, 1 mt. height & 0.2+1/2 mts. width) in the year 2009-10 was not carried out
	(c) During the year 2010-11, Plantation carried out was reported by planting 7969 saplings against proposal of 7500 saplings. A phased plantation programme proposed under EMP (page 45) has not been implemented in effective manner
	(d) Proposal made under EMP (page 48), for flow of rain water outside the ML area through ETP has not been carried out.
16 (1)	Sub-grade material / Nickelliferous laterite has not been stacked separately
23 (3)(c)	The yearly report on extent of protective and rehabilitative works carried out as envisaged in the approved Progressive Mine Closure Plan has not been submitted for the year 2010-11 to the Regional controller of Mines, IBM, Bhubaneswar.
29	Copies of the Plans and sections as required under rule 29 have not been submitted to RCOM, IBM, Bhubaneswar for the year 2010-11 on or before 30th June'2011
33 (2)	The waste Dump has not been properly secured to prevent escape of material and surface run off due to rain water.

Contd.... Page 1

14/11

Annex-15

02 In this connection, it is brought to your notice that the above violations constitute an offence punishable under rule 58 of MCDR, 1988. The relevant extract of the rule 58 is given below

"58 Penalty :- Whoever contravenes any of the provisions of these rules shall be punishable with imprisonment for a term which may extend up to two years or with fine extending to fifty thousand rupees or with both and in the case of continuing contraventions with an additional fine which may extend up to five thousand rupees for every day during which such contravention continues after conviction for the first such contravention Provided that for repeated contravention the punishment should be in the form of imprisonment only"

Besides inability to comply the provision of Rule 13(1) is also liable for suspension of mining operations under the provisions of rule 4a(2) of MCDR 1988

03 You are advised to rectify the above violations immediately and intimate the position to this office within 45 (forty-five) days from the date of issue of this letter

Yours faithfully,

(PRAKASH)
Assistant Controller of Mines

14/2

Annex-15

The Orissa Mining Corporation Ltd.

(A Government of Orissa Undertaking)
BHUBANESWAR - 751 001
ISO:9001 & 14001 Certified

BY SPEED POST

No 1142 /OMC/P&T/2011 Date 27/10/11

To

The Senior Asst. Controller of Mines
Indian Bureau of Mines (IBM)
Chandrasekharpur
Bhubaneswar-751 016.

Sub:- Violation of provisions of MCDR,1988 in respect of Sukrangi Chromite Mines of M/s OMC Ltd, over an area of 382.709 ha, in Jajpur district of Odisha State.

Ref Your letter No.ORI/CR/JJP/MCDR-6/BBS. DTD.16.11.2011.

Sir,

In pursuance to the above order dtd.16.11.2011, this is to kindly inform you that we are submitting herewith the point wise compliance to the observations made during the inspection to our Sukrangi Chromite Mines on 21.09.2011 which are as under:-

Rule No	Nature of Violation Observed by IBM	Compliance by OMC
13(1)	Mining operations are not being carried out in accordance with the approved scheme of mining dtd.18.12.2009 to the extent indicated below :-	
	i) Proposal made on page-23 for exploration by drilling 03 bore holes (390 meters) in the year 2010-11 and also back log of the previous year 2009-10 of drilling 03 bore holes(600 meters) were not carried out	Proposal for exploration by drilling 3 bore holes (390 mtrs) in the year 2010-11 and also backlog of previous year 2009-10 of drilling 03 Bore holes (600 mtrs) were not carried in want of forest clearance. However drilling work commenced from oct, 2011.Exploration work was undertaken in the N-W portion of sukrungi extension of North limb

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Annex-15

	Band III) chromite on priority basis. However in the meantime borehole locations has been surveyed for taking up the boreholes as was proposed during the year 2009-10 and 2010-11.
ii) Proposal made on page-39 for construction of retaining wall (1250 meter length, one meter height and (1.2 + 1)/2 meter width), in the year 2009-10 was not carried out.	The operation of the mine was suspended from 29.8.2009 to 10.9.2010 by DFO, Cuttack. We were allowed to do operations only in the non-forest area by way of TWP from 11.9.2010 to 25.8.2011. Mining operation resumed in approved forest area after obtaining stage - II clearance from 14.11.2011. After resumption of full fledged operation w.e.f 14.11.2011, steps have already been taken for construction of retaining wall 1250 Meters length, 1 Meter Height and (1.2 +1)/2 Meters width around the waste dump and ore plots, which will be completed before rainy season.
iii)During the year 2010-11, plantation carried out was reported by planting 2950 saplings against proposal of 7,500 saplings. A phased plantation programme proposed under EMP (page-46) has not been implemented in effective manner.	During the year 2010-11, plantation could not be done due to closure of mining operation for want of Forest clearance However, after resumption of mining operation steps have been taken for plantation

15/2

Annex-15 (1962)

		programme as per mining scheme.
	iv) Proposal made under EMP (page 40) for flow of rain water out side the Mt area through ETP has not been carried out	Now State Pollution Control Board have given proposal for establishment of common effluent treatment plant (CETP) in Sukinda Valley for which feasibility study has been completed by IIT, Kharagpur Letter of State Pollution Control Board is attached here with for reference. The same shall be established soon after we get the feasibility report as per the guide line of SPCB, Odisha, Bhubaneswar
16(1)	Sub grade material/nickel ferrous limonite has not been stacked separately.	After resumption of mining operation w.e.f. 14.11.2011, we have started stacking sub grade materials/nickeliferous limonite separately.
23E(2)	The yearly report on extent of protective and rehabilitative works carried out as envisaged in the approved progressive mine closure plan has not been submitted for the year 2010-11 to the Regional Controller of Mines, IBM Bhubaneswar.	Report has already been sent vide our letter No. 1436/OMC/SKG/11 dtd. 22.12.2011.
29	Copies of the plan and sections as required under Rule-28 have not been submitted to RCOM, IBM, Bhubaneswar	Submitted vide our letter No.1436/OMC/SKG/11 dtd. 22.12.2011

15/3

Annex-15

	for the year 2010-11 on or before 30th June,2011.	
23(2)	The waste dump has not been properly secured to prevent escape of material and surface run off due to rain water	The mining operation was suspended for want of Forest Clearance. After resumption of mining operation with effect from 14.11.2011 action has been taken to construct retaining wall and garland drains around the waste dump to prevent escape of material and surface run off due to rain water.

In view of the facts & circumstances stated above, it is requested to take lenient views on the matter. In future, we will take measures to ensure that such violation does not repeat and request to drop action under Rule, 5B and Rule, 13(2) of MCDR, 1988.

Yours faithfully

MANAGING DIRECTOR

15/4-

Annexure-15
Annex.-15

VIOLATION LETTER
REGISTERED WITH A/D

भारत सरकार/GOVERNMENT OF INDIA
खान मंत्रालय /MINISTRY OF MINES
भारतीय खान ब्यूरो /INDIAN BUREAU OF MINES
क्षेत्रीय खान नियंत्रक का कार्यालय /OFFICE OF THE REGIONAL CONTROLLER OF MINES

No. ORC/CR/JJPM/FOR-8/DHS

Mahani Complex, 2nd Floor
308, District Centre, Chandrasekharpur
Bhubaneswar – 751 016
Date: 17.07.2012

To

The Managing Director
M/S OMC Ltd.
OMC HOUSE
Bhubaneswar

Sub: Violation of provisions of MCDR, 1988 in respect of Sukarangi Chromite Mine over an area of 382.709 ha in Jajpur district of Odisha State.

Sir,

The following provision of Mineral Conservation and Development Rules, 1988 were found violated in the above mine during inspection on 7.07.2012, by the undersigned:

Rule 13 (1): The mining operations are not being carried out in accordance with the approved proposals of Scheme of Mining dt 18.12.2009:

i) that during the year 11-12 against the proposal of 7500 saplings only 1500 saplings have been planted.

Rule 23 (E) (2): The yearly report on extent of protective and rehabilitation works carried out as envisaged in the approved Scheme of Mining dt. 18.12.2009 has not been submitted so far for the year 2011-12 to the RCOM, IBM, Bhubaneswar

Rule 29: The copies of plans and sections as required under Rule 28 have not been submitted for the year 2011-12 so far to the RCOM, IBM, Bhubaneswar

Rule 45(1) (e): The annual return for the year 11-12 has not been submitted so far to the RCOM, IBM, Bhubaneswar.

02. In this connection it is brought to your notice that the above violations constitute an offence punishable under rule 58 of MCDR, 1988. The relevant extract of the rule 58 is given below:

"58 Penalty: - Whoever contravenes any of the provisions of these rules shall be punishable with imprisonment for a term which may extend up to two years, or with fine extending to fifty thousand rupees or with both, and in the case of continuing contravention with an additional fine which may extend up to five thousand rupees for every day during which such contravention continues, after conviction for the first such contravention, provided that for repeated contravention the punishment should be in the form of imprisonment only".

You are advised to rectify the above violations immediately and intimate the position to this office, within 45 (forty five) days from the date of issue of this letter.

Yours faithfully,

Forwarded to Regional Manager for necessary compliance and to enable AD to enforce compliance. Matter urgent

16/7

डॉ एम के सोमानी/Dr. M K Somani
वरिष्ठ खान भूवैज्ञानिकी /Senior Mining Geologist

Annex-15

The Odisha Mining Corporation Ltd.

(A Gold Category State PSU)
(A Government of Odisha Undertaking)
BHUBANESWAR 751 01

No /OMC/P&T/12 Date

Annexure-15

To
The Sr. Mining Geologist,
Indian Bureau of Mines (IBM),
Mahavir Complex, 2nd Floor
308 District Centre, Chandrasekharpur,
Bhubaneswar-751 016

Sub Violation Notice in respect of Sukrangi Chromite Mines of M/s OMC Ltd. in Jajpur district of Odisha State

Ref Letter No. ORI/CR/JJP/MCDR-8/BBS dtd 17.7.2012.

Sir

In purstance to the above order dtd.17.7.2012, this is to kindly inform you that we are submitting here with the point wise compliance to the observations made in respect of Sukrangi Chromite Mines which are as under:

Rule No.	Nature of violation observed by IBM	Compliance by OMC
15(1)	The mining operations are not being carried out in accordance with the approved proposals of Scheme of Mining dtd.18.12.2009. i) that during the year 11-12 against the proposal of 7500 saplings only 1500 saplings have been planted	Due to non availability of suitable land, only 1500 saplings have been planted against the proposal of 7500 saplings during the year 2011-12.Step is being taken for bulk plantation at our compensatory afforestation land in Jagannathpur village of Kamakhya Nagar Tahasil.
23(1)(2)	The yearly report on extent of protective and rehabilitation works carried out as envisaged in the approved Scheme of Mining dt.18.12.2009 has not been submitted so far for the year 2011-12 to the RCOM, IBM, Bhubaneswar.	This is already submitted by Sr Manager (M), Sukrangi vide letter No.710/ OMC/ SKG/12 dtd.06.08.2012.
29	The copies of plans and sections as required under Rule 28 have not been submitted for the year 2011-12 so far to the RCOM, IBM, Bhubaneswar.	This is already submitted by Sr Manager (M), Sukrangi vide letter No.710/ OMC/ SKG/12 dtd.06.08.2012
45(1)(c)	The annual return for the year 2011-12 has not been submitted so far to the RCOM, IBM, Bhubaneswar	This is already submitted by Sr Manager (M), Sukrangi vide letter No.725/OMC/SKG/12 dtd.08.08.2012.

In view of the facts and circumstances states above, it is requested that the action contemplated may kindly be dropped under Rule-5(1) of MCDR, 1988

Yours faithfully,

CHAIRMAN -CUM- M.D.

Contents ... Disclaimer
www.orissaminbyn.com
Phone : 0674 / 2395411, 2395689, 2390421, Fax : 0674-2396889, 2391529

Annex-16 Annexure-4

Phone Nos. (0674) 2744430/ 239 [illegible]
Fax No. (0674) 2744430
E-mail ibmbbsr@bsnl.in

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES
OFFICE OF THE REGIONAL CONTROLLER OF MINES

No. MS/ OTF.MECH/33-ORI/ BHU/ 2009-10

Mahani Complex, 2nd Floor
308, District Centre, Chandrasekharpur
Bhubaneswar – 751 016

Date: 18.12.2009

To

M/s Orissa Mining Corporation Ltd.
OMC House
At/PO: Bhubaneswar
Orissa – 751 001

Sub: **Approval of Scheme of Mining for Sukrangi Chromite Mine along with Progressive Mine Closure Plan (PMCP), over an area of 382.709 ha, in Jajpur District of Orissa state, submitted by M/s Orissa Mining Corporation Ltd under Rule 12 of MCDR, 1988 for the period 2009-10 to 2013-14.**

Ref: (1) Your letter No. 20790/ OMC/ F&E/ 09 dated 27.11.2009.
(2) This office letter of even number dated 15.12.2009.
(3) Your RQP letter No. Nil dated 17.12.2009.

Sir,

In exercise of the power conferred by Sub-rule (4) of Rule 12 of the Mineral Conservation and Development Rules, 1988, I hereby APPROVE the above the Scheme of Mining of **Sukrangi Chromite Mine along with Progressive Mine Closure Plan (PMCP), over an area of 382.709 ha, in Jajpur district of Orissa state, submitted by M/s Orissa Mining Corporation Ltd. under Rule 12 of MCDR, 1988.** This approval is subject to the following conditions:

(i) This Scheme of Mining is approved without prejudice to any other law applicable to the mine area from time to time whether made by the Central Government, State Government or any other authority.

(ii) It is also clarified that the approval of your aforesaid Scheme of Mining does not in any way imply the approval of the Government in terms of any other provision of Mines & Minerals (Development & Regulation) Act, 1957, or the Mineral Concession Rules, 1960 and any other laws including Forest (Conservation) Act, 1980, Environment (Protection) Act, 1986, or the rules made there under.

(iii) It is further clarified that this approval of the Scheme of Mining under Rule 12 of MCDR 1988 is subject to the provisions of Forest (Conservation) Act, 1980, Forest (Conservation) Rules, 2003 and other relevant statues, orders and guidelines as maybe applicable to the lease area from time to time.

(iv) It is further clarified that this approval of the Scheme of Mining is subject to the Provisions of the Mines Act, 1952 and Rule & Regulations made there under including submission of notice of opening, appointment of manager and other statutory officials as required by the Mines Act, 1952 shall be complied with

Annex. 16

(v) The execution of such [illegible] Mining shall be subjected to [illegible] notice, if any.

(vi) This approval for mining operations and associated activities [illegible] lease area only. The mining lease area is as shown on the statutory plans under Rule of Mineral Conservation and Development Rules 1988, by the Lessee/ ROP/ Applica and Indian Bureau of mines has not undertaken verification of the mining lea boundary on the ground.

(vii) If anything is found to be concealed as required by the Mines Act in the contents of t scheme of mining and the proposal for rectification has not been made, the appro shall be deemed to have been withdrawn with immediate effect.

(viii) At any stage, if it is observed that the information furnished in the document i incorrect or misrepresent facts, the approval of the document shall be revoked w immediate effect.

(ix) This approval is given for the received proposals as applicable from this date

(x) The Scheme of Mining is approved without prejudice to any order or direction from a court of competent jurisdiction.

(xi) Your attention is invited to the Supreme Court interim order in W.P.(C) No.202, da 12.12.96 for compliance. The approval of Scheme of Mining is, therefore, issu without prejudice to and is subject to the said directions of the Supreme Court applicable in your case.

(xii) An yearly report before 1st July of every year setting forth the extent of protective r rehabilitative works carried out as envisaged in the approved mine closure plan, an there is any deviation, reasons thereof should be submitted to Regional Controller Mines, Indian Bureau of Mines, Bhubaneswar under Rule 23 F (2) of MCDR, 1988

(xiii) The Financial Assurance submitted on 17.12.2009 for an amount of Rs. 42,34,05 (Rupees Forty Two Lakh Thirty Four Thousand Fifty only) is valid up to 31.03.2014 new bank guarantee is to be submitted on or before its expiry i.e. 31.03.2014 or bef the expiry of scheme period which ever is earlier.

(xiv) A copy of Environmental clearance letter issued by MOEF should be submitted to R Bhubaneswar immediately after approval of BIA - EMP for record and information.

(xv) The Environmental Monitoring Cell established by the company shall condu monitoring ambient air quality, dust-fall rate, water quality, soil sample analysis noise level measurements at various stations established for the purpose both in the c zone and buffer zone as per requirement of Environment Guidelines and keeping view IBM's circular No. 3/ 92 & 2/ 93 season-wise every year or by engaging services of an Environmental Laboratory approved by MOEF/ CPCB. The data generated shall be maintained in a bound paged register kept for the purpose and same shall be made available to the inspecting officer, on demand.

Yours faithfully,

Encl: One copy of approved Scheme of Mining.

[illegible] Controller of Mi

C/12.

Annex. 16

Copy for kind information to.

1. Shri P.S. Acharya, RQP, M/s Gemtech Consultants Pvt. Ltd., N4/ 347, IRC Village, Nayapalli, Bhubaneswar – 751 015.
2. The Director of Mines Safety, Directorate General of Mines Safety, Bhubaneswar Region, At: Plot No. 1, Nayapalli, Near Swosti Plaza Hotel, Post RRL Campus, Bhubaneswar along with one copy of modifications to the approved scheme of mining by **REGISTERED PARCEL.**
3. The Director of Mines, Directorate of Mines, Government of Orissa, Heads of the Department **Building**, New Capital, Bhubaneswar– 751 001 Orissa along with one copy of the approved scheme of mining by **REGISTERED PARCEL.**

(S. TIU)
Regional Controller of Mines

C/13

Annex. 17

NABL

National Accreditation Board for Testing and Calibration Laboratories

Department of Science & Technology, India

CERTIFICATE OF ACCREDITATION

SUPERINTENDENCE COMPANY OF INDIA (P) LTD.

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

'General Requirements for the Competence of Testing & Calibration Laboratories'

for its facilities at

Plot Y-23, Block-EP, Sector-V, Salt Lake City, Kolkata

in the discipline of

CHEMICAL TESTING

(To see the Scope of Accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Certificate Number T-1230

Issue Date 31/03/2012

Valid Until 30/03/2014

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

R. Prakash
Convenor

Anil Kella
Director

Dr. T. Ramasami
Chairman

SUPERINTENDENCE CO. OF INDIA (P) LTD.

Dy. Managing Director

Annex - 13





URS

TEST CERTIFICATE

Date : 05.12.2013

Job No. / Lpo#	Date of Testing		Date of Completion
Name & Address of Cli	M/S. Tata Chemicals Magadi Limited, Magadi		
Reference No. & Date.	LPO/6/2013, Dated: 24.10.2013		
Name of Work	Mashu Hill, variety of different grades of Chloride Ore sampling.		
	and Supply of Sodium Kimberlite Mines.		
Material	Chloride Ore		
Source.	South Kenya Soda Mines		
Sampling & Work Done	By: Client		
Testing Reference	IS: 4737		

TEST RESULTS

Sl. No.	Test Sieve	Cumulative Wt. Retained	Date of Sampling	Weight Taken (gms)	Weight Retained (gms)	Weight Passed (gms)	Percentage Passed	Wet Weight of the Empty Tray (Kg)	Wet Weight (Kg)
								(A)	(B) = (C) - (A)
27	Empty Tray of Mine	50/05/2013-28	19.09.2013	0.310	0.000	0.310	100.00	54.200	54.200 (Empty)
28	Empty Tray of Mine	30/09/2013-01	19.09.2013	0.310	0.000	0.310	100.00	54.200	54.200 (Empty)
29	Empty Tray of Mine	05/09/2013-29	19.09.2013	0.310	0.000	0.310	100.00	54.200	54.200 (Empty)
30	Empty Tray of Mine	05/09/2013-29	19.09.2013	0.310	0.000	0.310	100.00	54.200	54.200 (Empty)
31	Empty Tray of Mine	03/09/2013-30	19.09.2013	0.310	0.000	0.310	100.00	54.200	54.200 (Empty)

Overall Accuracy

[illegible] Percentage of Weight Retained of IDS Laboratory Grade

Allowable Percentage

0.00

Sl. No.	Test Sieve	Cumulative Wt. Retained	Percentage Passed	Percentage Retained	Allowable Percentage
26	05/09/2013-28	4.20	95.80	0.164 LT	44.50
27	30/09/2013-01	13	87.80	0.503 LT	5.50
28	05/09/2013-29	49.7	12.40	2.393 LT	12.50
29	05/09/2013-29	45.1	14.70	1.711 LT	10.20
30	03/09/2013-30	45.1	14.70	0.000 LT	10.20

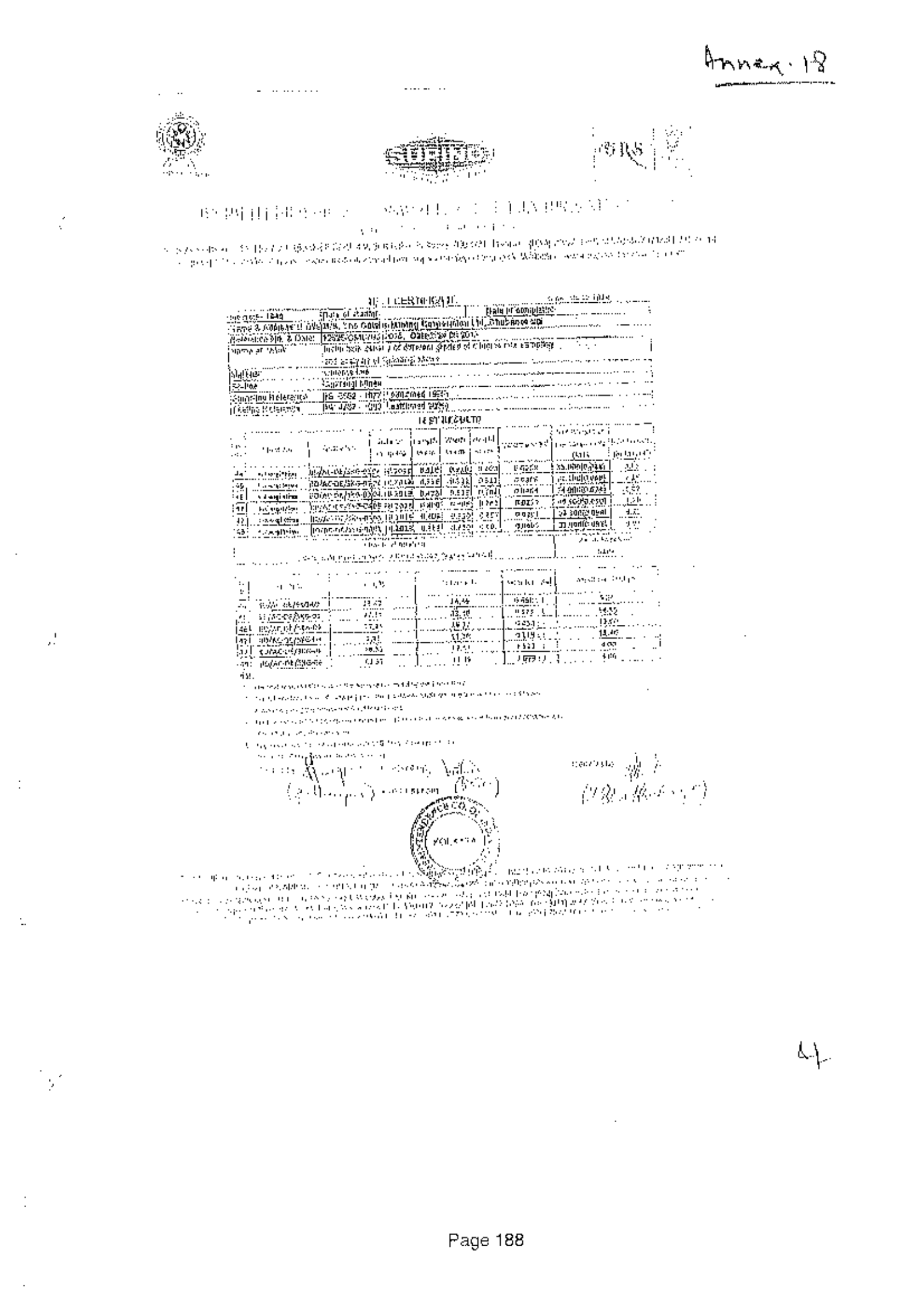
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- [illegible]
- [illegible]
- [illegible]
- [illegible]

End of Report

4

Annex-18

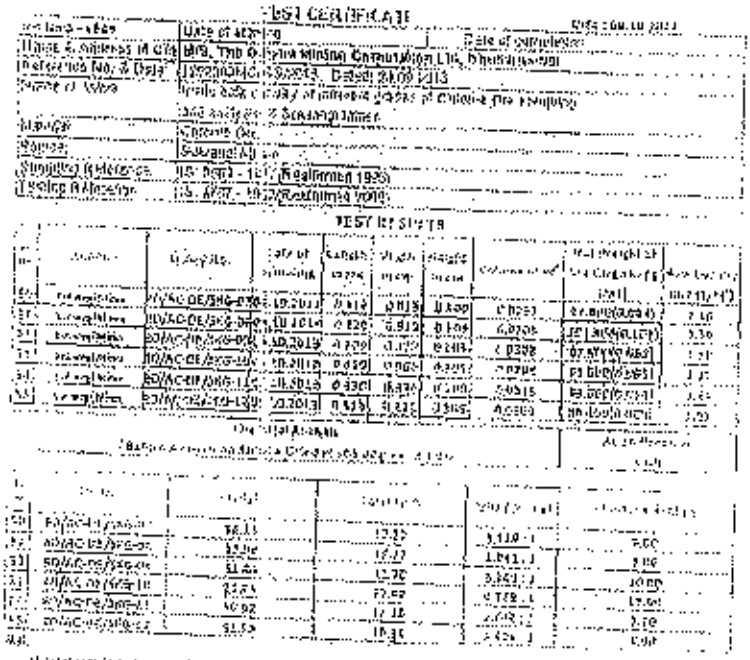


Page 188

Annex - 13









Annex - 19



ASSAY CERTIFICATE

Date of start: [illegible] Date of completion

Name & address of Client/S. The Orissa Mining Corporation Ltd, Bhubaneswar

Reference No. & Date: 12525/OMC/05/2012, Dated: 30/06/2012

Nature of Work: Analysis of different grades of Chromite Ore samples

Lead Analysis of Jilingarga Mines

Materials: Chromite Ore

Source: Jilingarga Mines

Sampling Reference: IS: 8662 - Pt-7 (Reaffirmed 1995)

Testing Reference: IS: 4737 - 1968 (Reaffirmed 2016)

TEST RESULTS

Sl. No.	Description	Date of Receiving	Initial Wt. (gm)	Weight after drying	Weight after crushing	Loss (%)	Assay Value (Cr2O3) %	Remarks
1	Jilingarga Mines	D/AC-01/325-1	0.201	0.200	0.196	02.50	51.65	
2	Jilingarga Mines	D/AC-01/325-1	0.201	0.328	0.326	0.317	02.84	
3	Jilingarga Mines	D/AC-01/325-1	0.201	0.300	0.298	0.293	52.07	
4	Jilingarga Mines	D/AC-01/325-1	0.201	0.301	0.300	0.312	51.98	
5	Jilingarga Mines	D/AC-01/325-1	0.201	0.296	0.295	0.285	51.86	

Chemist/Analyst

Verified and found correct by the Director of Mines

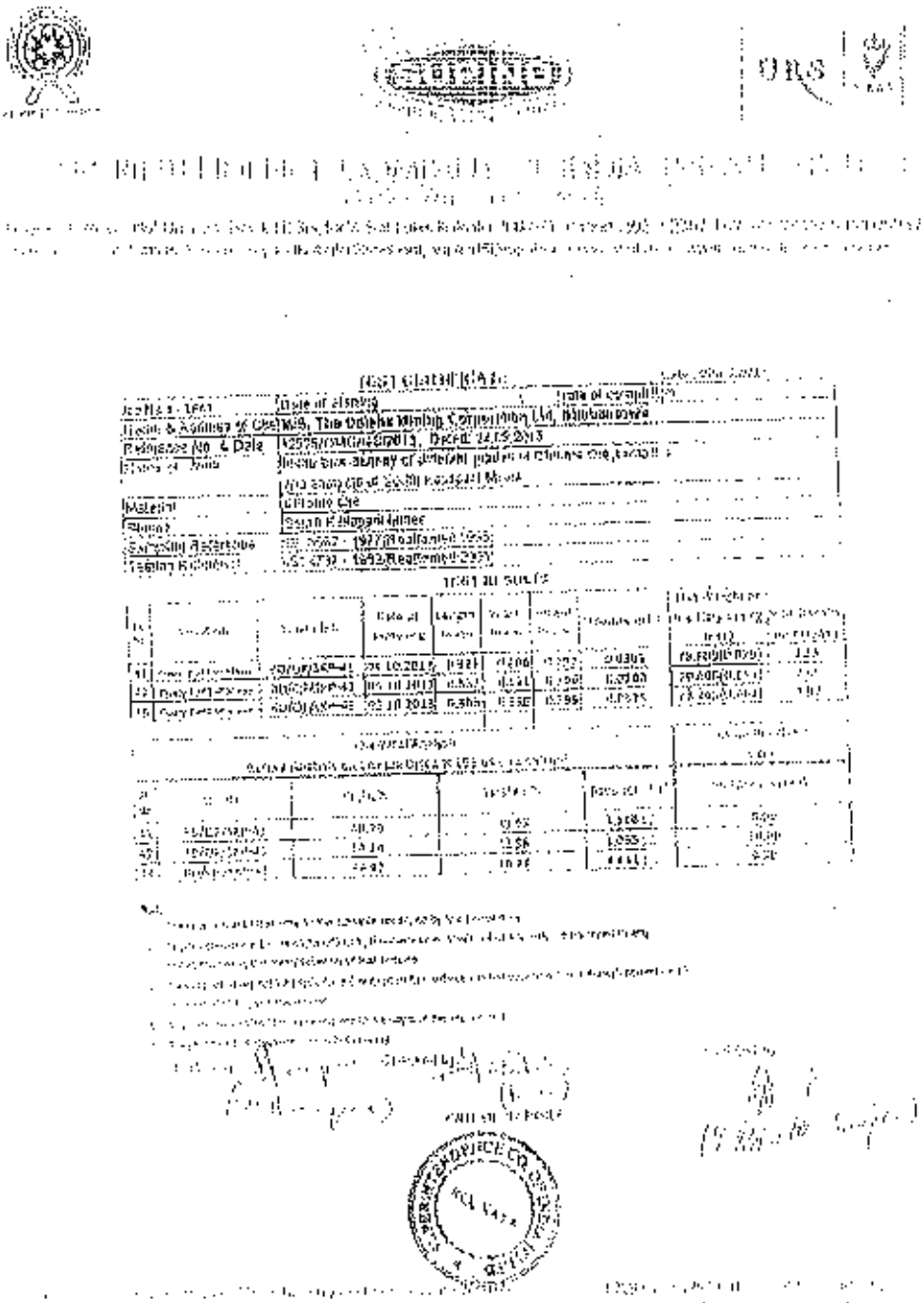
Sl. No.	Description	Assay Value (Cr2O3) %	Remarks
1	Jilingarga Mines	51.65	
2	Jilingarga Mines	52.16	
3	Jilingarga Mines	51.98	
4	Jilingarga Mines	51.75	
5	Jilingarga Mines	51.86	

1. The results relate only to the sample tested by the laboratory.
2. This certificate shall not be reproduced except in full without written approval from the laboratory.
3. Testing has been carried out as per relevant standard.
4. Any deviation from the standard test procedure.
5. Uncertainty of measurement is available on request.
6. Sampling has been carried out by the customer.
7. Opinions and interpretations are not covered by the scope of accreditation.

Authorised Signatory

END OF REPORT

Annex - 13



Annex - 13

SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001:2008 Certified Company)

Regd. Office : Premises No. 24, Block-GP, Sector-V, Salt Lake, Kolkata-700 091, Phone : +91-33-2357 0201 Fax : +91-33-2357 0217, E-mail : info@superindia.com, Website : www.superindia.com

Corporate Office : Plot No. A-2, Block-DN, Sector-V, Salt Lake, Kolkata-700 091, Phone : +91-33-2357 0201 Fax : +91-33-2357 0217, E-mail : info@superindia.com, Website : www.superindia.com

TEST CERTIFICATE

Date : 06.10.2013

Job Code - 1838	Date of starting	Date of completion
Name & Address of Client	M/S. The Odisha Mining Corporation Ltd, Bhubaneswar	
Reference No. & Date.	12535/OMC/05/2013, Dated: 24.09.2013	
Name of Work	Specific bulk density on different grades of Chromite Ore sampling from stockpile of South Kaliapani Mines.	
Material	Chromite Ore	
Source	South Kaliapani Mines	
Sampling Reference	IS: 6652 - 1977 (Reaffirmed 1995)	
Testing Reference	IS: 4737 - 1972 (Reaffirmed 2005)	

TEST RESULTS

Sl. No.	Description	Survey No.	Date of Sampling	Length in cm	Width in cm	Height in cm	Volume in m^3	Net Weight of the Cylinder in Kg (app.)	Bulk Density in (in MT/m^3)
1	Chromite Ore	KK/CO/SKP-01	26.09.2013	0.300	0.300	0.300	0.027	110.000(0.110)	4.07
2	Chromite Ore	KK/CO/SKP-02	26.09.2013	0.300	0.300	0.300	0.027	113.200(0.113)	4.19
3	Chromite Ore	KK/CO/SKP-03	26.09.2013	0.300	0.300	0.300	0.027	81.300(0.0813)	3.01
4	Chromite Ore	KK/CO/SKP-04	26.09.2013	0.320	0.320	0.200	0.0205	42.000(0.042)	2.05
5	Chromite Ore	KK/CO/SKP-05	26.09.2013	0.300	0.300	0.300	0.027	107.400(0.1074)	3.98

Sl. No.	Grade	Cr2O3 %	Proximate Analysis (Sample Analysed on Dry basis Drying at 105 degree Celsius) Fe/Cr	As per Part (1) Moisture (TM) %
1	KK/CO/SKP-01	47.88	1.596 : 1	5.00
2	KK/CO/SKP-02	44.18	1.558 : 1	5.50
3	KK/CO/SKP-03	51.49	1.604 : 1	4.00
4	KK/CO/SKP-04	30.69	0.318 : 1	12.50
5	KK/CO/SKP-05	53.04	1.607 : 1	3.00

N.B.

1. The test results refer only to the sample(s) tested by the Laboratory.
2. Superintendence Co. of India (P) Ltd., Bhubaneswar shall not be responsible in any way for any incorrect or misleading information/interpretation of test results.
3. This report shall not be reproduced or published without written approval from Superintendence Co. of India (P) Ltd., Bhubaneswar.
4. Any application for re-examination within 15 days of the report date.
5. Sample will be disposed after 15 days.

Checked by

Checked by

END OF REPORT

SUPERINTENDENCE CO. OF INDIA (P) LTD. KOLKATA

Page 192

Annex - 18

SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001 : 2008 Certified)

Regd. Office : Plot No. 6-7, Mondal Building, 2nd Floor, Sector-V, Salt Lake, Kolkata-700 091 Phone : (033) 2357-3401/02/03/04/2358-1...
Fax : +91-033-2357-3404 E-mail : salkol@vsnl.net Website : www.superintendence.com

TEST CERTIFICATE

Date : 09.10.2013

Job No. : 1843	Date of starting	Date of completion
Name & Address of Cli...	M/S. The Odisha Mining Corporation Ltd, Bhubaneswar	
Reference No. & Date	...SMD/OMC/GS/2013, Dated: 24.09.2013	
Name of Work	Intact bulk density of ordered grades of Chrome Ore sampling and analysis at South Kaliapani Mines	
Material	Chrome Ore	
Source	South Kaliapani Mines	
Sampling Reference	IS: 9982 - 1977(Reaffirmed 1996)	
Testing Reference	IS: 4127 - 1967(Reaffirmed 2006)	

TEST RESULTS

Sl. No.	Location	Coding No.	Date of Sampling	Length in cm	Width in cm	Height in cm	Volume in M³	Wet Weight in Kg	Wet Cargo in Kg (M.T.)	Bulk density (in MT/M³)
23	Kaliapani Mines	SD/GD/SKP-23	18.09.2013	0.302	0.305	0.190	0.0174	55.20kg	0.207	3.57
24	Kaliapani Mines	SD/GD/SKP-24	18.09.2013	0.303	0.303	0.505	0.0289	104.5kg	0.207	3.59
25	Kaliapani Mines	SD/GD/SKP-25	18.09.2013	0.508	0.508	0.300	0.0385	85.30kg	0.286	3.01
26	Kaliapani Mines	SD/GD/SKP-26	18.09.2013	0.415	0.411	0.192	0.0330	109.20kg	0.363	3.77
27	Kaliapani Mines	SD/GD/SKP-27	18.09.2013	0.410	0.313	0.305	0.0392	105.30kg	0.363	3.67

Chemical Analysis

(Chemical Analysis of Samples Given at JDS Orissa Colony)

As per Reference Letter

Sl. No.	Cr. No.	Cr_2O_3 %	Total Fe %	Ratio (Cr : Fe)	Quantity (in M.T.)
23	SD/GD/SKP-23	35.20	11.20	3.350 : 1	2.30
24	SD/GD/SKP-24	54.55	10.84	5.500 : 1	4.56
25	SD/GD/SKP-25	48.78	12.50	3.948 : 1	3.40
26	SD/GD/SKP-26	42.65	11.26	3.800 : 1	11.80
27	SD/GD/SKP-27	54.33	10.31	5.551 : 1	6.50

N.B.

1. ...
2. ...
3. ...
4. ...
5. ...

Checked By

Checked By

Certified By

END OF REPORT

SUPERINTENDENCE CO. OF INDIA (P) LTD. KOLKATA

Annex - 13

SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001 : 2008 Certified)

Regd. Office : Plot No. 6/2, Block-HF, Sector-V, Salt Lake, Kolkata-700 091, Phone : (033) 2357 [illegible]
Fax : (033) [illegible] Website : www.[illegible]

TEST CERTIFICATE

Date : 08.10.2013

Job / Bill No.	Date of starting : Date of completion :
Name & Address of Client	M/S. The Orissa Mining Corporation Ltd, Bhubaneswar
Reference No. & Date	12(58)/OMC/GS/2013, Dated: 24.05.2013
Name of Work	Heavy bulk density of different grades of Chromite Ore, sampling from analysis of South Karaspani Mines.
Material	Chromite Ore.
Source	South Karaspani Mines
Sampling Reference	IS: 6552 : 1977(Reaffirmed 1995)
Testing Reference	IS: 4737 - 1968(Reaffirmed 2004)

TEST RESULTS

Sl. No.	Description	Quarry No.	Date of Sampling	Length in cm	Width in cm	Height in cm	Volume in cm^3	Net Weight of the Sample in gm (wt)	Wet Density (in MT/m^3)
16	Quarry Run Chromite Ore	SD/QD/SKP-16	18.09.2013	0.600	0.600	0.510	0.0460	163.000(0.5435)	3.01
17	Quarry Run Chromite Ore	SD/QD/SKP-17	18.09.2013	0.320	0.430	0.360	0.0397	120.000(0.120)	3.02
18	Quarry Run Chromite Ore	SD/QD/SKP-18	18.09.2013	0.302	0.402	0.360	0.0374	98.000(0.098)	2.62
19	Quarry Run Chromite Ore	SD/QD/SKP-19	18.09.2013	0.510	0.530	0.320	0.0864	310.000(0.310)	3.59
20	Quarry Run Chromite Ore	SD/QD/SKP-20	18.09.2013	0.320	0.311	0.360	0.0731	205.000(0.205)	2.80

Chemical Analysis	As on Received Basis
(Quality Analysis of Samples Grade at 10% dry bed Cr2O3)	

Sl. No.	Sample No.	Cr_2O_3 %	Total Fe %	Ratio (Cr : Fe)	Acid Insoluble (AI) %
16	SD/QD/SKP-16	47.69	11.44	3.438 : 1	5.10
17	SD/QD/SKP-17	45.61	10.58	3.140 : 1	4.60
18	SD/QD/SKP-18	47.69	11.54	3.939 : 1	5.00
19	SD/QD/SKP-19	47.69	11.44	3.838 : 1	10.10
20	SD/QD/SKP-20	46.28	10.08	3.334 : 1	3.80

Note :

1. The test results refer only to the samples received by the Laboratory.
2. Superintendence Co. of India (P) Ltd., Bhubaneswar shall not be held responsible for any loss or damage arising out of misrepresentation of test results.
3. This report shall not be reproduced in part or in full without written approval from Superintendence Co. of India (P) Ltd., Bhubaneswar.
4. Any objection should be reported within 7 days of the report date.
5. [illegible]

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Compiled by

END OF REPORT

SUPERINTENDENCE CO. OF INDIA (P) LTD. KOLKATA

41

Annex - 13

SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001 : 2015 Certified)

Regd. Office : Plot No. 2/1, Middle Lane, Kolkata 700 001 Phone : (033) 2367-1492, Fax No. (033) 2367-0805, E-mail : supco@vsnl.net Website : www.superintendence.com

TEST CERTIFICATE

Date : 08.10.2014

Job No. & Date	Date of starting	Date of completion
Name & Address of Client	M/s. The Odisha Mining Corporation Ltd, Bhubaneswar	
Reference No. & Date	11258/OMC/GIS/2013, Dated: 24.09.2013	
Name of Work	Insitu bulk density of different grades of Chromite Ore remaining	
	pits and pits of South Kaliapani Mines	
Material	Chromite Ore	
Source	South Kaliapani Mines	
Sampling Reference	IS: 8622 - 1977 (Reaffirmed 1993)	
Testing Reference	IS: 4737 - 1968 (Reaffirmed 2009)	

TEST RESULTS

Sl. No.	Description	Date of Sampling	Length (in cm)	Width (in cm)	Height (in cm)	Volume (in m^3)	Net Weight of the Cargo (in Kg) (wet)	Bulk Density (in kg/m^3)
11	Quarry Excavated	BD/QD/SKP-11	27.09.2013	0.300	0.500	0.1500	0.0150	359.200/0.1500	2.392
12	Quarry Excavated	BD/QD/SKP-12	27.09.2013	0.500	0.550	0.5500	0.0825	72.500/0.0750	1.500
13	Quarry Excavated	BD/QD/SKP-13	27.09.2013	0.400	0.3201	0.3520	0.0329	146.000/0.1350	1.081
14	Quarry Excavated	BD/QD/SKP-14	27.09.2013	0.300	0.510	0.1500	0.0279	32.805/0.0343	1.001
15	Quarry Excavated	BD/QD/SKP-15	27.09.2013	0.450	0.500	0.3000	0.0441	78.005/0.0378	1.75

Chemical Analysis — As on Records

Before Analysis on Sample Dried at 105 degree Centrigrade

Sl. No.	Grade	Cr_2O_3 %	Total Fe %	Ratio (C) : (Fe)	Analysis (DMS) %
11	BD/QD/SKP-11	42.65	10.02	2.893 : 1	2.50
12	BD/QD/SKP-12	41.01	10.85	0.336 : 1	13.05
13	BD/QD/SKP-13	52.96	11.30	3.385 : 1	3.60
14	BD/QD/SKP-14	53.69	13.13	0.759 : 1	3.30
15	BD/QD/SKP-15	38.16	14.80	0.757 : 1	13.20

Remarks :

1. The test results refer only to the samples received by the Laboratory.
2. Duplicate Memorandum of Fees (Rs. 25% Surcharge shall be levied) may be issued on the request for issuing the Duplicate/Copy of Test Results.
3. This report shall not be reproduced except in full without written approval of the Superintendence Co. (P) Ltd., Kolkata.
4. Any discrepancy must be reported within 3 days of this report date.
5. Sample(s) drawn by Client/Customer (if).

Tested by

Checked by

Approved by

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SUPERINTENDENCE CO. OF INDIA (P) LTD. KOLKATA

Annex - 13

SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001 : 2008 Certified)

Regd. Office : Plot No. 7/A, Sarat Bose Road, Kolkata 700 020. Phone : (033) 2287 [illegible] Fax : (033) 2287 4815 • Email : [illegible] • Website : www.supervisioncompany.com

TEST CERTIFICATE

Date : 03.10.2013

Contract No. 1644	Date of starting		Date of completion
Name & Address of Client	M/S. The Orissa Mining Corporation Ltd, Bhubaneswar		
Reference No. & Date	1292SQMC/SS/2013 Dated: 24.09.2013		
Name of Work	Inside bulk sample of different grades of Chromite Ore sampling and analysis of Sukinda Kansposa Mines.		
Materials	Chromite Ore		
Source	Boulet Kansposa Mines		
Sampling Reference	IS: 8962 - 1977(Reaffirmed 1996)		
Testing Reference	IS: 4732 - 1968(Reaffirmed 2006)		

TEST RESULTS

Sl. No.	Location	Query No.	Date of sampling	Length in cm	Width in cm	Height in cm	Volume in M^3	Net Weight of the Sample in (MT)	Bulk Density (in MT/M^3)
26	Open cut bulk sample	SQ/QC/SKP-26	29.09.2013	0.904	0.803	0.304	0.0221	54.600(0.054)	2.50
27	Open cut bulk sample	SQ/QC/SKP-27	29.09.2013	0.313	0.316	0.328	0.0325	78.300(0.078)	1.93
28	Open cut bulk sample	SQ/QC/SKP-28	29.09.2013	0.316	0.313	0.306	0.0304	61.200(0.061)	1.85
29	Open cut bulk sample	SQ/QC/SKP-29	29.09.2013	0.313	0.296	0.303	0.0279	57.000(0.057)	2.04
30	Open cut bulk sample	SQ/QC/SKP-30	29.09.2013	0.605	0.606	0.300	0.0329	28.500(0.029)	1.19

Chemical Analysis
(Before Analysis the Sample Dried at 105 degree Celsius)

As on Received basis

Sl. No.	Qr. No.	Cr2O3 %	Total Fe %	Insitu (MT in Lakh)	Moisture (Tonne)
26	SQ/QC/SKP-26	48.89	11.48	3.864 Lakh	5.00
27	SQ/QC/SKP-27	18.84	15.14	0.754 Lakh	5.00
28	SQ/QC/SKP-28	7.84	23.54	0.345 Lakh	15.00
29	SQ/QC/SKP-29	20.08	17.16	0.758 Lakh	11.00
30	SQ/QC/SKP-30	45.02	12.04	3.786 Lakh	5.50

N.B.

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SUPERINTENDENCE CO. OF INDIA (P) LTD. KOLKATA

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SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(an ISO 9001 : 2008 Certified)

Registered Office : Premises No. 25A, Block HB, Sector III, Salt Lake, Kolkata-700 091 Phone : (033) 2357 [illegible]
... (033) 2357-4804, ... e-mail : [illegible]

TEST CERTIFICATE

Date : 08.10.2015

Job Nos - 1650	Date of starting	Date of completion
Name & Address of Client	M/S. The Orissa Mining Corporation Ltd, Bhubaneswar	
Reference No. & Date	1052/OMC/GSG/2015, Dated: 24.09.2015	
Name of Work	Insitu cell density of chromite glades of Chrome Ore sampling and analysis of Sukinda Mines	
Material	Chrome Ore	
Source	Sukinda Mines	
Sampling Reference	IS: 8552 - 1977(Reaffirmed 1995)	
Testing Reference	IS: 4737 - 1982(Reaffirmed 2000)	

TEST RESULTS

Sl. No	Location	Survey No.	Date of Sampling	Length in cm	Width in cm	Height in cm	Volume in M³	Net Weight of the Cargo in Kg (MT)	Bulk Density in Kg/M³ (MT)
56	Sukinda Mines	SD/AC-DE/SKG-1405	30.09.2015	0.886	0.843	0.915	0.0683	61.850(0.062)	2.29
57	Sukinda Mines	SD/AC-DE/SKG-1405	30.09.2015	0.845	0.210	0.813	0.0541	78.300(0.077)	1.34
58	Sukinda Mines	SD/AC-DE/SKG-1405	30.09.2015	0.800	0.540	0.791	0.0571	49.000(0.045)	1.88
59	Sukinda Mines	SD/AC-DE/SKG-1405	30.09.2015	0.803	0.513	0.931	0.0765	61.000(0.060)	2.07
60	Sukinda Mines	SD/AC-DE/SKG-1405	30.09.2015	0.805	0.905	0.935	0.0680	65.300(0.086)	2.85

Chemical Analysis (Values Are Given on Samples Dried at 105 degree Celsius)	Ajab Represented by/in

Sl. No.	Or. No.	Cr_2O_3 %	Iron as Fe %	Ratio (Cr : Fe)	Alumina (Al) in %
56	SD/AC-DE/SKG-56	38.65	33.28	0.860 : 1	8.10
57	SD/AC-DE/SKG-57	53.18	19.04	1.593 : 1	10.50
58	SD/AC-DE/SKG-58	8.85	30.24	0.185 : 1	12.50
59	SD/AC-DE/SKG-59	31.15	30.14	1.057 : 1	13.20
60	SD/AC-DE/SKG-60	42.73	13.72	2.933 : 1	9.85

N.B.

1. The test results refer only to the samples received by the Laboratory.
2. Superintendence Co. of India (P) Ltd. shall not in any way be responsible in any action for using the publication of test results.
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Tested by: (S. Mukherjee) Checked by: (Illegible) Certified by:

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SUPERINTENDENCE COMPANY OF INDIA (PRIVATE) LIMITED

(An ISO 9001 : 2008 Certified Co.)

TEST CERTIFICATE

Date : 08.10.2013

Test Mark - Self	Date of Starting	Date of completion
Name & Address of the M/S.	M/S. The Orissa Mining Corporation Ltd, Bhubaneswar	
Reference No. & Date	12926/DMC/OMC/2013, Dated: 24.09.2013	
Name of Work	Insitu bulk density of defined grades of Chrome Ore sampling and analysis of South Kaliapani Mines.	
Material	Chrome Ore.	
Source	South Kaliapani Mines	
Sampling Reference	IS: 8503 - 1977 (Reaffirmed 1995)	
Testing Reference	IS: 4737 - 1992(Reaffirmed 2006)	

TEST RESULTS

Sl. No.	Location	Cavity No.	Date of Sampling	Length in cm	Width in cm	Height in cm	Volume in m^3	Net Weight of the Sample in Kg (WT)	Bulk Density (in MT/m^3)
33	Cavity No-SKP-21	SO/GO/SKP-21	30.09.2013	0.618	0.301	0.300	0.0195	31.200(0.031)	1.59
34	Cavity No-SKP-33	SO/GO/SKP-33	30.09.2013	0.936	0.813	0.600	0.0456	83.300(0.083)	1.82
35	Cavity No-SKP-34	SO/GO/SKP-34	30.09.2013	0.398	0.110	0.196	0.0214	37.500(0.038)	1.75
36	Cavity No-SKP-44	SO/GO/SKP-44	30.09.2013	0.318	0.083	0.308	0.0081	40.200(0.040)	1.68
37	Cavity No-SKP-35	SO/GO/SKP-35	30.09.2013	0.467	0.210	0.104	0.0204	103.600(0.103)	2.61

Chromite Analysis (Before Analysis the Sample Dried at 105 degree Centi)	As received basis

Sl. No.	Cavity No	Cr_2O_3 %	Iron Fe %	Ratio (Cr : Fe)	Moisture (TM) %
33	SO/GO/SKP-21	28.80	24.64	0.691 : 1	12.50
34	SO/GO/SKP-33	35.99	11.98	3.443 : 1	11.40
35	SO/GO/SKP-34	34.53	40.04	0.249 : 1	14.00
36	SO/GO/SKP-44	41.11	48.43	0.116 : 1	10.50
37	SO/GO/SKP-35	38.56	11.20	3.291 : 1	9.60

N.B.

1. The test results refer only to the sample (s) stated by the customer(s).
2. Superintendence Co. of India (P) Ltd., shall not be responsible for any action taken by the customer following the interpretation of test results.
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4. Any objection shall be reported within 15 days of the report date.
5. Subject to Bhubaneswar Jurisdiction only.

Tested by

Checked by

Certified by

END OF REPORT...

Annex-19 Annexure-26

TO,
THE REGIONAL CONTROLLER OF MINES,
INDIAN BUREAU OF MINES, MAITRI COMPLEX,
2ND FLOOR, 306 - VIJAY CENTRE, - PUR. DBS
SUNDRA
DR .



Dear Sirs,

CONFIRMATION OF BANK GUARANTEE ISSUED BY US
Your Ref.

With reference to your letter referred above we confirm having issued a Guarantee/extension of guarantee favouring yourselves, the details of which are given below:

a. Our Guarantee Number	:	0018091GFIN0016
b. Date of Guarantee	:	17-12-2009
c. Guarantee Amount	:	INR 42,34,050.00
d. Issued at the request of	:	ORISSA MINING CORPN LTD
e. Valid Upto	:	
f. Validity Extended Upto	:	31-03-2014
g. Claim Period Upto	:	
h. Claim Period Extended Upto	:	31-03-2014

Yours faithfully,

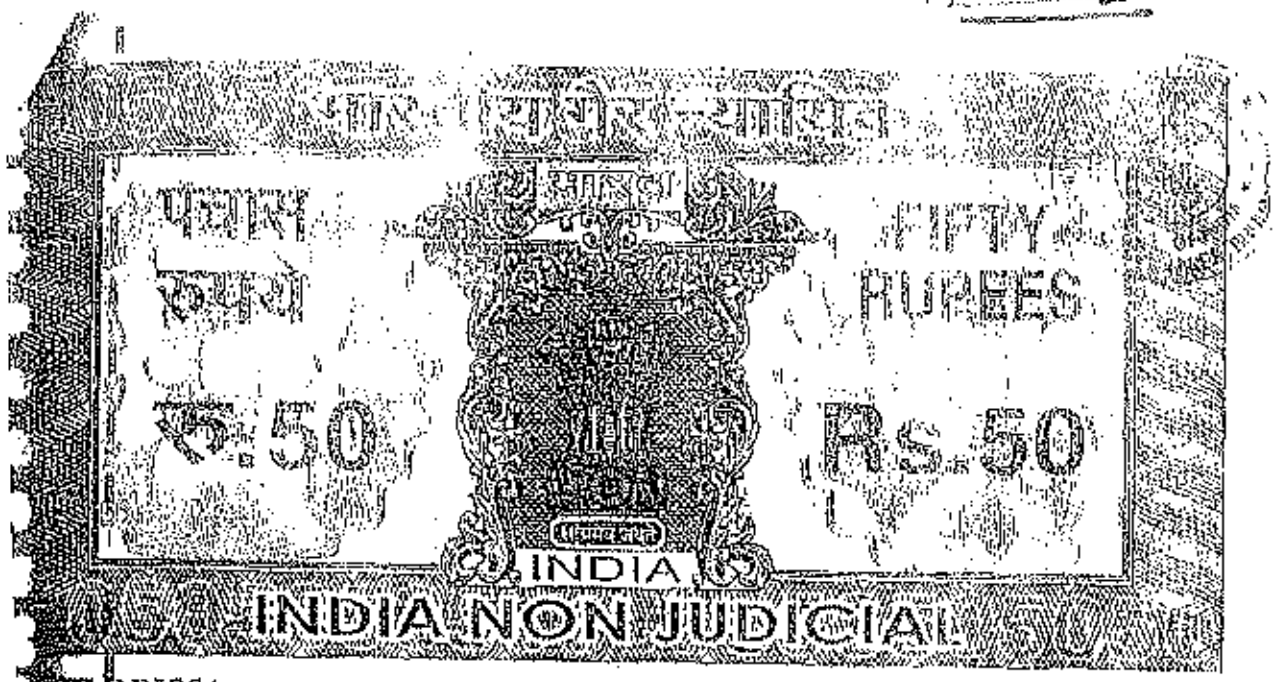
MANAGER/CHIEF MANAGER.

for JAMMU & KASHMIR BANK

Chief Manager/Asst. General Manager
(Authorised Signatory)

26/1

Annex-19



ORISSA

A 207789

Form No.

The Regional Controller of Mines
Indian Bureau of Mines,
Bhubaneswar.

Dear Sir,

Guarantee No. 00120116FIN0015
Amount of Guarantee Rs. 42,34,050/-
Guarantee Period from 17.12.2009 to 31.03.2014
Last date for lodgment of claim 31.03.2014

This Deed of guarantee executed on 17th Day of December 2014 by Andhra Bank constituted under the Banking companies (Acquisition & Transfer of Undertaking) Act, 1980 having its central office at Hyderabad and amongst other places, a branch at Bhubaneswar (hereinafter referred to as the bank) in favour of the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar (hereinafter referred to as the Beneficiary) for an amount not exceeding Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only at the request of M/s Orissa Mining Corporation Ltd (hereinafter referred to as the Contractor/s).

This guarantee is issued subject to the condition that the liability of the bank under the guarantee is limited to maximum of Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only and guarantee shall remain in full force up to 31.03.2014 (date of expiry) and cannot be revoked on or before 31.03.2014 (last date of claim) by the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar in writing.

SUBJECT TO AS ABOVE AND
(Main guarantee matter may be typed hereafter)

For ANDHRA BANK

26/2

Annex-19

BANK GUARANTEE AND CO-ACCEPTANCE BOND

1. Agreement on production of a Bank guarantee for Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only under rule 23F of MCDR 1988

2. We Andhra Bank (bank name), at the request of M/s Orissa Mining Corporation Ltd (lessee) do hereby undertake to pay to the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other officer authority nominated by the Controller General, Indian Bureau of Mines an amount not exceeding Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only against any loss or damage caused to or suffered or would be caused to or suffered by the Government or toward non compliance of provisions of Rules 23A, B & 23E of MCDR, 1988 i.e. Mine closur plan, progressive mine closure plan approved in respect of the mining lease fo Sukarangi (Chromite), M. L . No. 7288 over an area of 382.709 Hects. (S.I.T.No7 G/16 granted by the Steel & Mines Dept; Government of Orissa Letter No. III (C MG.10/ 78 – 7924 dated the 5th August, 1978 to M/s Orissa Mining Corporatio Ltd (lessee) situated in Kaliapani & Forest Block – 27 village, Sukinda Taluk Jajpur district, Orissa State by reason of any breach of the said lesser or any of t terms or conditions contained in the Mine closure plan / progressive mine closure pla

आन्ध्रा बैंक
ANDHRA BANK

NARAYAN BISWAL
SENIOR MANAGER

For ANDHRA BANK

Branch Manager

26/2

Annex:19

3. Andhra Bank, (Bank) do hereby, undertake to pay the amount due and payable under this guarantee without any demur, merely on a demand from the authority stated in paragraph 4 hereinafter, stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the government by reason of breach by the said lessee of any of the terms or conditions contained in the mining plan/mining scheme or by reason of lessee's failure to perform the said mine closure plan/ progressive mine closure plan. Any such demand made on the bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only.

4. We undertake to pay to the authority on a demand from the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other officer authorized by the notwithstanding any dispute or disputes raised by the lessee in any suit or proceedings pending before any court or tribunal relating thereto our liability under this present being absolute and unequivocal.
The payment so made by us under this bond shall be valid discharge of our liability for payment there under and lessee shall have no claim against us for making such payment.

5. We, **Andhra Bank** (bank name), further agree that the guarantee herein contained shall remain in full force and effect during the period up to the end of the Mining plan/ Scheme of Mining period of five years that would be taken for performance of the said Agreement and that shall continue to be enforceable till all the dues of the Govt under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged till Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other officer authorized by the Controller General, Indian Bureau of Mines certifies that the terms and conditions of the said progressive mine closure plan/ final mine closure plan have been fully and properly carried out by the said lessee and accordingly discharge this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before **31.03.2014**, we shall be discharged from all liability under this guarantee thereafter.

6. We further agree that Regional Controller of Mines, Indian Bureau of Mines, **Bhubaneswar** or any other officer authorized by the Controller General, Indian Bureau of Mines shall have fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said agreement or the extend time of performance by the said lessee from time to time or to postpone for any time or from time to time any power exercisable by Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar against the agreement, we (bank) shall not be relived from our liability by reason of any such variation part of Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any indulgence by Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar to the said lessee or any manner or thing whatsoever which under the law relating to sureties would, but this provision have effect of so relieving us.

(Bank) Seal

26/4

Annex-19

7. This guarantee will not be discharged due to change in constitution of the bank or lessee.

8. We, Andhra Bank (bank name), lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar in writing.

9. Not withstanding anything contained herein:

   a) Our liability under this Bank guarantee shall not exceed Rs. 42,34,050/- (Rupees Forty Two Lakh Thirty Four Thousand and Fifty) only.
   b) The bank guarantee shall be valid up to 31.03.2014.
   c) The period of bank guarantee submitted is valid for the period of the proposals given in the mining plan/ Scheme of mining / PMCP etc. We are liable to pay the guarantee amount or any part thereof under this Bank guarantee and only if served upon us a written claim or demand on or before.

10. If the bank guarantee is to be en-cashed through the court, in that case the (city where Regional office, IBM is located) court will have jurisdiction.

11. In witness whereof, the bank through its authorized officer has set its hand and stamp on this 17th Day of December 2014 at Orissa.

(Bank) Seal
आंध्रा बैंक
ANDHRA BANK
Branch Manager
Branch)

आंध्रा बैंक
ANDHRA BANK

N-1174
नारायण बिस्वाल/NARAYAN BISWAL
वरिष्ठ प्रबंधक/SENIOR MANAGER

Sai Sudhakar

A1

26/5

Annex-2b

ODISHA MINING CORPORATION LIMITED

SUKRANGI CHROMITE MINING PROJECT

ENVIRONMENTAL MONITORING REPORT

FOR THE MONTH

OF

FEBRUARY 2013

M/s ECOLOGICAL DEVELOPMENT CONSULTANCY PVT. LTD.,

BHUBANESWAR, ODISHA

Annex. 20

CONTENTS

Sl. No.	Descriptions	Page No.
1.	Introduction	02
2.	Monitoring Description	03-04
3.	Methodology	05
4.	Results & Discussion	06-16

1.0 INTRODUCTION

Odisha Mining Corporation Limited (OMCL), a Government of Odisha undertaking has engaged M/s Ecological Development Consultancy Pvt. Ltd. (EDCPL), Bhubaneswar, Odisha for carrying out Environmental Monitoring for their different mine leases in the district of Jajpur, Keonjhar and Sundergarh.

Environmental Monitoring includes monitoring of various environmental attributes such as Ambient Air Quality, Work Zone Air Quality, Noise Level, Water Quality, Waste Water Quality, Vehicular Emission and Soil Quality. Apart from these, various other activities such as suggestions to control the pollution, conducting various kinds of audits are also a part of this programme.

1.1 Present Report

The present report presents the Environmental related data in respect of Meteorology, Ambient Air Quality, Work Zone Air Quality (Fugitive Emission), Surface Water Quality and Noise Level in and around the Sukrangi Chromite Mining Project of Jajpur district of Odisha during February 2013.

1.2 Scope of the Work

The Scope of work for during February 2013 is as follows:

Table No. 1.1: Scope of Work within the Mine Lease Area

Environmental Attributes	No. of Locations
Ambient Air Quality	6 locations
Work Zone Air Quality	6 locations
Surface Water Quality	4 locations
Ambient Noise Level	6 locations

2.0 MONITORING DESCRIPTION

In order to assess the pollution level in and around the mining lease, different environmental attributes such as meteorology, air quality, water quality, soil quality and noise level are being monitored. The monitoring is carried out as per the CPCB guideline and every care has been taken for preservation and transportation of samples to the respective laboratory. M/s EDCPL has set up a site laboratory equipped with adequate instruments and equipments to monitor and analyze all the parameters of Air Quality i.e. $PM_{2.5}$, PM_{10}, SO_2, NO_X & CO and few physicochemical parameters (10 parameters) of water samples. For other parameters of water, the samples are sent to EDCPL's Main Laboratory at Bhubaneswar. The locations of monitoring stations are shown in Plate I & II.

2.1 Meteorology

An Automatic Weather Monitoring Station is installed at the rooftop of OMC office (21°02'1.08"N; 85°43'8.46"E) of South Kaliapani Chromite Mine (South Kaliapani Meteorological Station is common station for Sukrangi Chromite Mine) of M/s OMCL to collect the meteorological data on hourly basis continuously.

The parameters monitored at the meteorological station were Temperature, Relative Humidity, Wind Speed, Wind Direction and Rainfall. These parameters were recorded at weather monitoring station using the respective sensors.

2.2 Ambient Air Quality

The prime objective of the ambient air quality study is to establish the existing ambient air quality in and around the mining lease area. The existing ambient air quality was monitored at six (6) locations. The locations were identified after due consultation of the OMCL officials. Monitoring was carried out for Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X) and Carbon Monoxide (CO). The PM_{10} & $PM_{2.5}$ were monitored for 24 hourly, while SO_2 and NO_X were monitored on 4 hourly basis for 24 hours at each sampling location and CO was monitored using the CO Monitor for 1 hr in a day in each monitoring station twice in a week, for a month. Details about Air Quality Monitoring locations are given in **Table No. 2.1.**

Table No.2.1: Ambient Air Quality Monitoring Stations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Transit House	A1	21°02'44.04"N	85°43'7.28" E
2	Sukrangi Hospital	A2	21°02'46.92" N	85°48'21.06"E
3	Somnahil	A3	21°03'30.12"N	85°46'4.44"E
4	Sukrangi Dubbing	A4	21°03'15.72" N	85°46'37.80"E
5	Sukrangi School	A5	21°03'16.18" N	85°47'57.42"E
6	Ostapala	A6	21°03'43.98" N	85°48'0.96"E

2.3 Work Zone Air Quality (Fugitive Emissions)

To assess the level of fugitive dust due to mining and allied activities, six (6) monitoring stations were selected within the lease considering the activity area. Fugitive emissions monitoring was carried out once in a month on 8 hrly basis. The lists of fugitive emissions monitoring stations are given in Table No. 2.2.

Table No. 2.2: Fugitive Emissions Monitoring Stations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Quarry pit	FE1	21°02'48.18" N	85°48'40.5" E
2	Near Crech	FE2	21°02'48.24" N	85°48'30.42" E
3	Haul Road(1) (DI quarry)	FE3	21°02'53.28" N	85°48'46.86" E
4	Haul Road(2) (AC quarry)	FE4	21°02'16.26" N	85°48'36.96" E
5	Stack Yard	FE5	21°03'0.24" N	85°48'44.7" E
6	Dump	FE6	21°03'2.22" N	85°48'49.8" E

2.4 Surface Water Quality

6 nos. of grab samples were taken from three (03) surface water locations twice in a month. Details about surface water locations are given in **Table No. 2.3.** The fourth station (SW4) namely DI Quarry mines Reserve water is dried up.

Table No.2.3: Surface Water Sampling Locations

Sl. No.	Location	Sample code	Coordinate	
			Latitude	Longitude
1.	Damsala Nala before entering Mi_urea	SW1	21°03'30.29" N	85°47'54.02" E
2	Damsala Nala near Saurabil	SW2	21°03'24.97" N	85°48'23.61" E
3	Damsala Nala after mining lease boundary	SW3	21°03'29.17" N	85°48'46.37" E

2.5 Noise Level

In order to assess the existing noise levels in and around mining lease area, noise monitoring was carried out at 6 locations. Details of Noise monitoring stations are given in Table No. 2.4.

Table No. 2.4: Ambient Noise Monitoring Locations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Transit House	N1	21°02'44.04" N	85°48'7.38" E
2	Sukrangi Hospital	N2	21°02'46.92" N	85°48'21.06"E
3	Sorabil	N3	21°03'30.12"N	85°48'4.44"E
4	Sukrangi Hatting	N4	21°03'15.72" N	85°48'37.86"E
5	Sukrangi School	N5	21°03'15.78" N	85°47'07.42"E
6	Ostapala	N6	21°03'43.98" N	85°48'0.96"E

3.0 METHODOLGY

3.1 Meteorology

The meteorological parameters were monitored on hourly basis continuously by installing a weather monitoring system on rooftop of OMC office of South Kalinganei Chromite Mine (South Kalingani Meteorological Station is same station for Sukrangi Chromite Mine) of M/s OMCL.

3.2 Air Monitoring

Monitoring was carried out for Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). The PM_{10} & $PM_{2.5}$ were monitored for 24 hourly, while SO_2 and NO_x were monitored on 4 hourly basis for 24 hours at each sampling location and CO was monitored using the CO Monitor for 1 hr in a day in each monitoring station twice in a week, for a month. The sampling and analysis of ambient air quality was carried out as per the approved procedures by CPCB.

3.3 Surface Water Monitoring

For assessing the water quality, surface water samples were collected. Eight (8) water samples from four locations (04) were taken in sterilized plastic cans twice a month. The samples were analyzed for essential physical, chemical and bacteriological parameters as per the list enclosed in the work order. The samples were analyzed as per standard procedure / method mentioned by CPCB/APHA.

3.4 Noise Monitoring

The monitoring of noise level was carried out at specified locations. Ambient Noise levels were recorded at hourly intervals for 24 hrs.

4.0 RESULTS AND DISCUSSIONS

4.1 Meteorology

Summarized meteorological data such as temperature, relative humidity, rainfall, wind speed And wind direction are given in **Table No. 4.1.**

Table No. 4.1: Results of Site Specific Meteorological Data

Sl. No.	Parameters		February 2013
1	Temperature (°C)	Maximum	37.07
		Minimum	14.10
		Average	24.06
2	Relative Humidity (%)	Maximum	96.34
		Minimum	18.30
		Average	60.59
3	Wind speed(m/s)	Maximum	5.9
		Average	1.76
4	Wind Direction(%)	N	6.10
		NNE	6.85
		NE	5.8
		ENE	6.61
		E	6.25
		ESE	2.89
		SE	3.12
		SSE	2.23
		S	2.53
		SSW	2.50
		SW	4.32
		WSW	8.46
		W	24.20
		WNW	6.70
		NW	2.38
		NNW	2.52
		CALM	7.50
5	Rainfall(mm)	Monthly Total	11.2
		No. of rainy days	3

During the month of February 2013, the temperature varied from 14.10°C to 37.07°C & Relative Humidity varied from 18.30% to 96.34%. The maximum wind speed recorded during the month was 5.9 m/s and overall average wind speed was calculated 1.76 m/s. 7.50 % of the time the wind remained calm (<0.5 m/s). The predominant wind direction was observed from West direction during the month of February.

Max. and Min. value of temperature, relative humidity, rainfall, wind speed and wind direction on each day basis for the month of 'February 2013' are given in **Table No. 4.2.**

Table No. 4.2: Max and Min value of Meteorological Data of month February 2013

Date	Temperature		Relative Humidity (%)		Wind Speed (m/s)		Rainfall (mm)
	Max.	Min.	Max.	Min.	Max.	Min.	
01.02.2013	29.11	16.73	93.21	39.14	3.1	0	0
02.02.2013	30.14	14.64	93.50	37.74	2.9	0.5	0
03.02.2013	30.51	16.22	94.63	41.63	3.6	0.3	0
04.02.2013	31.26	17.34	98.52	37.23	4.5	0	0
05.02.2013	32.66	16.80	86.58	31.75	3.3	0.4	0
06.02.2013	33.14	16.87	89.90	32.14	3.0	0	0
07.02.2013	34.36	18.30	87.22	31.98	2.5	0.2	0
08.02.2013	30.28	19.73	91.51	43.80	3.5	0	0.2
09.02.2013	31.23	17.95	95.02	40.80	3.1	0	0
10.02.2013	31.97	15.89	81.45	27.91	5.6	0	0
11.02.2013	32.56	14.16	85.69	20.71	5.0	0	0
12.02.2013	32.07	14.68	86.70	23.94	4.5	0	0
13.02.2013	30.44	18.74	76.91	33.41	3.2	0.4	0
14.02.2013	34.22	18.84	82.36	20.22	3.4	0.2	0
15.02.2013	34.18	17.14	74.47	25.19	4.7	0.6	0
16.02.2013	29.25	18.74	79.30	36.06	3.3	0.7	0
17.02.2013	22.40	17.65	93.47	76.36	3.2	0	10.8
18.02.2013	29.17	18.10	96.34	37.06	3.7	0	0
19.02.2013	30.22	16.30	94.00	36.54	3.7	0	0
20.02.2013	31.17	15.49	91.62	32.8	3.7	0	0
21.02.2013	31.05	16.0	80.56	34.88	3.8	0	0
22.02.2013	33.18	16.35	89.40	26.09	4.0	0	0
23.02.2013	34.53	15.80	80.07	20.49	3.2	0.7	0
24.02.2013	34.09	17.14	82.67	23.02	4.0	0.4	0
25.02.2013	34.63	16.09	75.81	25.86	4.2	0.7	0.2
26.02.2013	34.88	17.40	81.82	27.19	3.7	0.6	0
27.02.2013	36.02	17.57	86.55	21.75	3.4	0.8	0
28.02.2013	37.97	16.92	83.46	18.36	4.4	0.5	0

4.2 Ambient Air Quality Monitoring

The Summarized results of AAQ are given in the Table No. 4.3 and the details of AAQ monitoring during the month of 'February 2013' are given in the Table No. 4.4.

Table No. 4.3: The Summarized results of AAQ

Sl. No.	Locations	Co-ordinate	Station Code	PM_{10}			$PM_{2.5}$			SO_2			NO_x			CO		
				Max.	Min.	Avg.	Max.	Min	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max	Min.	Avg.
1.	Transit House	21°02'44.04"N 85°48'7.25" E	A1	162	78	118	66	38	50	6	BDL	6	16	BDL	12	0.2	BDL	0.2
2.	Sukurangi Hospital	21°02'46.92" N 85°48'21.06"E	A2	213	97	152	86	44	63	8.7	BDL	8	17.3	11.4	15	0.3	BDL	0.2
3.	Sarsabil	21°03'30.12"N 85°48'4.44"E	A3	169	65	117	68	27	50	8	BDL	6	16	9.1	12	0.2	BDL	0.2
4.	Sukurangi Hatting	21°03'15.72" N 85°48'37.86"E	A4	181	106	139	70	50	60	8.3	5	6	14	BDL	12	0.3	BDL	0.2
5.	Sukurangi School	21°03'15.18" N 85°47'57.42"E	A5	163	73	110	65	42	53	8.2	BDL	6.1	16	BDL	13	0.3	BDL	0.2
6.	Ostapalu	21°03'43.98" N 85°48'0.96"E	A6	163	99	118	57	43	48	7.8	BDL	6	15	BDL	11.4	0.3	BDL	0.2
CPCB Standard				100 µg/m³			60 µg/m³			80 µg/m³			80 µg/m³			4.0 mg/m³		

Note: BDL value for NO_x -9.0 µg/m³, SO_2 -4.0 µg/m³ and for CO-0.1 mg/m³.

Table No. 4.4: The details of AAQ Monitoring during the Month of 'February 2013'

Station Name	Station Code	Date	CPCB Standards				
			100 µg/m³	60 µg/m³	80 µg/m³	80 µg/m³	4 mg/m³
			PM_{10}	$PM_{2.5}$	SO_2	NOx	CO
Transit House	A1	01.02.2013	98	45	5.4	11.5	0.4
		05.02.2013	97	43	6.3	12.2	0.2
		08.02.2013	73	38	BDL	BDL	BDL
		12.02.2013	106	48	7.6	11.2	0.2
		15.02.2013	162	65	8.6	10.6	BDL
		19.02.2013	114	51	BDL	BDL	BDL
		22.02.2013	121	55	6.2	13.2	0.2
		26.02.2013	136	57	7.7	15.7	BDL
Sukrangi Hospital	A2	01.02.2013	146	59	8.1	12.4	0.3
		05.02.2013	188	68	8.3	15.9	BDL
		08.02.2013	124	53	7.6	13.6	0.2
		12.02.2013	213	80	8.7	16.7	BDL
		15.02.2013	175	69	7.4	15.8	BDL
		19.02.2013	97	44	BDL	11.4	0.3
		22.02.2013	208	78	7.7	12.9	BDL
		26.02.2013	147	60	8.1	17.3	0.2
Barwabil	A3	02.02.2013	Monitoring has not been done due to electrical problem				
		06.02.2013	76	40	4.7	0.1	0.2
		09.02.2013	55	27	BDL	9.1	BDL
		13.02.2013	160	68	7.4	16.7	0.2
		16.02.2013	134	57	5.2	11.6	BDL
		20.02.2013	Monitoring has not been done due to strike				
		23.02.2013	103	46	6.3	11.8	BDL
		27.02.2013	Monitoring has not been done due to SPCB Inspection				
Sukrangi Hatting	A4	02.02.2013	143	60	4.7	BDL	BDL
		06.02.2013	120	52	6.6	13.8	BDL
		09.02.2013	106	50	5.8	13.1	0.3
		13.02.2013	128	56	5.2	11.7	BDL
		16.02.2013	153	68	5.3	9.8	0.2
		20.02.2013	Monitoring has not been done due to strike				
		23.02.2013	181	76	8.2	15.4	0.2
		27.02.2013	Monitoring has not been done due to SPCB Inspection				
Sukrangi School	A5	04.02.2013	107	46	6.1	15.6	0.3
		07.02.2013	96	43	4.8	9.9	0.2

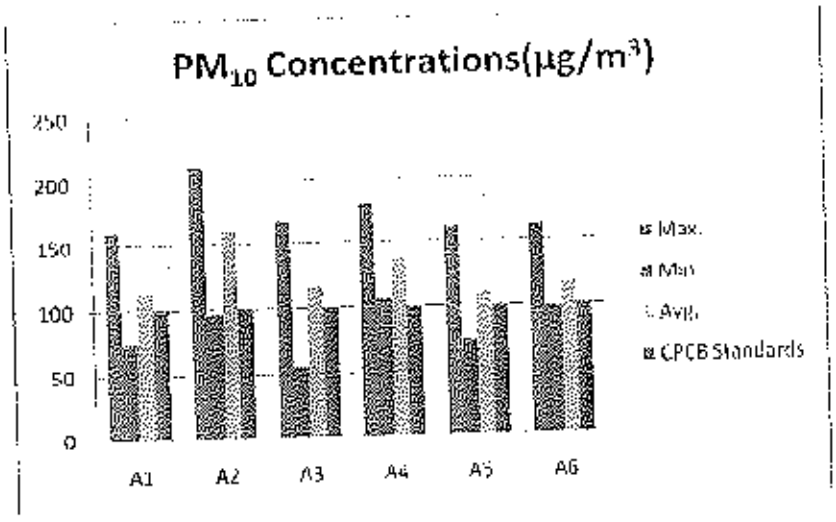
		11.02.2013	163	65	7.6	14.3	0.2
		14.02.2013	98	53	5.8	11.9	BDL
		18.02.2013	124	51	BDL	BDL	0.2
		21.02.2013	123	60	6.7	13.4	0.3
		25.02.2013	96	45	8.2	15.2	BDL
		28.02.2013	73	42	BDL	10.5	BDL
Ostapala	A6	04.02.2013	124	54	7.3	12.2	BDL
		07.02.2013	99	43	4.2	BDL	0.2
		11.02.2013	163	67	6.1	13.7	BDL
		14.02.2013	131	48	5.3	8.3	0.2
		18.02.2013	100	46	BDL	BDL	BDL
		21.02.2013	101	47	7.1	14.7	0.3
		25.02.2013	101	47	6.5	13.8	BDL
		28.02.2013	121	53	4.8	9.8	0.2

Conclusion:

Particulate Matter (PM_{10}):

The Value of PM_{10} ranges between 55 $\mu g/m^3$ to 213 $\mu g/m^3$. However, the average value of PM_{10} ranges between 110 to 162 $\mu g/m^3$. The results exceeds the prescribed norms of CPCB for Industrial, residential, Rural & Other areas.

Figure No. 4.1: Graph showing PM_{10} Concentrations



Annex. 20

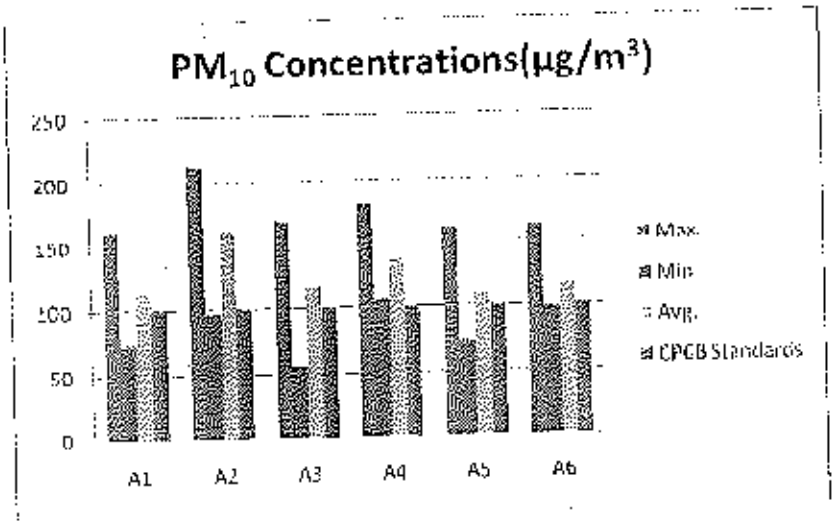
		11.02.2013	103	66	7.0	14.3	0.2
		14.02.2013	98	51	5.8	11.9	BDL
		18.02.2013	124	61	BDL	BDL	0.2
		21.02.2013	123	59	6.7	13.4	0.3
		25.02.2013	96	45	8.2	15.2	BDL
		28.02.2013	73	42	BDL	10.6	BDL
Ostapala	A6	04.02.2013	124	64	7.3	12.2	BDL
		07.02.2013	99	48	4.2	BDL	0.3
		11.02.2013	163	57	6.1	13.7	BDL
		14.02.2013	131	48	5.9	0.9	0.2
		18.02.2013	100	46	BDL	BDL	BDL
		21.02.2013	101	47	7.1	14.7	0.3
		25.02.2013	101	47	6.5	13.8	BDL
		28.02.2013	121	53	4.8	0.8	0.2

Conclusion:

Particulate Matter (PM_{10}):

The Value of PM_{10} ranges between 55 $\mu g/m^3$ to 213 $\mu g/m^3$. However, the average value of PM_{10} ranges between 110 to 102 $\mu g/m^3$. The results exceeds the prescribed norms of CPCB for Industrial, residential, Rural & Other areas.

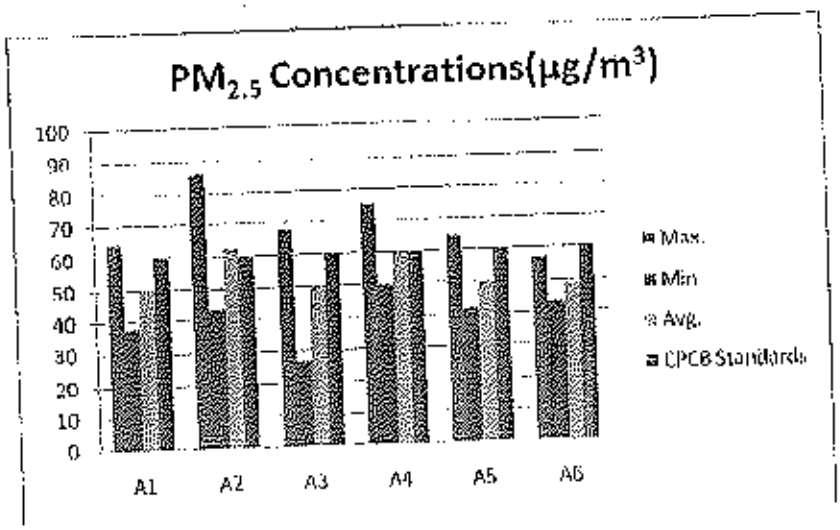
Figure No. 4.1: Graph showing PM_{10} Concentrations



Particulate Matter ($PM_{2.5}$)

The Value of $PM_{2.5}$ ranges between 27 µg/m³ to 86 µg/m³. However, the average value of $PM_{2.5}$ ranges between 49 to 63 µg/m³. The results exceeds the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas.

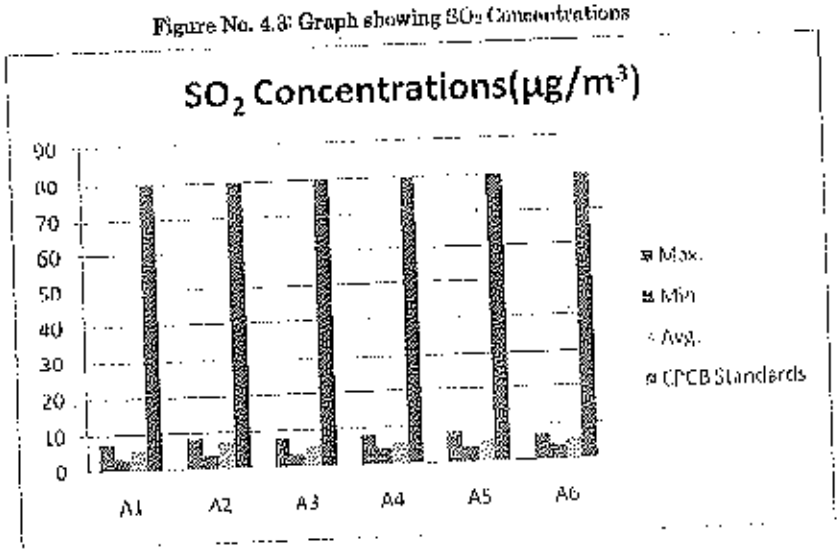
Figure No. 4.2: Graph showing $PM_{2.5}$ Concentrations



Sulphur Dioxide (SO_2)

The Value of SO_2 ranges between BDL to 8.7 µg/m³. However, the average value of SO_2 ranges between 6.0 to 8.0 µg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of SO_2 is less than 4.0 µg/m³.

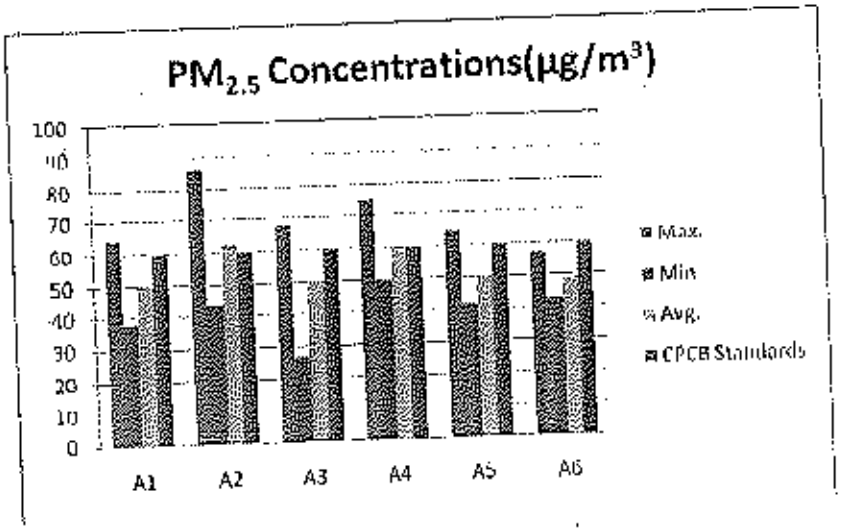
Figure No. 4.3: Graph showing SO_2 Concentrations



Particulate Matter ($PM_{2.5}$):

The Value of $PM_{2.5}$ ranges between 27 µg/m³ to 86 µg/m³. However, the average value of $PM_{2.5}$ ranges between 49 to 68 µg/m³. The results exceeds the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas.

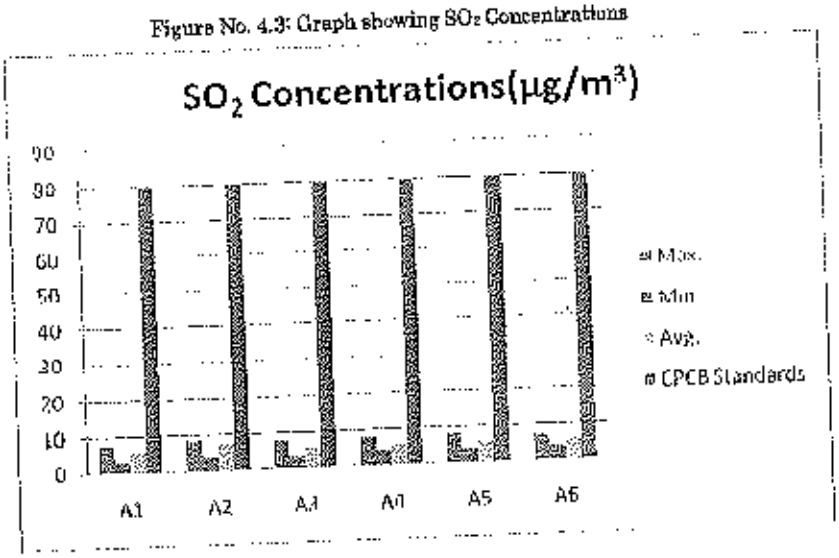
Figure No. 4.2: Graph showing $PM_{2.5}$ Concentrations



Sulphur Dioxide (SO_2):

The Value of SO_2 ranges between BDL to 8.7 µg/m³. However, the average value of SO_2 ranges between 6.0 to 8.0 µg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of SO_x is less than 4.0 µg/m³.

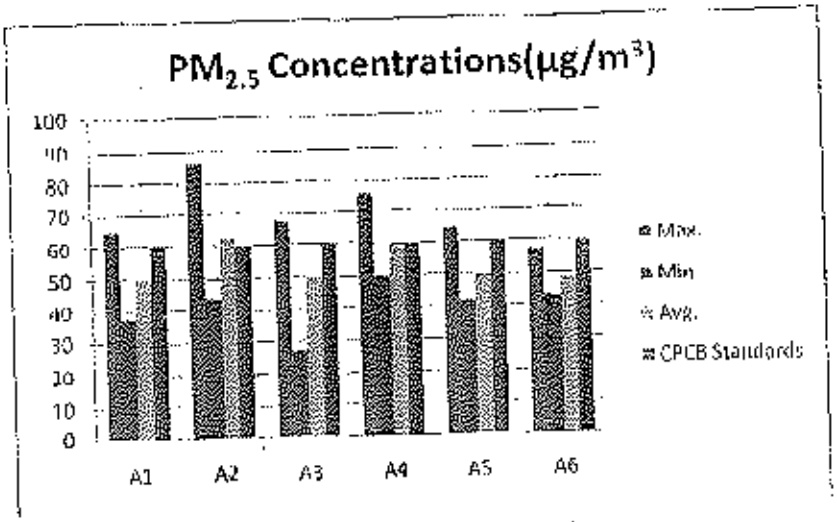
Figure No. 4.3: Graph showing SO_2 Concentrations



Particulate Matter ($PM_{2.5}$)

The Value of $PM_{2.5}$ ranges between 27 µg/m³ to 86 µg/m³. However, the average value of $PM_{2.5}$ ranges between 49 to 63 µg/m³. The results exceeds the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas.

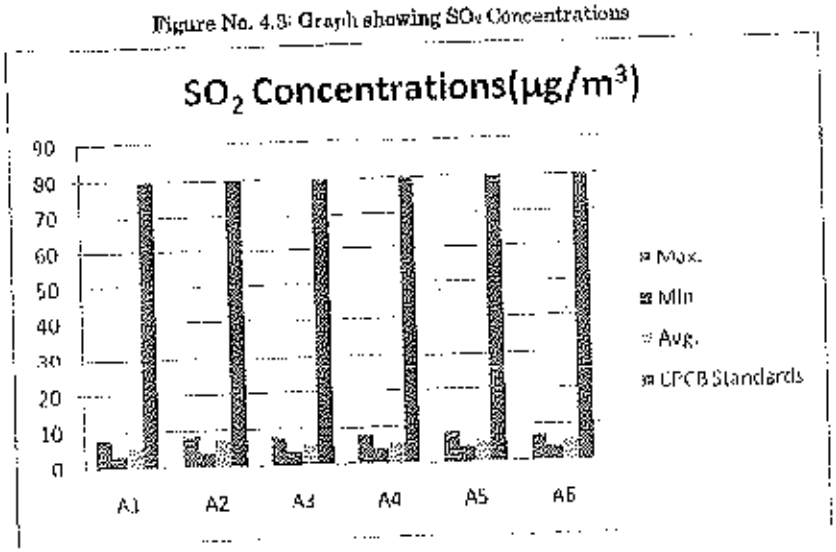
Figure No. 4.2: Graph showing $PM_{2.5}$ Concentrations



Sulphur Dioxide (SO_2)

The Value of SO_2 ranges between BDL to 8.7 µg/m³. However, the average value of SO_2 ranges between 6.0 to 8.0 µg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of SO_2 is less than 4.0 µg/m³.

Figure No. 4.3: Graph showing SO_2 Concentrations

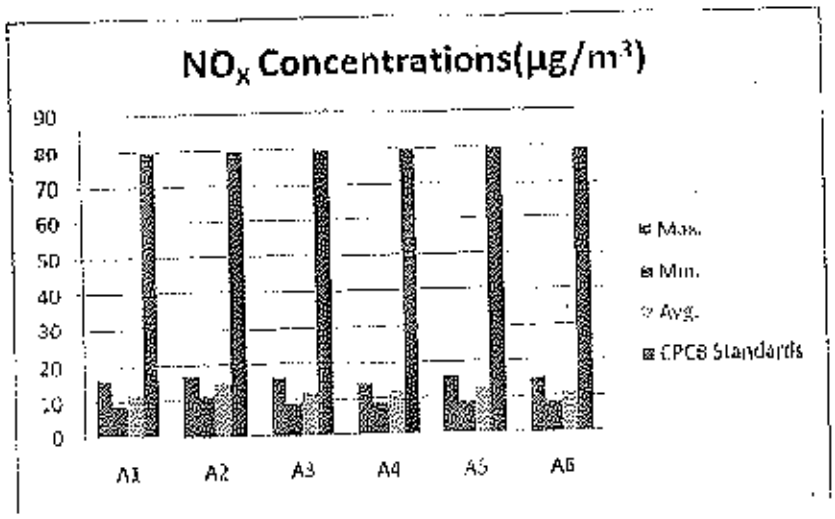


Annex-4.20

Oxides of Nitrogen (NOx):

The Value of NOx ranges between BDL to 17.8 µg/m³. However, the average value of NOx ranges between 11.4 to 15.0 µg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of NOx is less than 0 µg/m³.

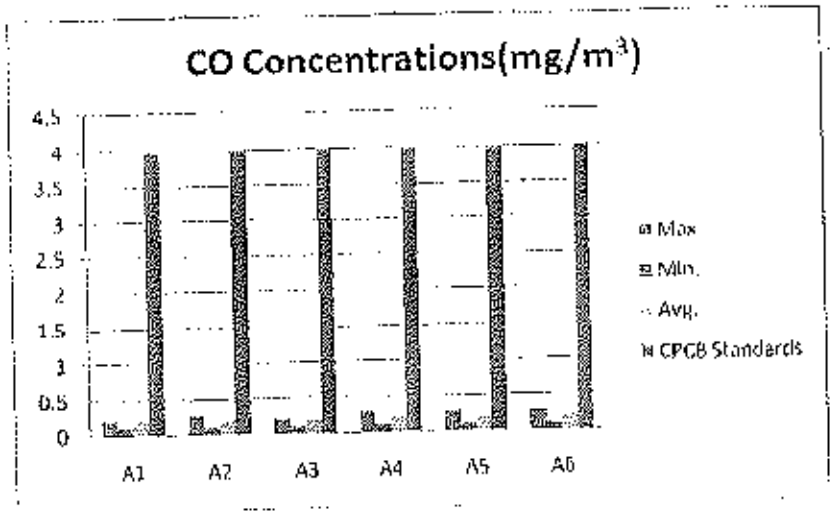
Figure No. 4.4: Graph showing NOx Concentrations



Carbon Monoxide (CO):

The Value of CO ranges between BDL to 0.8 mg/m³. However, the average value of CO ranges is 0.2 mg/m³ at all sites. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of CO is less than 0.11 mg/m³.

Figure No. 4.5: Graph showing CO Concentrations



4.3 Fugitive Emissions Monitoring

The results of fugitive emissions are given in Table No. 4.5.

Table No. 4.5: Results of Fugitive Emissions Monitoring

Station code	Co-Ordinate	Particulate Matter (PM) in µg/m³
FE1	21°02'48.18" N; 85°48'40.6" E	187.3
FE2	21°02'48.24" N; 85°48'30.42" E	215.5
FE3	21°02'53.28" N; 85°48'46.86" E	184.2
FE4	21°02'46.26" N; 85°48'16.96" E	317.4
FE5	21°03'0.24" N; 85°48'44.7" E	231.6
FE6	21°03'2.22" N; 85°48'49.8" E	287.5
Standards		1200 µg/m³

4.4 Surface Water Quality Monitoring

Table No. 4.6: Water Quality Criteria as per CPCB.

Sl. No.	Parameters	Class A	Class B	Class C	Class D	Class E
1	pH	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.5-8.5
2	Dissolved Oxygen (as O2), mg/l, min	6	5	4	4	-
3	BOD, 3 days at 27°C, mg/l, max.	2	3	3	-	-
4	Total Coliform Organism, MPN/100ml, max.	50	500	5000	-	-
5	Free Ammonia (as N), mg/l, max.	-	-	-	1.2	-
6	Electrical conductivity mmhos/cm, max.	-	-	-	-	2250
7	Sodium Absorption Ratio, max.	-	-	-	-	26
8	Boron (as B), mg/l, max.	-	-	-	-	2

Class A: Drinking water source without conventional treatment but after disinfection

Class B: Outdoor bathing (organized)

Class C: Drinking water source after conventional treatment and after disinfection

Class D: Propagation of Wildlife and Fisheries

Class E: Irrigation, Industrial Cooling and Controlled Waste Disposal

Class F: Not meeting A, B, C, D & E Criteria

The results of analysis of surface water are given in **Table No. 4.7 (A) & 4.7 (B).**

Annex. 20

Table No. 4.7 (A): Results of Surface Water Analysis

Sl. No.	Parameters	SW1	SW2	SW3
		15.02.2013	15.02.2013	15.02.2013
1	Colour, Hagen Units	Colourless	Colourless	Colourless
2	Turbidity, NTU, max.	5	5	6
3	pH value	7.4	7.6	7.0
4	Total Hardness (as $CaCO_3$), mg/l, max.	47	58	41
5	Iron (as Fe), mg/l, max.	0.35	0.23	0.33
6	Chloride (as Cl), mg/l, max.	10	7	12
7	Fluoride (as F), mg/l, max.	BDL	BDL	BDL
8	Total Dissolved Solids, mg/l, max.	95	107	98
9	Calcium (as Ca), mg/l, max.	10	8	11
10	Magnesium (as Mg), mg/l, max.	7	5	3
11	Copper (as Cu), mg/l, max.	BDL	BDL	BDL
12	Manganese (as Mn), mg/l, max.	0.0018	0.021	0.014
13	Sulphate (as SO_4), mg/l, max.	8	5	6
14	Nitrate (as NO_3), mg/l, max.	0.21	0.13	0.19
15	Phenolic compounds (as C_6H_5OH), mg/l, max.	BDL	BDL	BDL
16	Mercury(as Hg), mg/l, max.	BDL	BDL	BDL
17	Cadmium (as Cd), mg/l, max.	BDL	BDL	BDL
18	Selenium (as Se), mg/l, max.	BDL	BDL	BDL
19	Arsenic (as As), mg/l, max.	BDL	BDL	BDL
20	Cyanide (as CN), mg/l, max.	BDL	BDL	BDL
21	Lead (as Pb), mg/l, max.	BDL	BDL	BDL
22	Zinc (as Zn), mg/l, max.	BDL	BDL	BDL
23	Anionic Detergent as MBAS	BDL	BDL	BDL
24	Alkalinity (as $CaCO_3$), mg/l	38	30	33
25	Free Ammonia (N), mg/l, max.	0.4	0.5	0.5
26	Boron (as B), mg/l	BDL	BDL	BDL
27	Coliform Organism MPN/100ml, max	176	174	182
28	Sodium Absorption Ratio, max	0.34	0.38	0.22
29	Dissolved Oxygen as O_2, mg/l	6.2	6.1	6.4
30	BOD, 3 days at 27°C, mg/l	2	3	3
31	COD, mg/l	6.0	7.2	6.8
32	Electrical Conductivity (EC), µmhos/cm, max.	116	123	118
33	Phosphate, mg/l	0.27	0.29	0.34
34	CO_2, mg/l	3.0	4.0	3.4

Note : Surface water sample at DE Quarry has not been collected because there was no water on dated 15.02.2013

Table No. 4.7 (B): Results of Surface Water Analysis

Sl. No.	Parameters	SW1	SW2	SW3
		22.02.2013	22.02.2013	22.02.2013
1	Colour, Hazen Units	Colourless	Colourless	Colourless
2	Turbidity, NTU, max.	6	4	5
3	pH value	7.1	7.3	7.0
4	Total Hardness (as $CaCO_3$), mg/l, max.	49	57	44
5	Iron (as Fe), mg/l, max.	0.35	0.23	0.18
6	Chloride (as Cl), mg/l, max.	10	8	12
7	Fluoride (as F), mg/l, max.	BDL	BDL	BDL
8	Total Dissolved Solids, mg/l, max.	106	126	132
9	Calcium (as Ca), mg/l, max.	12	9	12
10	Magnesium (as Mg), mg/l, max.	7	4	5
11	Copper (as Cu), mg/l, max.	BDL	BDL	BDL
12	Manganese (as Mn), mg/l, max.	0.02	0.021	0.22
13	Sulphate (as SO_4), mg/l, max.	7	6	6
14	Nitrate (as NO_3), mg/l, max.	0.24	0.16	0.27
15	Phenolic compounds (as C_6H_5OH), mg/l, max.	BDL	BDL	BDL
16	Mercury(as Hg), mg/l, max.	BDL	BDL	BDL
17	Cadmium (as Cd), mg/l, max.	BDL	BDL	BDL
18	Selenium (as Se), mg/l, max.	BDL	BDL	BDL
19	Arsenic (as As), mg/l, max.	BDL	BDL	BDL
20	Cyanide (as CN), mg/l, max.	BDL	BDL	BDL
21	Lead (as Pb), mg/l, max.	BDL	BDL	BDL
22	Zinc (as Zn), mg/l, max.	BDL	BDL	BDL
23	Anionic Detergent as MBAS	BDL	BDL	BDL
24	Alkalinity (as $CaCO_3$), mg/l	30	32	33
25	Free Ammonia (N), mg/l,max.	0.4	0.5	0.6
26	Boron (as B), mg/l	BDL	BDL	BDL
27	Coliform Organism MPN/100ml,max	146	176	188
28	Sodium Absorption Ratio, max	0.34	0.28	0.32
29	Dissolved Oxygen as O_2, mg/l	6.8	6.6	6.4
30	BOD, 3 days at 27°C, mg/l	4	5	5
31	COD, mg/l	7.9	8.2	9.0
32	Electrical Conductivity (EC), µmhos/cm, max.	121	134	130
33	Phosphate, mg/l	0.24	0.29	0.33
34	CO_2, mg/l	3.5	4.2	4.1

Note : Surface water sample of DB Quarry has not been collected because there was no water on dated 22.02.2013

4.5 Noise Monitoring

Summarized results of ambient noise monitoring are given in Table No. 4.8. The results have been compared with the standard specified in schedule III, Rule 3 of Environmental Protection Rules given in Table No. 4.9.

Table No. 4.8: Summarized Results of Noise Monitoring

Sl. No.	Location	Results						Type of Area
		Day (0600-2200 hrs.)			Night (2200-0600hrs.)			
		Min.	Max.	Mean*	Min.	Max.	Mean*	
1.	Transit House	38.7	64.9	48.0	BDL	42.8	34.1	Industrial Area
2.	Sukrangi Hospital	37.2	66.6	64.1	BDL	43.7	34.0	Silence Area
3.	Surunjil	BDL	54.5	46.7	BDL	44.6	33.0	Residential
4.	Sukrangi Halting	BDL	62.0	47.4	BDL	41.8	32.6	Residential
5.	Sukrangi School	BDL	52.1	43.6	BDL	38.7	32.7	Silence Area
6.	Ostapala	BDL	47.2	41.6	BDL	39.9	32.5	Residential

*Note: *Logarithmic Averages; BDL - <30 dB(A).* *All Values in dB(A).*

Table No. 4.9: CPCB Norms in respect of Ambient Noise.

Type of Area	Day (0600 – 2200hrs)	Night (2200 – 0600 hrs)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

All Values in dB (A)

Conclusion:

Noise Level as observed in ambient are well below the standard norms stipulated by CPCB except Sukrangi Hospital during day and night time and Sukrangi School during day time for silence zone area, which is due to vehicular movement.

4.1

Annex. 2a

SUKURANGI CHROMITE MINE
ODISHA MINING CORPORATION LTD.
MAP SHOWING MONITORING LOCATION
SCALE: 1:50,000
PLATE-I
ROAD
RIVER
VILLAGE
LEASE AREA
AIR MONITORING STATION
WATER/GROUNDWATER QUALITY
METEOROLOGY
Kilometers
Sukurangi
Kamakhia
Gurupang
Kalapani
Chirigumia
Bhimarangar
Jamshuri Ghat
Ganganahi
Pipla

Annex. 21

SUKURANGI CHROMITE MINE
ODISHA MINING CORPORATION LTD.
MAP SHOWING MONITORING LOCATION
SCALE: 1:30,000
PLATE-II
ROAD
RIVER
VILLAGE
LEASE AREA
SW
SURFACE WATER
N
NOISE MONITORING STATION
Kilometers
0 0.35 0.7 1.4 2.1 2.8
Sukurangi
Kaliapani
Osada
Gurguli
Chirigumma
Dhankesangar
Jajpur Road
Jajpur
Barabati
Kamarda
Sarang
Budhiar
Jajpur district road
Jajpur Keonjhar road
Jajpur Road-Keonjhar road
Jajpur Road-Barbil road
Jajpur Road-Kendrapara road
Jajpur Road-Cuttack road
Jajpur Road-Bhadrak road
Jajpur Road-Bhubaneswar road
Jajpur Road-Paradip road
Jajpur Road-Kolkata road
Jajpur Road-Chandikhol road
Jajpur Road-Rourkela road
Jajpur Road-Sambalpur road
Jajpur Road-Berhampur road
Jajpur Road-Puri road
Jajpur Road-Balasore road
Jajpur Road-Angul road
Jajpur Road-Dhenkanal road
Jajpur Road-Talcher road
Jajpur Road-Rourkela road
Jajpur Road-Sambalpur road
Jajpur Road-Berhampur road
Jajpur Road-Puri road
Jajpur Road-Balasore road
Jajpur Road-Angul road
Jajpur Road-Dhenkanal road
Jajpur Road-Talcher road

Annex-20

ODISHA MINING CORPORATION LIMITED

SUKRANGI CHROMITE MINING PROJECT

ENVIRONMENTAL MONITORING REPORT

FOR THE MONTH

OF

APRIL 2013

M/s ECOLOGICAL DEVELOPMENT CONSULTANCY PVT. LTD.,

BHUBANESWAR, ODISHA

Annex. 2D

CONTENTS

Sl. No.	Descriptions	Page No.
1.	Introduction	02
2.	Monitoring Description	03-04
3.	Methodology	05
4.	Results & Discussion	06-17

1.0 INTRODUCTION

Odisha Mining Corporation Limited (OMCL), a Government of Odisha undertaking has engaged M/s Ecological Development Consultancy Pvt. Ltd. (EDCPL), Bhubaneswar, Odisha for carrying out Environmental Monitoring for their different mine leases in the district of Jajpur, Keonjhar and Sundergarh.

Environmental Monitoring includes monitoring of various environmental attributes such as Ambient Air Quality, Work Zone Air Quality, Noise Level, Water Quality, Waste Water Quality, Vehicular Emission and Soil Quality. Apart from these, various other activities such as suggestions to control the pollution, conducting various kinds of audits are also a part of this programme.

1.1 Present Report

The present report presents the Environmental related data in respect of Meteorology, Ambient Air Quality, Work Zone Air Quality (Fugitive Emission), Surface Water Quality, Noise Level and Flow of Water Measurement in and around the Sukrangi Chromite Mining Project of Jajpur district of Odisha during April 2013.

1.2 Scope of the Work

The Scope of work for during April 2013 is as follows:

Table No. 1.1: Scope of Work within the Mine Lease Area

Environmental Attribute	No of Locations
Ambient Air Quality	6 locations
Work Zone Air Quality	6 locations
Surface Water Quality	4 locations
Ambient Noise Level	6 locations
Flow of Water Measurement	4 locations

2.0 MONITORING DESCRIPTION

In order to assess the pollution level in and around the mining lease, different environmental attributes such as meteorology, air quality, water quality, soil quality and noise level are being monitored. The monitoring is carried out as per the CPCB guideline and every care has been taken for preservation and transportation of samples to the respective laboratory. M/s EDCPL has set up a site laboratory equipped with adequate instruments and equipments to monitor and analyze all the parameters of Air Quality i.e. $PM_{2.5}$, PM_{10}, SO_2, NOx & CO and few physic-chemical parameters (10 parameters) of water samples. For other parameters of water, the samples are sent to EDCPL's Main Laboratory at Bhubaneswar. The locations of monitoring stations are shown in Plate I & II.

2.1 Meteorology

An Automatic Weather Monitoring Station is installed at the rooftop of OMC office (21°02'1.08"N: 85°46'8.46"E) of South Kaliapani Chromite Mine (South Kaliapani Meteorological Station is common station for Sukrangi Chromite Mine) of M/s OMCL to collect the meteorological data on hourly basis continuously.

The parameters monitored at the meteorological station were Temperature, Relative Humidity, Wind Speed, Wind Direction and Rainfall. These parameters were recorded at weather monitoring station using the respective sensors.

2.2 Ambient Air Quality

The prime objective of the ambient air quality study is to establish the existing ambient air quality in and around the mining lease area. The existing ambient air quality was monitored at six (6) locations. The locations were identified after due consultation of the OMCL officials. Monitoring was carried out for Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO). The PM_{10} & $PM_{2.5}$ was monitored for 24 hourly, while SO_2 and NOx were monitored on 4 hourly basis for 24 hours at each sampling location and CO was monitored using the CO Monitor for 1 hr in a day in each monitoring station twice in a week, for a month. Details about Air Quality Monitoring locations are given in Table No. 2.1.

Table No.2.1: Ambient Air Quality Monitoring Stations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Transit House	A1	21°02'44.04"N	85° 18'7.28" E
2	Sukrangi Hospital	A2	21°02'46.92" N	85°18'21.06"E
3	Sornabil	A3	21°03'30.12"N	85°18'4.44"E
4	Sukrangi Halting	A4	21°03'15.72" N	85°18'37.86"E
5	Sukrangi School	A5	21°03'15.18" N	85°17'57.42"E
6	Ostapala	A6	21°03'43.08" N	85°18'41.06"E

2.3 Work Zone Air Quality (Fugitive Emissions)

To assess the level of fugitive dust due to mining and allied activities, six (6) monitoring stations were selected within the lease considering the activity area. Fugitive emissions monitoring was carried out once in a month on 8 hrly basis. The lists of fugitive emissions monitoring stations are given in Table No. 2.2.

Table No. 2.2: Fugitive Emissions Monitoring Stations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Quarry pit	FS1	21°02'48.18" N	85°48'10.5" E
2	Near Orech	FS2	21°02'48.24" N	85°48'30.42" E
3	Haul Road(1) (DE quarry)	FS3	21°02'53.28" N	85°48'40.80" E
4	Haul Road(2) (AC quarry)	FS4	21°02'46.26" N	85°48'36.90" E
5	Stock Yard	FS5	21°03'0.24" N	85°48'44.7" E
6	Dump	FS6	21°03'2.22" N	85°48'49.8" E

2.4 Surface Water Quality

8 nos. of grab samples were taken from four (04) surface water locations twice in a month. Details about surface water locations are given in Table No. 2.3.

Table No.2.3: Surface Water Sampling Locations

Sl. No.	Location	Sample code	Coordinate	
			Latitude	Longitude
1.	Damsala Nala before entering ML area	SW1	21°03'30.29" N	85°47'54.02" E
2	Damsala Nala near Saurabil	SW2	21°03'24.97" N	85°48'23.61" E
3	Damsala Nala after mining lease boundary	SW3	21°03'29.17" N	85°48'46.37" E
4	DE Quarry mines Reserve water	SW4	21°02'53.52" N	85°48'49.38" E

2.5 Noise Level

In order to assess the existing noise levels in and around mining lease area, noise monitoring was carried out at 6 locations. Details of Noise monitoring stations are given in Table No. 2.4.

Table No. 2.4: Ambient Noise Monitoring Locations

Sl. No.	Location	Station Code	Coordinates	
			Latitude	Longitude
1	Transit House	N1	21°02'44.04" N	85°48'7.28" E
2	Sukrangi Hospital	N2	21°02'46.92" N	85°48'21.06"E
3	Sorabil	N3	21°03'30.12" N	85°48'4.44" E
4	Sukrangi Hatting	N4	21°03'16.72" N	85°48'37.50"E
5	Sukrangi School	N5	21°03'16.18" N	85°47'57.42"E
6	Ostapala	N6	21°03'43.98" N	85°48'0.96"E

2.6 Flow of Water Measurement

To assess the flow of water in and around mining area, 04 locations were selected. The details about locations are given in Table No. 2.5

Table No. 2.5: Flow of Water Locations

Sl. No.	Location	Sample code	Coordinate	
			Latitude	Longitude
1.	Damsala Nala before entering ML area	FW1	21°03'30.29" N	85°47'54.02" E
2	Damsala Nala near Saurabil	FW2	21°03'24.97" N	85°48'23.61" E
3	Damsala Nala after mining lease boundary	FW3	21°03'29.17" N	85°48'46.37" E

3.0 METHODOLOGY

3.1 Meteorology

The meteorological parameters were monitored on hourly basis continuously by installing a weather monitoring system on rooftop of OMC office of South Kalinganal Chromite Mine (South Kalinganal Meteorological Station is same station for Sukrangi Chromite Mine) of M/s OMCL.

3.2 Air Monitoring

Monitoring was carried out for Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). The PM_{10} & $PM_{2.5}$ was monitored for 24 hourly, while SO_2 and NO_x were monitored on 4 hourly basis for 24 hours at each sampling location and CO was monitored using the CO Monitor for 1 hr in a day in each monitoring station twice in a week, for a month. The sampling and analysis of ambient air quality was carried out as per the approved procedures by CPCB.

3.3 Surface Water Monitoring

For assessing the water quality, surface water samples were collected. Eight (8) water samples from four locations (04) were taken in sterilized plastic cans twice a month. The samples were analyzed for essential physical, chemical and bacteriological parameters as per the list enclosed in the work order. The samples were analyzed as per standard procedure / method mentioned by CPCB/APHA.

3.4 Noise Monitoring

The monitoring of noise level was carried out at specified locations. Ambient Noise levels were recorded at hourly intervals for 24 hrs.

3.5 Flow of Water Measurement

The monitoring of flow of water was carried out monthly once of the springs and perennial nalas present within and adjoining the mining lease area . The flow of water measurement was carried out at three specific locations (03) and are expressed in m^3/min .

4.0 RESULTS AND DISCUSSIONS

4.1 Meteorology

Summarized meteorological data such as temperature, relative humidity, rainfall, wind speed and wind direction are given in Table No. 4.1.

Table No. 4.1: Results of Site Specific Meteorological Data

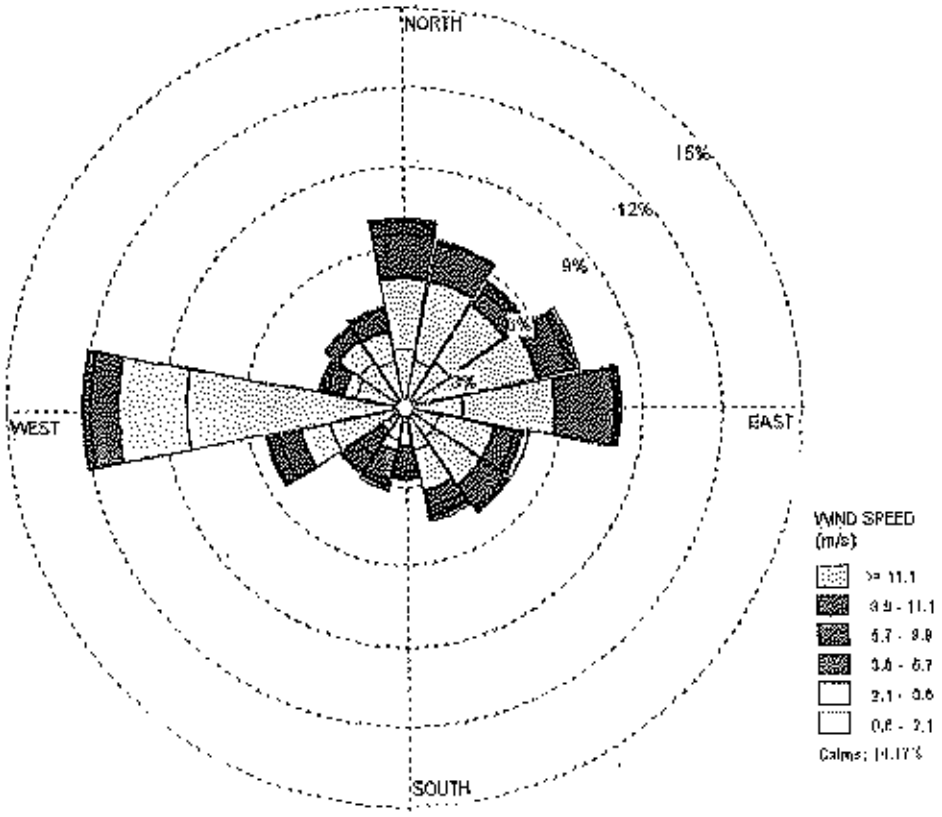
Sl. No.	Parameters		Month of April 2013
1	Temperature (°C)	Maximum	42.70
		Minimum	20.98
		Average	31.04
2	Relative Humidity (%)	Maximum	95.35
		Minimum	8.03
		Average	58.69
3	Wind speed(m/s)	Maximum	16.30
		Average	2.66
4	Wind Direction (%)	N	7.08
		NNE	6.39
		NE	5.69
		ENE	6.81
		E	8.19
		ESE	4.86
		SE	3.86
		SSE	4.44
		S	2.78
		SSW	3.19
		SW	3.06
		WSW	5.42
		W	12.08
		WNW	3.33
		NW	3.75
		NNW	3.89
		CALM	14.17
5	Rainfall(mm)	Monthly Total	73.6
		No. of rainy days	11

During the month of April 2013, the temperature varied from 20.98°C to 42.70°C & Relative Humidity varied from 8.03% to 95.36%. The maximum wind speed recorded during the month was 16.30 m/s and overall average wind speed is calculated to be 2.66 m/s. 14.17% of the time the wind remained calm (≤0.5 m/s). The predominant wind direction as observed to be from West during the month.

Max. and Min. value of temperature, relative humidity, rainfall, wind speed and wind direction on each day basis for the month of 'April 2013' are given in Table No. 4.2.

Annex.20

Figure No. 4.3: Windrose (24 hrly) for the month of April' 2013



Annexure-20

Table No. 4.2: Max and Min value of Meteorological Data of month April 2013

Date	Temperature		Relative Humidity (%)		Wind Speed (m/s)		Rainfall (mm)
	Max.	Min.	Max.	Min.	Max	Min.	
01.04.2013	38.11	24.76	93.21	36.66	11.2	0	0
02.04.2013	38.02	23.68	89.16	32.10	4.5	0	0
03.04.2013	36.62	23.07	88.51	29.14	9.6	0	7.2
04.04.2013	39.20	20.20	79.88	31.74	10.7	0.2	0
05.04.2013	39.48	23.81	84.67	17.28	16.3	0.3	0
06.04.2013	39.79	22.06	82.50	11.56	5.8	0.3	0
07.03.2013	41.01	22.69	87.62	8.03	5.8	0.4	0
08.04.2013	42.49	22.91	84.88	11.21	4.9	0	0
09.04.2013	41.89	23.72	84.02	16.08	4.1	0	0
10.04.2013	42.20	24.44	81.26	22.06	4.2	0	0
11.04.2013	41.64	25.01	79.67	27.56	7.3	0	13.4
12.04.2013	39.47	25.90	82.60	29.63	3.8	0.7	0
13.04.2013	41.60	24.84	70.16	17.32	4.2	0.3	0
14.04.2013	38.23	24.40	78.37	28.99	11.2	1.2	0.2
15.04.2013	36.71	22.68	88.91	37.60	7.7	0	3.0
16.04.2013	41.24	23.96	92.28	21.80	9	0	0
17.04.2013	42.70	25.92	86.29	17.92	6.5	0	0
18.04.2013	30.42	26.60	83.18	29.90	8.2	1.1	0
19.04.2013	36.64	25.08	80.80	37.33	11.7	0.8	0.4
20.04.2013	32.90	21.57	90.21	41.47	6.1	0	2.6
21.04.2013	35.04	21.71	94.34	54.46	12.7	0	11.8
22.04.2013	34.88	20.08	95.35	41.20	3.4	0	0
23.04.2013	36.08	25.4	94.06	31.09	5.4	0	0
24.04.2013	37.77	24.60	93.27	36.89	6	0	0
25.04.2013	37.60	25.68	86.13	36.36	6.4	0	0
26.04.2013	39.62	26.10	90.73	33.86	7.7	0	12.8
27.04.2013	41.08	24.2	90.67	26.63	4.9	0	0
28.04.2013	41.96	27.20	89.75	32.78	8.6	0	1.2
29.04.2013	41.16	27.67	87.60	41.25	8.9	0	0.2
30.04.2013	41.70	24.48	91.33	39.32	9.1	0	20.2

4.3 Ambient Air Quality Monitoring

The Summarized results of AAQ are given in the Table No. 4.3 and the details of AAQ monitoring during the month of 'April 2013' are given in the Table No. 4.4.

Table No. 4.8: The Summarized results of AAQ

Sl. No.	Locations	Co-ordinate	Station Code	PM_{10}			$PM_{2.5}$			SO_2			NOx			CO		
				Max.	Min.	Avg.	Max.	Min	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max	Min.	Avg.
1.	Transit House	21°02'44.04"N 85°48'7.28" E	A1	205	68	154	182	25	75	7.6	BDL	5.1	17.6	9.2	13.5	0.3	BDL	0.2
2.	Sukrangi Hospital	21°02'46.92" N 85°48'21.06"E	A2	246	72	156	95	18	45	8.3	BDL	4.8	22.4	14.7	17.9	0.3	BDL	0.2
3.	Sarsabil	21°03'30.12"N 85°48'4.44"E	A3	153	55	113	65	8	38	9.3	4.4	6.2	15.4	9.4	12.8	0.3	BDL	0.2
4.	Sukrangi Hatting	21°03'15.72" N 85°48'37.86"E	A4	141	58	100	132	16	66	8.2	BDL	5.4	17.9	BDL	14.3	0.3	BDL	0.2
5.	Sukrangi School	21°03'15.18" N 86°47'57.42"E	A5	126	41	89	90	10	43	8.3	BDL	5.9	16.7	BDL	12.3	0.3	BDL	0.2
6.	Ostapala	21°03'43.98" N 85°48'0.96"E	A6	236	93	123	182	9	78	8.9	BDL	5.9	19.2	BDL	13.9	0.2	BDL	BDL
CPCB Standard				100 µg/m³			60 µg/m³			80 µg/m³			80 µg/m³			4.0 mg/m³		

Note: BDL value for NO_x -9.0 µg/m³, SO_2 -4.0 µg/m³ and for CO-0.1 mg/m³

Annex. 20

Table No. 4.4: The details of AAQ Monitoring during the Month of 'April 2013'

Station Name	Station Code	Date	PM10	PM2.5	SO2	NOx	CO
Transit House	A1	3/4/2013	192	182	4.4	0.2	BDL
		6/4/2013	153	176	4.9	15.7	0.2
		9/4/2013	68	37	7.5	11.0	BDL
		13/4/2013	150	60	6.6	14.4	BDL
		16/4/2013	197	18	BDL	15.6	0.2
		19/4/2013	203	29	BDL	12.4	BDL
		23/4/2013	94	25	7.6	11.7	0.3
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	175	35	4.4	17.6	0.2
Sukrangi Hospital	A2	3/4/2013	210	26	8.3	16.2	BDL
		6/4/2013	215	52	4.7	19.7	BDL
		9/4/2013	72	53	4.2	21.7	0.2
		13/4/2013	122	20	5.6	14.7	0.3
		16/4/2013	197	76	4.7	15.2	BDL
		19/4/2013	246	20	BDL	17.2	0.3
		23/4/2013	98	18	BDL	22.4	0.3
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	123	95	4.6	16.8	0.2
Sorushil	A3	3/4/2013	153	59	9.3	12.2	BDL
		6/4/2013	139	53	4.5	9.4	BDL
		9/4/2013	105	31	5.3	13.7	0.2
		13/4/2013	124	25	7.6	12.3	BDL
		16/4/2013	80	8	4.4	15.4	0.3
		19/4/2013	101	13	6.8	14.7	BDL
		23/4/2013	55	51	5.3	13.8	BDL
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	147	65	6.2	11.2	0.2
Sukrangi Hatting	A4	3/4/2013	92	40	8.2	16.4	BDL
		6/4/2013	111	100	BDL	17.9	BDL
		9/4/2013	69	35	7.4	13.6	0.2
		13/4/2013	84	20	BDL	BDL	0.2
		16/4/2013	107	16	BDL	16.8	BDL
		19/4/2013	136	114	4.1	11.4	0.3
		23/4/2013	58	132	7.4	12.9	BDL
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	101	82	6.8	17.3	BDL
Sukrangi School	A5	3/4/2013	126	19	4.9	11.6	BDL
		6/4/2013	110	54	7.6	12.2	0.3

Annex. 2B

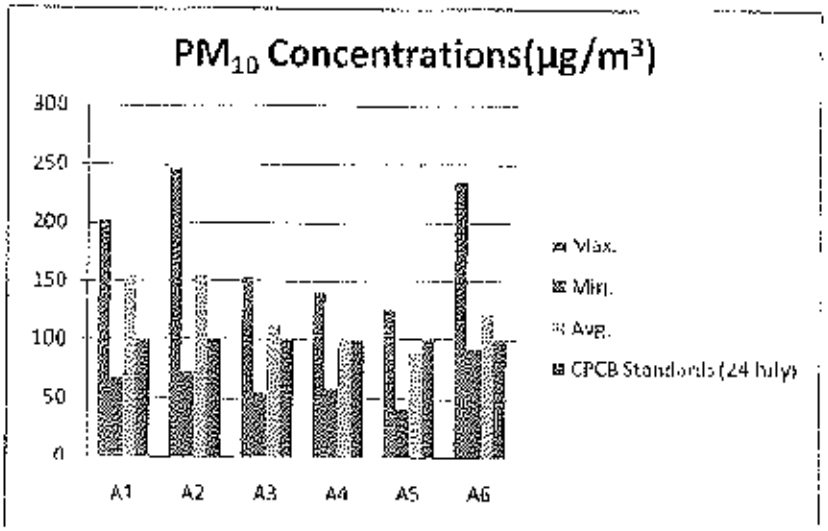
		9/4/2013	81	46	4.7	14.7	0.3
		13/4/2013	70	32	BDL	11.2	BDL
		16/4/2013	84	30	BDL	10.6	0.3
		19/4/2013	76	10	7.4	BDL	0.2
		23/4/2013	41	27	8.3	13.2	BDL
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	120	73	7.3	15.7	BDL
Ostapala	A6	3/4/2013	103	58	8.0	17.6	0.2
		6/4/2013	114	66	BDL	BDL	0.2
		9/4/2013	93	9	4.6	14.3	BDL
		13/4/2013	128	89	7.6	11.9	0.2
		16/4/2013	93	66	8.1	BDL	BDL
		19/4/2013	102	182	6.3	13.4	BDL
		23/4/2013	115	29	4.7	10.2	BDL
		26/4/2013	Monitoring has not been done due to Strike				
		30/4/2013	236	138	4.7	17.6	BDL
CPCB Standards			100 µg/m³	60 µg/m³	80 µg/m³	80 µg/m³	4 mg/m³

Conclusion:

Particulate Matter (PM_{10}):

The Value of PM10 ranges between 41 µg/m³ to 246 µg/m³. However, the average value of PM_{10} ranges between 80 to 166 µg/m³. The results are exceeding the prescribed norms of CPCB for Industrial, residential, Rural & Other areas

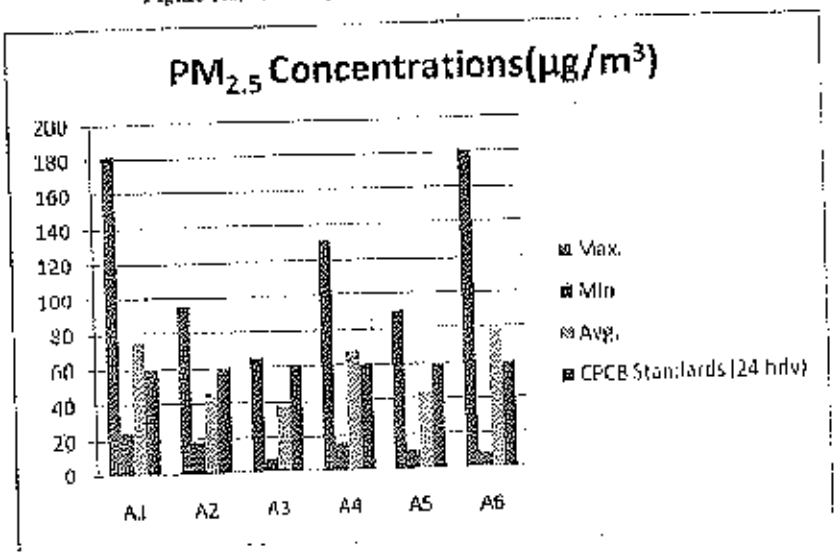
Figure No. 4.2: Graph showing PM10 Concentrations



Particulate Matter ($PM_{2.5}$):

The Value of $PM_{2.5}$ ranges between 8 $\mu g/m^3$ to 182 $\mu g/m^3$. However, the average value of $PM_{2.5}$ ranges between 38 to 78 $\mu g/m^3$. The results are exceeding the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas.

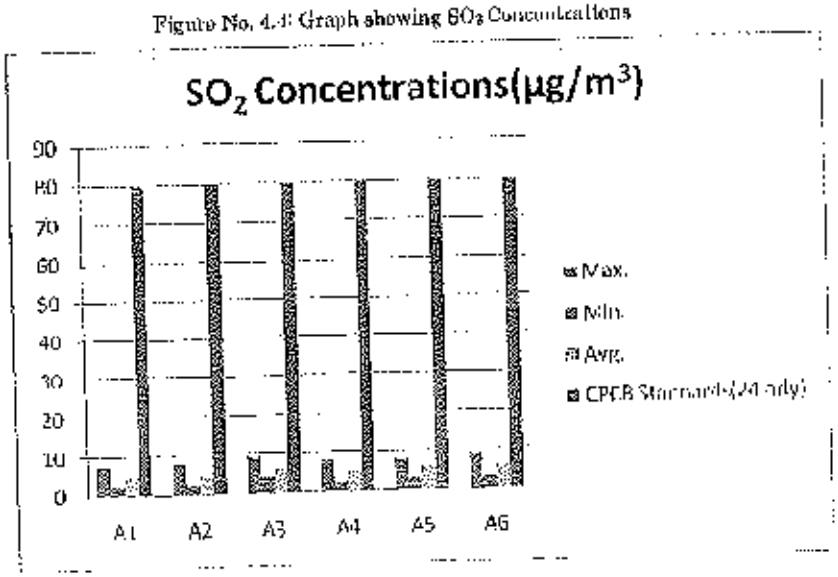
Figure No. 4.3: Graph showing $PM_{2.5}$ Concentrations



Sulphur Dioxide (SO_2):

The Value of SO_2 ranges between BDL to 9.4 $\mu g/m^3$. However, the average value of SO_2 ranges between 4.8 to 6.2 $\mu g/m^3$. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of SO_2 is less than 4.0 $\mu g/m^3$.

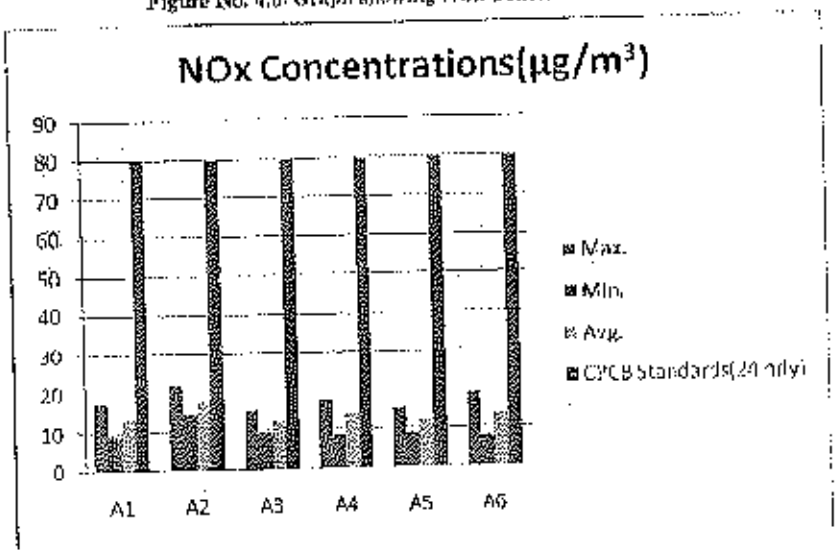
Figure No. 4.4: Graph showing SO_2 Concentrations



Oxides of Nitrogen (NOx):

The Value of NOx ranges between BDL to 22.4 µg/m³. However, the average value of NOx ranges between 12.3 to 17.0 µg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of NOx is less than 9 µg/m³.

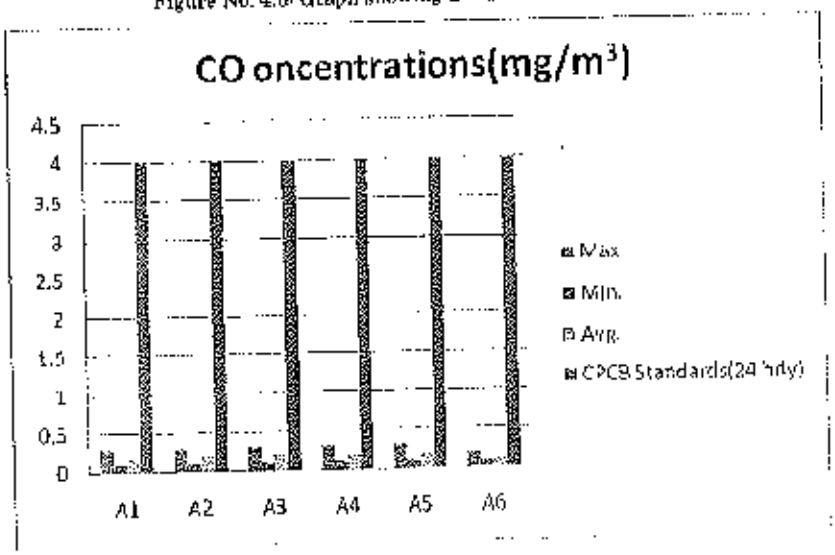
Figure No. 4.5: Graph showing NOx Concentrations



Carbon Monoxide (CO):

The Value of CO ranges between BDL to 0.3 mg/m³. However, the average value of CO ranges between BDL to 0.2 mg/m³. The results are well within the prescribed norms of CPCB for Industrial, Residential, Rural & Other areas. The BDL limit of CO is less than 0.11 mg/m³.

Figure No. 4.6: Graph showing CO Concentrations



4.3 Fugitive Emissions Monitoring

The results of fugitive emissions are given in Table No. 4.5.

Table No. 4.5: Results of Fugitive Emissions Monitoring

Station code	Co-Ordinate	Particulate Matter (PM) in µg/m³
FE1	21°02'48.18" N; 85°48'40.5" E	815.2
FE2	21°02'48.24" N; 85°48'30.42" E	467.7
FE3	21°02'53.28" N; 85°48'46.86" E	636.8
FE4	21°02'46.26" N; 85°48'36.96" E	482.6
FE5	21°03'0.24" N; 85°48'44.7" E	666.1
FE6	21°03'2.22" N; 85°48'49.8" E	792.4
Standards		1200 µg/m³

4.4 Surface Water Quality Monitoring

Table No. 4.6: Water Quality Criteria as per CPCB.

Sl. No.	Parameters	Class A	Class B	Class C	Class D	Class E
1	pH	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.5-8.5
2	Dissolved Oxygen (as O2), mg/l, min	6	5	4	4	-
3	BOD, 3 days at 27°C, mg/l, max.	2	3	3	-	-
4	Total Coliform Organism, MPN/100ml, max.	50	500	5000	-	-
5	Free Ammonia (as N), mg/l, max.	-	-	-	1.2	-
6	Electrical conductivity mmhos/cm, max.	-	-	-	-	2250
7	Sodium Absorption Ratio, max.	-	-	-	-	26
8	Boron (as B), mg/l, max.	-	-	-	-	2

Class A: Drinking water source without conventional treatment but after disinfection

Class B: Outdoor bathing (organized)

Class C: Drinking water source after conventional treatment and after disinfection

Class D: Propagation of Wildlife and Fisheries

Class E: Irrigation, Industrial Cooling and Controlled Waste Disposal

Class F: Not meeting A, B, C, D & E Criteria

The results of analysis of surface water are given in Table No. 4.7 (A) & 4.7 (B).

Annex.2a

Table No. 4.7 (A): Results of Surface Water Analysis

Sl. No.	Parameters	SW1	SW2	SW3	SW4
		03.04.2013	03.04.2013	03.04.2013	03.04.2013
1	Colour, Hazen Units	Colourless	Colourless	Colourless	colourless
2	Turbidity, NTU, max.	6	4	6	5
3	pH value	7.4	6.8	7.2	7.0
4	Total Hardness (as $CaCO_3$), mg/l, max.	47	58	44	44
5	Iron (as Fe), mg/l, max.	0.35	0.28	0.21	0.18
6	Chloride (as Cl), mg/l, max.	10	7	12	12
7	Fluoride (as F), mg/l, max.	BDL	BDL	BDL	BDL
8	Total Dissolved Solids, mg/l, max.	95	101	91	132
9	Calcium (as Ca), mg/l, max.	10	8	9	12
10	Magnesium (as Mg), mg/l, max.	7	6	3	5
11	Copper (as Cu), mg/l, max.	BDL	BDL	BDL	BDL
12	Manganese (as Mn), mg/l, max.	0.0018	0.023	0.018	0.22
13	Sulphate (as SO_4), mg/l, max.	8	5	6	6
14	Nitrate (as NO_3), mg/l, max.	0.21	0.18	0.17	0.27
15	Phenolic compounds (as C_6H_5OH), mg/l, max.	BDL	BDL	BDL	BDL
16	Mercury (as Hg), mg/l, max.	BDL	BDL	BDL	BDL
17	Cadmium (as Cd), mg/l, max.	BDL	BDL	BDL	BDL
18	Selenium (as Se), mg/l, max.	BDL	BDL	BDL	BDL
19	Arsenic (as As), mg/l, max.	BDL	BDL	BDL	BDL
20	Cyanide (as CN), mg/l, max.	BDL	BDL	BDL	BDL
21	Lead (as Pb), mg/l, max.	BDL	BDL	BDL	BDL
22	Zinc (as Zn), mg/l, max.	BDL	BDL	BDL	BDL
23	Anionic Detergent as MBAS	BDL	BDL	BDL	BDL
24	Alkalinity (as $CaCO_3$), mg/l	39	32	30	35
25	Free Ammonia (N), mg/l, max.	0.4	0.5	0.5	0.6
26	Boron (as B), mg/l	BDL	BDL	BDL	BDL
27	Coliform Organism MPN/100ml, max	176	176	177	188
28	Sodium Absorption Ratio, max	0.34	0.38	0.27	0.23
29	Dissolved Oxygen as O_2, mg/l	6.2	6.1	6.4	6.4
30	BOD, 3 days at 27°C, mg/l	2	3	3	5
31	COD, mg/l	5.0	6.2	6.2	9.0
32	Electrical Conductivity (EC), µmhos/cm, max.	126	114	118	130
33	Phosphate, mg/l	0.27	0.26	0.24	0.33
34	CO_2, mg/l	3.9	4.2	3.4	

Table No. 4.7 (B): Results of Surface Water Analysis

Sl. No.	Parameters	SW1	SW2	SW3	SW4
		29.04.2013	29.04.2013	29.04.2013	29.04.2013
1	Colour, Hazen Units	Colourless	Colourless	Colourless	Colourless
2	Turbidity, NTU, max.	4	7	3	4
3	pH value	7.2	6.9	7.5	6.5
4	Total Hardness (as $CaCO_3$), mg/l, max.	43	69	47	57
5	Iron (as Fe), mg/l, max.	0.25	0.33	0.70	0.23
6	Chloride (as Cl), mg/l, max.	10	7	13	6
7	Fluoride (as F), mg/l, max.	BDL	0.07	BDL	BDL
8	Total Dissolved Solids, mg/l, max.	106	76	59	126
9	Calcium (as Ca), mg/l, max.	10	5	9	9
10	Magnesium (as Mg), mg/l, max.	6	7	6	4
11	Copper (as Cu), mg/l, max.	BDL	BDL	BDL	BDL
12	Manganese (as Mn), mg/l, max.	0.012	BDL	BDL	0.024
13	Sulphate (as SO_4), mg/l, max.	7	10	6	6
14	Nitrate (as NO_3), mg/l, max.	0.24	0.10	0.13	0.16
15	Phenolic compounds (as C_6H_5OH), mg/l, max.	BDL	BDL	BDL	BDL
16	Mercury(as Hg), mg/l, max.	BDL	BDL	BDL	BDL
17	Cadmium (as Cd), mg/l, max.	BDL	BDL	BDL	BDL
18	Selenium (as Se), mg/l, max.	BDL	BDL	BDL	BDL
19	Arsenic (as As), mg/l, max.	BDL	BDL	BDL	BDL
20	Cyanide (as CN), mg/l, max.	BDL	BDL	BDL	BDL
21	Lead (as Pb), mg/l, max.	BDL	BDL	BDL	BDL
22	Zinc (as Zn), mg/l, max.	BDL	BDL	BDL	BDL
23	Anionic Detergent as MBAS	BDL	BDL	BDL	BDL
24	Alkalinity (as $CaCO_3$), mg/l	37	90	42	32
25	Free Ammonia (N), mg/l,max.	0.4	0.4	0.6	0.5
26	Boron (as B), mg/l	BDL	BDL	BDL	BDL
27	Coliform Organism MPN/100ml,max	114	66	57	175
28	Sodium Absorption Ratio, max	0.34	0.30	0.26	0.28
29	Dissolved Oxygen as O_2, mg/l	6.2	4.6	6.8	6.6
30	BOD, 3 days at 27°C, mg/l	4	3	2	5
31	COD, mg/l	7.9	9	6	8.2
32	Electrical Conductivity (EC), µmhos/cm, max.	123	103	113	134
33	Phosphate, mg/l	0.24	0.22	0.32	0.29
34	CO_2, mg/l	3.6	4.4	6.9	4.2

4.5 Noise Monitoring

Summarized results of ambient noise monitoring are given in Table No. 4.8. The results have been compared with the standard specified in schedule III, Rule 3 of Environmental Protection Rules given in Table No. 4.9.

Table No. 4.8: Summarized Results of Noise Monitoring

Sl. No.	Location	Results						Type of Area
		Day (0600-2200 hrs.)			Night (2200-0600hrs.)			
		Min.	Max.	Mean*	Min.	Max.	Mean*	
1.	Transit House	BDL	58.7	48.2	BDL	39.7	32.0	Industrial Area
2.	Sukrangi Hospital	BDL	49.7	46.1	BDL	30.1	31.7	Silence Area
3.	Sorughit	BDL	53.7	47.1	BDL	41.0	38.8	Residential
4.	Sukrangi Hatting	38.4	56.4	47.0	BDL	42.7	34.7	Residential
5.	Sukrangi School	37.6	58.9	50.0	BDL	40.7	34.5	Silence Area
6.	Ostapale	BDL	49.7	41.2	BDL	42.0	33.4	Residential

*Note: *Logarithmic Averages; BDL = <30 dB(A).* *All Values in dB(A).*

Table No. 4.9: CPCB Norms in respect of Ambient Noise.

Type of Area	Day (0600 – 2200hrs)	Night (2200 – 0600 hrs)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

All Values in dB (A)

Conclusion:

Noise level as observed in ambient are well below the standard norms stipulated by CPCB except Sukrati Hatting during day time for Residential Area and Sukrangi School during day time and night time for silence zone area, which is due to vehicular movement.

4.6 Flow of Water Measurement

The results of flow of water are given in Table No. 4.10

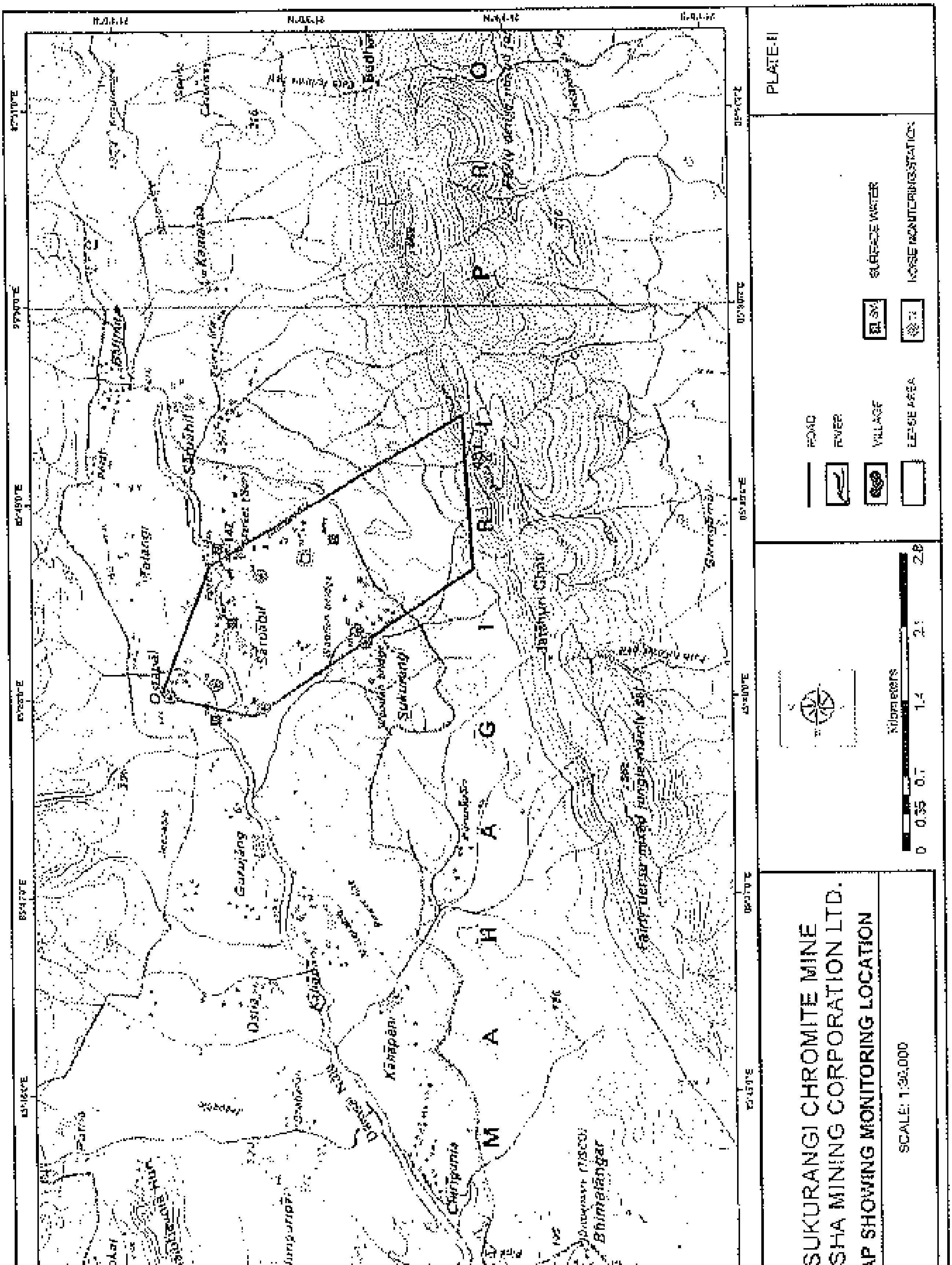
Table No. 4.10: Result of Flow of Water Measurement

Station code	Coordinates	Flow of water in m³/min
FW1	21°03'30.29" N; 85°47'54.02"E	1.86
FW2	21°03'24.97" N; 86°48'23.61"E	1.60
FW3	21°03'29.17" N; 86°48'46.37" E	1.80

Annex. 2b

SUKURANGI CHROMITE MINE
ODISHA MINING CORPORATION LTD.
MAP SHOWING MONITORING LOCATION
SCALE 1:30,000
PLATE-1
ROAD
RIVER
VILLAGE
LEASE AREA
AIR MONITORING STATION
WORK ZONE AIR QUALITY
METEOROLOGY
Kilometers
Sukurangi
Jamuni Ghati
Chingamali
Kalabani
Chingurali
Bhimatangar
Gudari
Pandaloi
Sarandi
Ostapal
Gurudijo
Gokul
Pora
Bangiriposi

Annex.20


PLATE-II
ROAD
RIVER
VILLAGE
LEASE AREA
SURFACE WATER
NOISE MONITORING STATION
Kilometers
0 0.35 0.7 1.4 2.1 2.8
SUKURANGI CHROMITE MINE
ODISHA MINING CORPORATION LTD.
MAP SHOWING MONITORING LOCATION
SCALE: 1:50,000
MAHAGIRI
Sukurangi
Saruabil
Ostapal
Jatahari Ghati
Gurujang
Kalapani
Chingudipal
Bhimatangar

Annex-2.1

भारत सरकार/Govt. of India
श्रम एवं रोजगार मंत्रालय/Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय/Directorate General of Mines Safety
भुवनेश्वर क्षेत्र/Bhubaneswar Region

Plot No.E-1, Nayapalli, PO: RRL Campus, Bhubaneswar-751013 - FAX/Phone :-(0674) 2302761

संख्या: BCU/C[A-2]P-106(2)(b)/2009/ ... ... / दिनांक ... / /2009

प्रति

भा.खा.नि.,
भुवनेश्वर क्षेत्र ।

To

The Agent,
Sukrangi Chromite Mine,
M/s. Orissa Mining Corporation Ltd,
P.O, Jajpur Road, Dist. Jajpur (Orissa)

Sub: Relaxation under Regulation 106(2)(b) of the Metalliferous Mines Regulations, 1961 for using Heavy Earth Moving Machineries(HEMMs) in conjunction with deep hole blasting at at Sukrangi Chromite Mine of M/s Orissa Mining Corporation Ltd.

Dear Sir

Please refer to your letter No. 5564/OMC/JKR/08, dated 25th November, 2008, and plans enclosed therewith, seeking the above relaxation.

The matter has since been examined on the basis of information furnished in your application under reference and shown on the enclosed plans and sections submitted by you.

In exercise of the powers conferred on the Chief Inspector of Mines (also designated as Director General of Mines Safety) under the provisions of Regulations 106(2)(b) of the Metalliferous Mines Regulations, 1961 and by virtue of authorisation granted to me by the Chief Inspector of Mines (also designated as Director-General of Mines Safety) under Section 6(1) of the Mines Act, 1952, *I, hereby grant you relaxations from the said provisions and permit you to work Sukrangi Chromite Mine of M/s Orissa Mining Corporation Ltd. by deployment of HEMMs and in conjunction with deep hole blasting, for a period of 5 (five) years from the date of issue of this letter,* subject to the following conditions and conditions as stipulated herein, being strictly complied with

1.0 GENERAL:

1.1 Except where otherwise provided for in this permission, all provisions of the Metalliferous Mines Regulations, 1961 relating to opencast workings, use of explosives and use of machinery shall be strictly complied with.

1.2 This conditional relaxation is subject to the amendment or withdrawal at any time.

2.0 OPENCAST WORKINGS:

2.1 *Height and Width of Benches:*

Annex-21

2.1.1 The height of the benches in overburden, mineral or other rock formation shall not be more than the digging height of the machine deployed thereat for digging, excavation or removal.

2.1.2 The width of any bench shall not be less than : (i) the width of the widest machine plying on the bench plus two metres, or (ii) three times the width of the largest dumper/truck/ tipper if dumpers/trucks/tippers ply on the bench, or (iii) the height of the bench, whichever is more.

2.2.1 The benches shall be kept sloped at an angle not exceeding 60^0.

2.2.2 Keeping the above restrictions in view, the pit-slope of opencast workings shall not exceed 25^0 in laterite material and 30^0 in quartzite and hard ultrabasic rock upto a depth of 50 m (i.e. upto 158 mRL) from the surface pending study by any reputed scientific institution to establish a safe angle of slope in different types of strata encountered in the pit.

2.3 Monitoring of strata movement and pit slope shall be done with the assistance of *any reputed scientific or academic institution.* Appropriate EDM instrument and precise level having requisite level of accuracy shall be used for the purpose. Adequate number of beacons/reflectors shall be installed as to cover the entire length, breadth and depth of the quarries. The readings of horizontal and vertical displacements shall be recorded and plotted for all such stations installed with respect to time in graph. In the event of any sharp or asymptotic increase in the slope/gradient of the plots so generated, all work in the section/pit shall immediately be stopped. Intimation thereof shall also be sent to this Directorate in writing and work in the section/pit shall not resume till express permission is accorded to this effect by this Directorate.

2.4 Where the excavation is proposed in an area having surface topography in the form of hillock(s), the mining shall be started with making of haul roads right upto the top(peak) of the hillock(s) and the workings shall proceed by forming benches from top downwards.

2.5 No manual workers shall be employed where HEMM is deployed in the mine.

2.6 No mineral or debris or overburden shall be stacked within 100 metres around the active faces and peripheries of the opencast workings.

3.0 ROADS FOR TRUCKS AND DUMPERS ETC:

3.1 All haul roads for dumpers/trucks/tippers or other mobile machinery shall be constructed to suit its load capacity and shall be maintained in good condition. No vehicle other than the transport vehicles shall be used on the haul roads, except between designated points and when permitted in writing by the manager.

3.2 Where practicable, all haul roads leading from the opencast workings to surface shall be arranged to provide one way traffic. Where it is not practicable to provide for one way traffic, no haul road shall be of a width less than three times the width of the largest vehicle plying on that road plus(+) 5 m, or definite turnouts, crossing points and waiting points shall be designated and demarcated by proper sign boards for the guidance of operators/drivers of such vehicles.

3.3.1 If large capacity dumpers and smaller capacity tipping trucks or similar transport vehicles are deployed in the mine, separate roads for tipping trucks or similar transport vehicles shall be provided.

3.3.2 Plying of dumpers or tipping trucks on the same bench where men are to work, travel or rest shall be avoided.

Annex. 21

3.4 All corners and bends on haul roads shall be so designed, made and kept maintained that the operators and drivers of vehicles plying on the haul road have clear view for a distance not less than 3 times the braking distance of the largest HEMM working at 40 km/hour. Where it is not possible to ensure the visibility as stated above the road shall be provided with two separate lanes for up and down traffic, each of width not less than 2 times the width of the largest vehicles plying thereon plus 3 m, with a strong divider at centre with adequate lighting and reflector along the divider.

3.5 Except with the express permission in writing of the Regional Inspector of Mines (now designated as Director of Mines Safety), no haul roads shall have a gradient steeper than 1 in 16 at any place, except for ramps over small stretches not exceeding 10 m in length, where gradient upto 1 in 10 may be permitted.

3.6 Where any part of the road exists above the level of the surrounding area, a strong parapet wall or bund or embankment of the following dimensions:

(i) width at top not less than 1 m.
(ii) width at bottom not less than 2.5 m.
(iii) the height not less than the diameter of the tyre of largest vehicle plying on the road.

It may be noted that mere dumping of mud or overburden shall not be treated as strong parapet wall.

3.7 Warning notices and road signs shall be posted along the haul roads at appropriate places like crossings, curves etc. for guidance of drivers of dumpers/trucks/tippers.

3.8 At every curve, parapet wall or vertical posts with zebra lines shall be provided to help the drivers to keep the trucks/tippers/dumpers on the track.

4.0 FENCING AROUND OPENCAST WORKINGS:

4.1 The periphery around the limits of opencast workings shall be kept fenced with a masonry wall not less than 0.10m thick and not less than 1.2 m in height, with a parapet top.

4.2 The top edges of the opencast workings shall be kept fenced with wire rope strands or barbed wire, supported on movable posts (wooden, iron or concrete). The gap between the adjacent rope strands or wires shall not be more than 0.30 m, the bottom-most rope strand/wire shall not be more than 0.25 m above the ground level and the top most rope strand or wire shall not be less than 1.00m from ground level.

5.0 SPOIL, OVERBURDEN OR DEBRIS BANKS:

5.1.1 Spoil, overburden or debris shall be deposited at places belonging to the mine and duly approved by the manager in writing.

5.1.2 Spoils, overburden or debris shall not be deposited, beneath transmission telephone or power lines or near any other public structure.

5.1.3 The slope of a spoil bank face shall be determined by natural angle of repose of the material being deposited, but shall in no case exceed 37.5^0 from the horizontal. The spoil bank face shall not be retained by artificial means at an angle in excess of its natural angle of repose.

5.1.4 Any spoil bank exceeding 30 m in height shall be kept benched so that no such bench exceeds 30 m in height and the general slope does not exceed 1 vertical to 1.5 horizontal. In no case, the height of any spoil bank shall be allowed to exceed 60 metres unless a scientific study on its stability has been done and a separate permission is obtained from this Directorate.

5.1.5 The spoil bank face shall not be retained by any artificial means at an angle in excess of its natural angle of repose.

5.1.6 Garland drains shall be provided around the periphery of the dumps, both at top and bottom, to collect run-off water. A clay capping shall be made over the exposed dump surface to prevent water entry.

5.2.1 The spoils, overburden or debris shall not be deposited within 45 m of a railway line, public road, other public works or other structures of permanent nature, not belonging to management.

5.2.2 The toe of the dump shall not be allowed to approach any of the above-stated structures closer than 1.5 times the vertical height of its face.

5.2.3 A suitable fence shall be erected between any railway line, other public works or road, or building or structures of permanent nature not belonging to the management, and the toe of every active spoil bank so as to prevent un-authorised persons from approaching the spoil bank.

5.3 No person shall be or shall be permitted to approach the toe of an active spoil bank where he may be endangered from material rolling down the face. Suitable warning signs at conspicuous places shall also be displayed.

6.0 GENERAL LIGHTING:

6.1 Adequate general lighting arrangements conforming to stipulations not less than as specified in Govt. Notification No.GSR-829 dated 18.6.75, published in the Gazette of India dated 5.7.1975, Part II; Section 3(i) (reproduced in DGMS (Legis.) Circular No.3 of 1976), issued under Regulation 148(2) of the Metalliferous Mines Regulations, 1961, shall be provided at all opencast workings, haul roads, dump yards, stumps and other working places for working the mine beyond day light hours.

6.2 Illumination surveys at interval not exceeding 30 days shall be conducted at all work-places to ascertain that stipulations of Govt. Notification No. GSR 829 dated 18.6.75 are being met with.

6.3 Suitable search lights shall be provided to the concerned mine officials for better supervision at night.

7.0 PRECAUTIONS AGAINST FIRE:

7.1 A code of practice shall be drawn up for dealing with fires at different locations in the opencast mine, and for dealing of fires in heavy earth moving machinery.

7.2 Automatic fire protection system shall be provided and kept maintained in working order on every HEMM used for loading and transportation. Recommended procedure for testing of such fire protection system, at a given interval as prescribed by the manufacturer shall also be adopted.

8.0 SUPERVISION:

8.1 During every production shift, the opencast workings shall be placed under the charge of an Assistant Manager, assisted by sufficient numbers of mine foremen and mining mates, and during maintenance shift the workings shall be placed under the charge of a Foreman, assisted by sufficient numbers of mining mates, to have overall control and guidance of operations connected with the mine and who shall be responsible to see that all the regulations and orders made thereunder are strictly complied with.

8.2 Each and every operation, including operations carried out through contractors' workers or by out side agency, shall be placed under the charge of a competent supervisor, duly appointed and authorised by the manager, with his jurisdiction being clearly demarcated.

8.3 A code specifying duties and responsibilities of all mine officials, i.e., Assistant Managers, Under Managers, Engineer(s), Supervisors, Technicians, Mechanics, Fitters, Machine Operators, helpers, loading supervisors etc. shall be drawn up and distributed to all concerned.

8.4 The Manager shall issue to every Driver/Operator, Supervisor and Mine Official connected with the use of Heavy Earth Moving Machinery, a copy of rules/regulations, orders made there-under and guidelines listed in this permission governing his duties, in a language understood by the person concerned. The Manager and the Engineer shall be responsible to ensure that all the precautions and guidelines listed in this permission are strictly followed by all concerned.

8.5 It shall be the responsibility of the Manager, Engineer and other supervisors to ensure that all persons working in the mine, and those working on machines/equipments etc. work, as per the code and all machines and equipments etc. are installed, operated and maintained in safe working conditions.

9.0 ADDITIONAL DUTIES OF ENGINEERS PLACED IN CHARGE OF MACHINES AND EQUIPMENTS IN OPENCAST WORKINGS :

9.1 During each shift, the machines and equipments deployed in the mine shall be placed under the charge of such number of qualified and experienced engineers as is adequate to effect adequate inspection, examination, safe operation and maintenance of the machines, equipments and accessories.

9.2 During his shift the engineer/engineers shall :

(i) inspect & examine machines, equipments and accessories, and satisfy himself that they are in sound and safe working order.
(ii) not allow any machine, equipment to be used, if it is found defective.
(iii) ensure that every machine, equipment, accessory is used in a safe and efficient manner.
(iv) ensure that each operation/activity concerning repair, maintenance and operation of machinery/equipment is carried on in a safe and efficient manner.

10.0 INSPECTION, EXAMINATION, REPAIR AND MAINTENANCE OF HEMM AND OTHER MACHINES:

10.1 A scheme for proper maintenance, repair, overhaul and erection in respect of heavy earth moving machinery (commensurate with the capacity/size type of machines used in the mine), covering places such as repair sheds and workshops, shall be drawn and implemented. This shall also include training and implementation of Code of Practice for erection, inspection, examination, repair, maintenance, etc. of such equipment before putting the same into use in the mine.

10.2 Every drilling and earth moving machinery or equipment or accessory (hereinafter called machine) shall be thoroughly examined at least once in every shift and maintained in good and safe working condition. In case of wheeled trackless HEMM like dumpers, trucks, tippers and other such machinery, special attention shall be paid to safe working order of brakes, steering system, horn, audio visual reversing alarm, side indicator lamps, rear view mirrors and head lights & tail lights.

Annex. 21

10.3 A record of examination and maintenance carried out in accordance with the above shall be maintained in a bound paged register which shall be signed by the concerned shift engineer and countersigned by the Engineer-in-charge.

10.4 If the engineer, mechanical foreman or other competent person making an inspection notices any defect in any machinery, the said machinery shall not be used until the defect has been remedied.

10.5 Any defect in any machinery, reported by its operator, shall be promptly attended to.

10.6 Any machinery found to be in an unsafe operating condition shall be tagged at the operator's position, "Out of Service, Do not Use" and its use shall be prohibited until the unsafe condition has been corrected.

10.7 All repairs to a machine shall be done at a location which provides a safe place for the persons engaged on repairs.

10.8 Except for testing, trial or adjustment, which must necessarily be done while the machine is in motion, every machine shall be shut down, and positive means taken to prevent its operation, before any repair, maintenance or lubrication is undertaken on it.

10.9 Power shall be disconnected when repairs are to be carried on any electrically powered machine/apparatus.

10.10 Any machinery, equipment or part thereof which is suspended or held apart by use of slings, hoists, or jacks shall be substantially blocked or cribbed, before men are permitted to work underneath or between the same.

10.11 While inflating tyres, suitable protective cages shall be used. Tyres shall in no case be inflated to such other in the front of it or on top of the same.

10.12 Operation and maintenance of heavy machineries such as shovels, excavators, pay loaders, dumpers, tippers, trucks etc. shall be done strictly in accordance with the OEM's operation and maintenance instructions which shall be obtained from the manufacturers.

10.13 The stability of HEMM shall be carried out at least once in every year and after every major overhaul by an independent agency.

10.14 The crane and overhead crane shall be subjected to proof load test and NDT test once in a year from a competent authority.

10.15 The pressure vessel receiver shall be subjected to hydraulic and NDT test and shall be carried by a competent authority.

10.16 In case of any defect in equipment such as brake, steering and safety device, the equipment shall immediately be taken out from use keeping a record thereof.

11.0 PROTECTIVE EQUIPMENT

11.1 Every person working in the mine shall be provided with, and shall use, a helmet and protective footwear of a type approved by the Chief Inspector of Mines.

Annex. 21

11.2 All the persons employed beyond day light hours shall be provided with, and shall use, fluorescent jacket and helmet with fluorescent band.

12.0 PRECAUTIONS AGAINST DUST:

12.1 Adequate arrangements to allay dry dust, by wetting, shall be made on haul roads and benches where mobile HEMM, trucks and dumpers operate.

12.2 All drills shall be provided with wet drilling arrangement and it shall be maintained in efficient working order. No dry drilling operation shall be carried on.

13.0 DRILLING AND BLASTING OF DEEP HOLES:

13.1 General:

13.1.1 Operations connected with Drilling, Charging, Stemming and Blasting of deep holes shall be placed under overall charge of an Assistant Manager, holding at least a second class manager's certificate of competency granted under Metalliferous Mines Regulations, 1961, who shall supervise the said operations in accordance with the guidelines and directives issued by the Manager.

13.1.2 Not withstanding anything contained in the Metalliferous Mines Regulations, 1961, preparation of charges, charging and stemming of holes shall be carried out under the personal supervision of a mine Foreman, who shall fire the shots in deep holes himself.

13.1.3 A proper record for every blast, showing blasting parameters like hole size, spacing, burden, depth of holes, number of holes fired in the round, charge/hole, charge/delay and total charge of explosives fired in the round, with a rough sketch showing the drilling and firing pattern shall be kept maintained in a bound paged register kept for the purpose.

13.1.4 Loss of persons and property not belonging to the management against injury and damages resulting out of blasting or operations being carried on in the mine shall be adequately indemnified. Should there be any controversy in this regard, decision of the D.G.M.S. shall be final and binding.

13.2 Drilling of Deep Holes:

13.2.1 The area where drilling is to be done shall be thoroughly cleaned of loose rocks and debris and position of every deep hole to be drilled shall be distinctly marked by the blasting foreman, so as to be readily seen by the drillers.

13.2.2 No drilling shall be commenced in an area where shots have been fired, until the blaster/ blasting foreman has made a thorough examination of all places, including remaining butts of old deep holes, for unexploded charges that the drill rod may strike.

13.2.3 No drill or bar, rod or pick shall be inserted in butts of old deep holes even if an examination under clause 13.2.2 has failed to reveal presence of explosives.

13.2.4 Drilling and charging of deep holes shall not be carried out in the same area at the same time.

13.2.5 Drilling operations shall not be carried on simultaneously on two benches, in places directly one above the other.

Annex. 21

13.3 Duties of Drill Operators:

13.3.1 At the beginning of his shift, the drill operator shall examine the drilling equipment and satisfy himself that

(i) crown blocks are mounted securely;
(ii) where compressed air drills are used, all hose connections are in order;
(iii) the drilling equipment is in safe working condition, and,
(iv) wet drilling system is in order.

13.3.2 The drill operator shall ensure that –

(i) work persons keep clear of auger and drill steel while the drill is in motion;
(ii) work persons do not work under suspended tools, when tools are removed from the holes,
(iii) all finished drill holes are properly plugged so as avoid possible injury to any one accidentally stepping onto the hole.

13.4 Charging of Deep Holes:

13.4.1 General precautions and rules regarding handling of explosives shall be observed by the blasting crew. Only such minimum number of person shall be allowed to remain at the charging site as are required during charging operations and firing of shot holes.

13.4.2 The entire area where charging of explosives is to be done shall be demarcated by suitable flags and effectively guarded to prevent unauthorised entry of persons or plying of other vehicles, and shall be kept free from dry vegetation and other combustible material.

13.4.3 Smoking, naked light or open flames shall not be allowed within 300m of the area where charging of explosives is being carried on.

13.4.4 The holes shall be charged (and fired) as soon as possible after the explosive is transported to the site of blasting. All normal precautions for charging (and firing) as laid down in the Metalliferous Mines Regulations,1961 shall be strictly observed.

13.4.5 Explosive cartridges shall not be slit or deformed. Adequate amount of cap sensitive explosive shall be used with non cap sensitive explosive charge to ensure complete detonation of the explosive charge.

13.4.6 Explosives shall be delivered/charged first into the hole farthest from the 'Firing Station'.

13.4.7 Not more than one hole shall be in process of being charged on any face at any point of time.

13.4.8 All operations connected with charging, stemming and making connections shall be done while standing on the solid ground.

13.4.9 The cartridges of explosives shall be lowered carefully into the shot holes, so as to avoid sticking of cartridges in the shot holes, thereby causing air space(s) in the explosive column. After charging each hole with explosives, the length of the uncharged/remaining portion of the hole shall be measured to confirm that the cartridges are in close contact with each other and there is no air gap between the explosive columns. In case the length of uncharged portion of the hole is not as per calculation, thereby indicating the presence of

air space, attempt may be made to push down the charge in case of slurry explosives only. The remaining hole shall then be stemmed with moist sand before blasting the shot holes.

13.4.10 Explosive charge shall not be allowed to sleep over in holes unless express permission in writing to the effect is obtained.

13.5 Precautions during Blasting/Firing:

13.5.1 Shots shall not be fired except during the hours of day light. All holes charged on any one day shall be fired on the same day.

13.5.2 Shots shall not be fired in crushed, broken or fractured ground.

13.5.3 As far as practicable, deep holes shall be fired either between the shifts, or during the rest interval, or at the end of work for the day.

13.5.4 The danger zone shall be distinctly demarcated (by means of red flags or other suitable means) at least 30 minutes before firing of holes.

13.5.5 Proper and distinct warning by a siren installed for the purpose shall be given within the danger zone, at least 10 minutes before the holes are fired.

13.5.6 Before the holes are charged, stemmed and fired, the shotfirer/blasting foreman, with assistance of his assistants, appointed in sufficient number in writing by the manager, shall ensure that all persons have either left the danger zone, or have taken adequate shelter.

13.5.7 In case part of a public road lies within the danger zone, guards shall be posted on either end of the road falling within danger zone, and traffic shall be stopped before shots are fired. In the event of any railway line lying within the danger zone, no shot shall be fired when there is traffic on the railway track.

13.5.8 During approach of an electric storm, following precautions shall be taken

(i) No explosives particularly detonators shall be handled.
(ii) If charging operations have begun, work shall be discontinued till the storm has passed
(iii) If shots are being fired electrically, all exposed wires shall be coiled up and kept covered by something other than a metal plate.
(iv) All wires shall be removed from contact with metallic plates/steel rails so as to prevent the charge from exploding prematurely by a local strike of the lightning.

13.5.9 After shots have been fired, no person shall enter or be allowed to enter the place, until 30 minutes after firing of the shots. Before allowing any person to enter the area, the Assistant Mines Manager in charge of the blasting operations shall make sure that the area is free from dust, smoke or fumes.

13.5.10 In case of misfires, precautions as laid down in Regulation 167 of Metalliferous Mines Regulations, 1961 shall be taken

14.0 DESIGN, OPERATION AND MAINTENANCE OF SHOVELS, EXCAVATORS, PAYLOADER & OTHER MACHINERIES:

14.1 Every shovel, excavator and pay loader shall be so designed as to afford the operator clear and uninterrupted vision all around.

14.2.1 Every shovel, excavator, pay-loader, dozer and drills shall be maintained in good and safe working condition and shall be provided with

(i) efficient warning devices;
(ii) front and rear lights of adequate intensity and a portable lamp for use in emergency, unless the loading equipment is not intended to be used beyond day-light hours; and
(iii) an approved type of portable fire extinguisher or other approved type fire suppression system in efficient working condition so placed as to be within easy reach of the operator
(iv) fire resistant hydraulic hoses in place of ordinary hoses to decrease the chance of fire and fire resistant sleeves and conduits where cable/wire is used;
(v) a retractable ladder for mounting onto the machine;
(vi) proper seat belt for operator;
(vi) turbo charge guard

14.2.2 The following safety features shall also be provided with every shovel and excavator -

(i) all functions cut-off switch;
(ii) swing motor brake;
(iii) vent valve on top of hydraulic tank of such a type which is removable without any tool;
(iv) a baffle plate between cold zone and hot zone;
(v) provision for limiting of hydraulic cylinders - stopper.

14.2.3 All dozers shall also be provided with roll over protection.

14.2.4 All drills shall also be provided with the following safety features -

(i) approved type of dust prevention or suppression system;
(ii) each moving parts shall be guarded/fenced in effective manner;
(iii) emergency push button switch in operator's cabin, main frame, propeller pendent and rear end;
(iv) tripping device to trip the field switch;
(v) thermostat motor protection relay in winding armature and other related parts;
(vi) explosive vent in transformer;
(vii) proper interlock (an electric interlock between drilling and propeller operation);
(viii) high air discharge temperature switch;
(ix) low lub oil pressure switch;
(x) oil stop valve (electric solenoid valve in compressor lubrication line);
(xi) no bump circuit
(xii) tower lock and lock check valve
(xiii) proper joystick - spring loaded type to return to neutral (dead man safety)
(xiv) disk brake and brake valve and its testing parameters;
(xv) lock check valve for preventing creeping in drill;

14.3 The operator's cabins of every shovel, excavator, pay loader and other HEMM shall be well designed and substantially built and air-conditioned so as to render adequate protection to the operator against heat, dust, noise etc. A seat belt for the safety of the operator shall also be provided in the equipment/HEMM

Annexe - 21

14.0 Every shovel, excavator and pay-loader shall be under the charge of a competent person, authorised in writing by the manager, herein called the 'Operator'.

14.5.1 All persons employed or to be employed to operate shovel, excavator, pay-loader and other HEMM shall be trained and their competency shall be evaluated by a Board constituted by the management. The members of such board shall be persons who are not connected with imparting of training. However, the training officer(s) may be co-opted in the Board as observer.

14.5.3 Only such fitters/mechanics possessing driver's/operator's license, shall be allowed to carry out test-run of shovel, excavator, pay loader and other HEMM.

14.6 No person other than the operator or the manager or any person so authorised in writing by the manager shall ride on a shovel, excavator or pay-loader.

14.7 No person shall be permitted to ride in the bucket of a shovel, excavator or pay-loader.

14.8 Shovel/excavator dippers and pay loader bucket shall be lowered to the ground during greasing operations.

14.9 No shovel, excavator or pay loader shall be operated in a position, where any part of the machine or suspended loads therefrom are brought closer than 3m to exposed high voltage transmission lines, unless the current has been cut off from such exposed transmission lines, and positive means have been taken to prevent the lines from being energised. A notice of this requirement shall be posted at the operator's position.

14.10 Electrical cables, if any, shall be laid in such a manner that they are not endangered either by falling rocks or by any mobile equipment.

14.11 The shovel/excavator/pay-loader bucket shall be pulled out of the bank as soon as it is full.

14.12 When being operated in soft or unstable ground, every shovel and excavator shall be supported on mats, heavy planks or poles so as to distribute the load of the machinery over larger area and prevent its toppling.

14.13 When not in use, shovel, excavator and pay-loader shall be moved to and stood on stable ground.

14.14 If more than one stripping machine is in use in any area, either on the same bench or on different benches, the machines shall be so spaced that there is adequate space for safe operation of each equipment, and there is no danger from flying or falling pieces of stones etc. from one machine to the other.

14.15 The safety features recommended in equipments shall be made a part of the notice inviting tender for new procurement and the design and drawing shall be obtained from OEM for fitting the same in old equipment.

15.0 DUTIES OF SHOVEL, EXCAVATOR & PAYLOADER OPERATORS:

15.1 Before any machine is put into operation, the operator shall look for any placards/tags on the machine like *"OUT OF ORDER"*, *"UNDER REPAIRS"*, etc. and in case such tags are seen anywhere in the control system, the machine shall not be started.

Annex. 21

15.2 At the commencement of his shift, the operator shall personally inspect and test the machine, paying special attention to the following details :-

(i) that every warning device is in working order.
(ii) that it is mechanically sound and in efficient working order, and
(iii) that the lighting fixtures are in proper working order, if the machine is required to work beyond day light hours.

15.3 He shall not take out the machine for work nor shall he work the machine, unless he is satisfied of its safe working order.

15.4 The operator shall maintain a record of every inspection made under clause 15.3 in a bound paged book kept for the purpose, and shall sign every entry made therein.

15.5 The operator shall keep the cab window clean so as to ensure clear vision at all times.

15.6 The walkways in or about the cab of any shovel, excavator and pay-loader shall be kept free of loose tools, grease containers or other materials that might fall or give rise to tripping hazard.

15.7 The operator shall not operate the machine when persons are in such proximity as to be endangered.

15.8 The operator shall not swing the bucket over-passing the trucks/dumpers when they are being loaded. He shall swing the bucket over the body of the truck/dumpers whilst loading and not over the cab, unless the cab is protected by a substantially strong cover.

15.9 Before leaving the machine, the operator shall lower the bucket to the ground.
15.10 The operator shall not allow any unauthorised person to ride on the machine.

16.0 DESIGN, OPERATION AND MAINTENANCE OF TRUCKS AND DUMPERS:

16.1 Every truck or dumper and other mobile equipment shall be maintained in good and safe working condition and shall be provided with:

(i) efficient service brake, secondary brake, parking brake, and speed retarder and an emergency steering in case the steering system is hydraulically operated;
(ii) efficient horn;
(iii) rear view mirrors of adequate size on either side of the vehicle and blind spot mirror apart from the rear view mirrors to enable operator to have clear visibility of blind spot in and around dumpers;
(iv) automatically operated audio-visual alarm which gets switched on no sooner the gear lever is shifted in "reverse" position;
(v) side indicator lights;
(vi) efficient head-lights, if the truck/dumper/equipment is required to work beyond day-light hours.
(vii) proper seat with seat belt for driver or operator; and.
(viii) a substantially strong cover over the driver's/operator's cabin.
(ix) mechanical steering locking to prevent unlowered movement of steering wheel and;
(x) mechanical type anti collision device to avoid head to tail collision on haul road such as tail gate, bumper extension or any other strong device;
(xi) fire resistant hydraulic hoses in place of ordinary hoses to decrease the chance of fire and fire resistant sleeves and conduits where cable/wire is used;

17

(xii) proper shaft guard;
(xiii) proximity warning device;
(xiv) provision of restricting maximum speed of the vehicle to 40 kms/hour by blocking higher gear or any other automatic means.
(xv) approved type of fire suppression system.

16.2 The operator's cabins of dumpers/tippers/other mobile equipments shall be well designed, substantially built and air conditioned so as to render adequate protection to the operator against heat, dust, noise etc. A seat belt for the safety of the operator shall also be provided in the dumper/vehicle.

16.3 The audio visual alarm provided on trucks/dumpers/other mobile equipment shall be of such intensity which is not less than 5dB(A) above the surrounding noise level.

16.4 Every truck or dumper shall be under the charge of a competent person authorised in writing by the manager herein called the 'driver'.

16.5.1 All persons employed or to be employed to drive/operate trucks/dumpers/tippers shall be trained and their competency shall be evaluated by a Board constituted by the management. The members of such board shall be persons who are not connected with imparting of training. However, the training officer(s) may be co-opted in the Board as observer.
16.5.2 Only such fitters/mechanics possessing driver's/operator's license, shall be allowed to carry out test run of trucks/dumpers/tippers.

16.6 No person other than the driver or the manager or any person authorised in writing by the manager shall ride on a truck or dumper.

16.7 No person shall, or shall be permitted to, ride on the board of a running truck or dumper.

16.8 No vehicle shall be loaded/unloaded on gradient.

16.9 As far as possible, loaded trucks or dumpers shall not be reversed on gradients.

16.10 Sufficient stop blocks shall be provided at every tipping point and these shall be used on every occasion, material is dumped.

16.11 Code of Traffic Rules framed by the Manager shall be adopted and followed during movement of all trucks and dumpers. They shall be prominently displayed at relevant places in the opencast workings and on trucks/dumpers roads.

16.12 When not in use, every truck or dumper or other wheeled trackless machinery shall be moved to and parked at proper parking place(s) which shall be on level ground and away from working area of other mobile equipment. The truck or dumper or other wheeled trackless machinery shall not be parked at a place where it cannot be observed.

16.13 No person shall, or shall be permitted to, work on the chassis of a truck or dumper, with the body in a raised position unless the truck or dumper body has been securely blocked in position. The hoist mechanism shall not be depended upon to hold the body of the truck or dumper in a raised position.

16.11 Suitable points shall be designated for parking utility vans and other light vehicles in the opencast workings, which in no case shall be less than 30m away from the area where mobile HEMM operates. The light vehicles shall in no case be taken beyond the designated point unless operation of HEMM in the vicinity has been stopped.

16.15 No person other than those authorised shall be permitted to enter or remain in any dumping yard, loading and unloading points and turning points.

16.16 In respect of every truck/dumper or class of truck/dumper, the maximum load to be hauled shall be determined and notified to operators/drivers by the Manager. Speed limits at which such loads can be hauled shall also be determined and fixed by the Manager, depending on the road gradient, direction of movement, road surface etc., and notices/sign boards specifying the same shall be posted along the haul road at appropriate places/sections.

16.17 The safety features recommended in dumpers/trucks/tippers shall be made a part of the notice inviting tender for new procurement and the design and drawing shall be obtained from OEM for fitting the same in old equipment.

17.0 DUTIES OF TRUCK/DUMPER/TIPPER OPERATORS:

17.1 Before commencing work, the driver shall personally check the dumper/truck/tipper for oil(s), fuel & water levels, tyre inflation, and general cleanliness, and inspect and test the vehicle, paying special attention to the following details:

(i) that brakes and steering system are in proper working order;
(ii) that the warning devices including automatically operated audio visual reversing alarm are in working order,
(iii) that rear view mirrors on either side of the vehicle is provided;
(iv) that side indicator lights are in working order; and
(v) that head lights are in working order, if the vehicle is required to work after day-light hours.

17.2.1 The driver/operator shall not take out the vehicle for work nor shall he drive the vehicle, unless he is satisfied that it is mechanically sound and in efficient working order.

17.2.2 He shall wear the seat belt before starting the vehicle and shall also ensure that other person(s), if so authorised to ride in the vehicle, are properly seated and also wear safety belts.

17.3 The driver shall maintain a record of every inspection made under clause 17.1 in a bound paged book kept for the purpose and shall sign every entry made therein.

17.4 The driver shall keep the cab window clean so as to ensure clear vision at all times.

17.5.1 The driver shall ensure that the gear is in neutral position, and parking brake is on, before stopping the engine.

17.5.2 The driver shall handle the truck/dumper carefully and keep it under control at all times. He shall negotiate downhill gradients in low gear so that minimum of braking is required.

17.5.3 He shall not drive too fast, shall avoid distractions and shall drive defensively. He shall not attempt to overtake another vehicle unless he can see clearly well enough ahead to be sure that he can pass it safely without exceeding the speed limit, and that area ahead is free of any road intersection or structure. He shall

Annex-21

22.2 Garland drains of adequate size shall be provided on the surface on the periphery of the opencast workings to divert rain water from flowing down the slopes. The drains shall preferably be made impervious by plastering of floor and sides to minimize seepage of water through the strata.

22.3 The layout of the workshop for maintenance of HEMM and other equipments shall be as per requirement mentioned in the DGI's Circular No.8 of 2003.

22.5 In the event of any change in the circumstances connected with this permission which is likely to endanger the life of persons employed in the mine or the mine, the mining operations for which this permission has been granted shall be stopped forthwith and intimation thereof shall be sent to this Directorate. The said mining operation shall not be resumed without express and fresh permission in writing from this Directorate.

22.6 If at any time any one of the conditions, subject to which this permission has been granted, is violated or not-complied with, this permission shall be deemed to have been revoked with immediate effect.

22.7 This permission may be amended or withdrawn at any time if considered necessary in the interest of safety and is being issued under Regulation 106(3)(b) of the Metalliferous Mines Regulations, 1961 only without prejudice to any other provisions of law which may be or may become applicable at any time.

22.8 This Directorate shall be informed as soon as the mining operations are commenced in accordance with the above permission. Intimation about completion of the mining operations should also be sent promptly and in any case not later than one month thereof.

22.9 This relaxation is in supersession of the exemption/relaxation, if any, granted under the aforesaid regulations in the past.

Yours faithfully

(N.K.Kherada)
Director of Mines Safety
Bhubaneswar Region

Memo No. DMS/BH-166(Ob)/2009/ 9455 dated the 15/09/2009
Copy forwarded for information & necessary action to -

1. The Manager, Sukinda Chromite Mine, M/s OMC, P.O. Kalinganagar, Dist: Jajpur (Orissa)
2. The General Manager, Sukinda Chromite Mine, M/s OMC Ltd., P.O. Jajpur, Dist: Jajpur
3. The MD/Nominated Owner, M/s Orissa Mining Corpn Ltd., Bhubaneswar.

Deputy Director of Mines Safety,
Bhubaneswar Region

17

Annex. 22

Government of Odisha
Department of Steel & Mines

DGM(M)

No. 9807 / SM, Bhubaneswar, the 10/10/2013
DI (CR) SM-03/2013

To

The Chairman-Cum-Manager Director,
Odisha Mining Corporation, Bhubaneswar.

Sub- Permission for dumping of OB of South Kaliapani Chromite Mines in adjacent Sukrangi Chromite Mines leasehold of OMC Ltd. as per rule 64© of Mineral Concession Rules 1960.

Sir,

I am directed to invite a reference to your letter No-1118 OMC dated 22.01.2013 on the above subject and to communicate approval for dumping of OB of South Kaliapani Chromite Mines in adjacent Sukrangi Chromite Mines leasehold of OMC Ltd. as per rule 64© of Mineral Concession Rules 1960 subject to the following conditions.

(1) Both the Mines should have approval of modified mining plan/scheme as the case may be, providing for dumping of OB from South Kaliapani Chromite Mines to their adjacent Sukrangi Chromite Mines OMC to obtain revised Mining Plan from I.B.M accordingly

AGM(Mining)

(2) The area adjoining Sukrangi Chromite Mines to the selected area for dumping of waste materials of South Kaliapani Chromite Mines should be proved to be barren of minerals by boreholes.

(3) M/S OMC Ltd should maintain correct account of waste materials of South Kaliapani Chromite leasehold removed and dumped in Sukrangi Chromite leasehold on daily basis.

(4) Since Sukinda Chromite deposit is the only source of Nickel ore of India, the waste materials including the top soil and Laterite will be preserved for Nickel ore in future.

(5) Bulk samples may be drawn duly from different horizons and sent to Government Laboratory for analysis to prove the occurrence of Nickel. If core samples are available it should be analyzed

Annex. 22

(6) The analysis report of samples collected should be preserved for future reference.

(7) Further Compliance to other statutory requirements as applicable in such cases is to be made by OMC Ltd, particularly the provisions of Forest (conservation) Act with regard to land use pattern.

Yours faithfully

10.X.13

Under Secretary to Government

Memo No. 9806 Date 10-10-2013

Copy forwarded to Director of Mines (O),Bhubaneswar for information & necessary action with reference to his letter No-9529, DM Dated 07.09.2013.

10.X.13

Under Secretary to Government

Annex. 23

Odisha Mining Corporation Limited

(A GOLD CATEGORY STATE PSU)

An Undertaking by Board of Directors of lessee with regards to their working in other firms/ Company/Organisation

Sl. No.	N a m e	Position	Name of other firms/ company/ organisation	Signature
01.	Sri Saswat Mishra, IAS	Chairman-cum-MD, OMC Ltd.	Director :- 1) M/s. Neelachal Ispat Nigam Ltd. 2) M/s. Odisha Thermal Power Corpn. Ltd. 3) M/s. Kalinga Coal Mining (P) Ltd, 4) M/s. East Coast Bauxite Mining Co. (P) Ltd., 5) M/s. Mandakini-B Coal Corp. Ltd. 6) M/s. South West Odisha Bauxite Mining Co. (P) Ltd. 7) M/s. Odisha Rural Housing & Development Corp. Ltd. 8) M/s. Nuagaon Coal Company Ltd.	
02.	Sri Rajesh Verma, IAS	Director	Director: I) Odisha Mining Corporation Ltd., Bhubaneswar. II) Industrial Promotion and Investment Corporation of Odisha Ltd., (IPICOL), Bhubaneswar. III) Industrial Development Corporation of Orissa Limited, Bhubahensar. Iv) Neelachal Ispat Nigam Limited, Bhubaneswar.	
03.	Sri C. J. Venugopal, IAS	Director	Director: Odisha Mining Corporation Ltd.,	
04.	Sri B. K. Rath, OFS	Director	Director : Odisha Mining Corporation Ltd.,	
05.	Sri Priyanath Padhi, IFS	Director	Director : I) Odisha Mining Corporation Limited, II) Odisha Forest Corporation Limited.	
06.	Sri Deepak Kumar Mohanty, IFS	Director	Director : Odisha Mining Corporation Ltd.,	
07.	Sri C. R. Das	Director	Director :-I) Odisha Mining Corpn. Ltd. II) Odisha Thermal Power Corpn. Ltd.	
08.	Sri D. K. Roy	Director	Director - 1. Odisha Mining Corporation Ltd., 2. Odisha Power Transmission Corporation Ltd. 3. Grid Corporation Ltd., BBSR 4. OTPCL, Bhubaneswar. 5. CESU- Member, Management Committee. 1. President, Friends of JDCA 2. President, Nayapalli Community Care Association, Nayapalli.	

10/12/13

S.R. Mohapatra
Secretary, OMC

Cont P/2

Annex : 23

OMC **Odisha Mining Corporation Limited**
(A GOLD CATEGORY STATE PSU)

09.	Sri S. N. Padhi	Director	Director, OMC Ltd., BBSR.	
			Director, Quality Mining Solutions (P) Ltd., Sambalpur.	
10.	Dr. S. Acharya	Director	Director, OMC Ltd., BBSR.	
			Director, Indian Metals & Ferro Alloys Ltd., Bhubaneswar.	
			President, Odisha Environmental Society(OES), Bhubaneswar.	
			Advisor -Society of Geoscientists and Allied Tech. (SGAT)	
			JDCA- Trustee Member	
11.	Sri G. S. Khuntia	Director	Director, OMC Ltd., BBSR.	
			Partner, India International Mining Consultancy & Service, BBSR.	
			Council Member, SGAT, Bhubaneswar. Institution of Engineers (India), Odisha MGMI MRAI IGS, Roorkee Vice-President, MDC on SHE Member of RINL Board Committee on Transit & Handling Loss of Raw Materials as outside Expert.	

10/12/13

S.R. Mohapatra
Secretary, OMC

Annx.A.24

KA - DGM GLCD

~~ANNEXURE - II~~

DISTRICT MINING OFFICE : BIDYADHARPUR, CUTTACK-12.

No. _____ /Mines, Dt.

To

The Regional Manager,
M/s.OMC, Ltd.
Joda (Via Keonjhar)

Sub:- Grant of surface right operation over an area of 649.96 acres within th. lease-hold area of 949.77 acres in village Sukarangi under P.S. Sukinda in the district of Cuttack.

Ref:- Your letter No. 7046/OMC Dt. 18.10.84.

Sir,

With reference to your letter cited above, you are hereby granted surface right permission over 649.96 acres (as per land schedule enclosed) and recommended by the Senior Mining Officer, Joda Road and Divisional Forest Officer, Keonjhar within the above leasehold area of 949.77 acres excluding an area of 12.09 hectares covering from plot No. 5 to 24 of village Surubili which is being used by the tenant as their homested and vital forest block bearing (forest block 27 - 36.10 acres, Kamardo forest block No. 27-58.25 acres and ~~1/4~~ th of Sukarangi No. 19 i.e. 4(nos) over 1.35 acres from the applied surface right area of 702.40 acres as per terms and conditions under clause 2 of part III of mining lease subject to the following conditions.

1. You shall pay compensatory plantation cost for the entire area granted under surface right and value of the forest growth to the D.F.O., Keonjhar before going in to the area for mining purpose.

2. You shall indemnify and reimburse to Government and third parties as laid down in clause 2 of part VIII, clause 3 & 15 of part VII and clause 4 and 6 part III of the said lease deed.

Yours Faithfully,

Sd/- ---

COLLECTOR, CUTTACK

Memo No. 3014 /Mines, Dt. 24.11.84

Copy forwarded to the Senior Mining Officer, Joda Road for information and necessary action with reference to his letter No. 3248 dated 6.11.84.

24-11-84

COLLECTOR, CUTTACK

Approved,

Sd/- ---
Addl. Secretary to Govt.
Mines Department.

Annex. 24

(4)

OFFICE: CENTRAL OFFICE: BADAMBADI: CUTTACK-13.

No. [illegible] Dt. 24.11.84

To

The Regional Manager,
M/s. I.D.C. Ltd.,
Jajpur Road

Subj:- Grant of surface right operation over an area of 549.96 acres within the lease-hold area of 945.71 acres in village Sukinda under P.S. Sukinda in the district of Cuttack.

Ref:- Your letter No.7048/OMC Dt. 18.10.84.

Sir,

With reference to your letter cited above, you are hereby granted surface right permission over 549.96 acres (as per land schedule enclosed and recommended by the Senior Mining Officer, Jajpur Road and Divisional Forest Officer, Keonjhar) withing the above lease-hold area of 945.71 acres excluding an area of 13.09 hectares covering from plot No. 5 to 24 of village Surabali which is being used by the tenant as their homestead and vital forest block measuring (forest block 27 - 36.10 acres, Kumarda Forest Block No. 22-58.25 acres and ¼ th of Sukinda No.16 i.e. ¼x160) over 139.35 acres from the applied surface right area of 702.40 acres as per terms and conditions under clause 2 of part III of Mining lease subject to the following conditions.

1. You shall pay compensatory plantation cost for the entire area granted under surface right and value of the forest growth to the D.F.O., Keonjhar before going in to the area for mining purpose.

2. You shall indemnify and reimburse to Government any claim/ [illegible] as laid down in clause 2 of part VIII, clauses 14 & 15 of part VII and clause 4 and 5 part III of the said lease deed.

Yours faithfully,

Sd,
24.11.84
COLLECTOR, CUTTACK

Yours [illegible] above.

To THE ORISSA MINING CORPORATION LIMITED
REGIONAL OFFICE: CHROME REGION
JAJPUR ROAD

No. [illegible]/7048/OMC Date 30-11-1984

Copy along with copies of land schedule forwarded to the Mines Manager, Sukinda/Kaliapani for information.

MANAGER (TECHNICAL)

Annexure-24

APPLICATION FOR SURFACE RIGHT

-SCHEDULE OF LANDS APPLIED FOR SURFACE RIGHT 702.40 ACRES AREAS OUT OF 945.71 ACRES 302.769 HECTOR FOR CHROMITE IN VILLAGE OSTAPAL NO.20, BAILANGI 21, KAMARDA 22, FOREST BLOCK NO.27, SARUABIL NO.19 AND SUKINDOI 18 IN FAVOUR OF M/S.ORISSA MINING CORPORATION LIMITED.

VILLAGE OSTAPAL 20

Khata No.	Plot No.	Name of the owner	Kisam	Area in Acre	Remarks
27	P 147	Anabadi Govt.	Sala Jungle	96.87	Part
"	P 150/151	-do-	Sala Jungle	4.07	Part
TOTAL :				100.94	

VILLAGE BAILANGI - 21

50	P [illegible]	[illegible] Govt.	Sala Jungle	5.42	Part
TOTAL:				5.42	

VILLAGE KAMARDA NO. 22

1	P 5	Anabadi Govt.	Sala Jungle	58.25	- Excluded
TOTAL:				58.25	-

FOREST BLOCK NO. 27	36.10	-	Part Excluded

VILLAGE SARUABIL NO. 19

34	1	Anabadi	Sala Jungle	135.04	Part
34	5	-do-	Purana Padia	2.84	
34	6	-do-	-do-	1.17	
34	7	-do-	-do-	1.46	
34	8	-do-	-do-	1.27	
34	9	-do-	-do-	0.59	
34	10	-do-	-do-	0.40	
34	11	-do-	-do-	0.50	
34	12	-do-	-do-	0.70	
34	13	-do-	-do-	0.43	
34	14	-do-	-do-	0.49	
34	15	-do-	-do-	0.56	
34	16	-do-	-do-	0.44	
34	17	-do-	-do-	0.39	
34	18	-do-	-do-	0.23	
34	19	-do-	-do-	0.40	
34	20	-do-	-do-	0.39	
34	21	-do-	-do-	0.40	
34	22	-do-	-do-	0.23	
34	23	-do-	-do-	0.23	
34	24	-do-	-do-	0.29	
34	25	-do-	Purana Padda	0.35	

Excluded area of 13.09 acres

.....2.

Annex - 24

No.	Plot No.	Name of the Owner	Mauza	Area in Acre	Remarks
	220	[illegible]	Purana Padia	1,06	
34	248	-do-	-do-	3,10	
34	261	-do-	-do-	1.07	
34	263	-do-	-do-	2,77	
34	264	-do-	Sala Jungle	4.01	
34	265	-do-	Purana Padia	2.66	
34	266	-do-	-do-	0.61	
34	267	-do-	-do-	1,78	
34	268	-do-	-do-	4,24	
34	270	-do-	-do-	2,12	
34	271	-do-	-do-	10,12	
34	272	-do-	-do-	3,95	
34	273	-do-	-do-	1,39	
34	274	-do-	-do-	0.67	
34	275	-do-	-do-	0,75	
34	276	-do-	-do-	0,60	
34	277	-do-	-do-	1,00	
34	278	-do-	-do-	2.14	
34	279	-do-	-do-	1.80	
34	280	-do-	-do-	0,89	
34	P 281	-do-	-do-	0.31	Part
34	282	-do-	-do-	3,15	
34	283	-do-	-do-	1.88	
34	284	-do-	-do-	2.26	
34	P 285	-do-	-do-	3,15	Part
34	P 286	-do-	-do-	2.26	Part
34	287	-do-	-do-	0,60	
34	288	-do-	-do-	1,05	
34	289	-do-	Sala Jungle	1,18	
34	290	-do-	Purana Padia	0,10	
34	291	-do-	-do-	0,47	
34	P 304	[illegible]	Purana Padia	2,26	Part
34	307	-do-	-do-	1,12	
34	308	-do-	-do-	0,53	
34	P 309	-do-	-do-	1,25	Part
34	P 313	-do-	-do-	0,15	Part
34	P 316	-do-	-do-	0,05	Part
34	P 317	-do-	-do-	3,35	Part
34	P 318	-do-	Sala Jungle	9,40	Part
34	P 319	-do-	Purana Padia	0,66	Part
34	P 320	-do-	-do-	0,26	Part

...3.

Annex. 21

	Plot No.	Name of the Owner	Kisam	Area in Acre	Remarks
	P 333	A R A B A D I	Jungle	0.06	Part
4	169/427	-do-	Puruna Padia	0.27	
34	416	-do-	Sala Jungle	86.38	
TOTAL				321.47	

VILLAGE SUKRANGI NO.16

24	P 1	A R A B A D I	Bad Jungle	1.93	Part
24	P 124	-do-	Puruna Padia	0.36	Part.
24	P 135	-do-	-do-	0.10	
24	137	-do-	-do-	2.28	
24	152	-do-	-do-	0.06	
24	P 176	-do-	-do-	175.47	
TOTAL				180.22 x 1/4th=45.055	

Acres excluded

XX

A B S T R A C T

VILLAGE	OSTAPAL No.20	100.94	
"	TALLANGI NO.21	5.42	Part
"	PANADA NO.22	58.25	Excluded
"	FOREST BLOCK No.27	16.10	Excluded
"	SARUABIL No.19	321.47	
"	SUKRANGI No.16	180.22 - 45.055	
		549.96 Acres	

Sd/- S.N.Mishra
14.10.86
Regional Manager

//True copy//

Annex. 25

REGISTERED.

GOVERNMENT OF INDIA
MINISTRY OF LABOUR
DIRECTORATE GENERAL OF MINES SAFETY
*****

B.Exam/Exempt/SPV/Rect/ 48 /Dated, Dhanbad, 01/03/01 19 .

To
Sri PRIYARANJAN BISWAL
AT:& PO: TANDIKUL, VIA:TIRAN,
DIST: JAGATSINGHPUR,
ORISSA, PIN:754138.



Priyaranjan Biswal
The photograph is attested

MEMORANDUM

Ref:- His application dated 1.11.2000 .

By virtue of Government Notification No.712(E) dated 11.12.74, Sri PRIYARANJAN BISWAL S/O. SRI UDAYA NATH BISWAL of village TANDIKUL, Thana BALIKUDA, District JAGATSINGHPUR State ORISSA born on 1st November, 1971 (Seventyone) possessing Diploma in Mining Engineering and Mine Surveying approved under Regulation 17 of the Metalliferous Mines Regulations,1961 and on completion of the prescribed experience/has become eligible to work in a capacity requiring possession of Surveyor's Certificate in a Metal Mine having opencast workings only.

This Certificate is effective from 08.12.1999 till the above notification remains in force.

Secretary,
Board of Mining Examinations and
Director of Mines Safety(Exam.)

Enclo:
1:Diploma Certificate.
2:S.S.C./Matric Cert.
3.First Aid Certificate

Annex. 2.6.

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No /OMC/CPC/2011 Date.

To

1. The Controller General,
   Indian Bureau of mines, Nagpur,
   PIN-440001.
2. The Controller of Mines,
   Indian Bureau of Mines, Nagpur,
   PIN-440001.
3. The Regional Controller of Mines,
   Indian Bureau of Mines, Bhubaneswar,
   PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrungi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the Boreholes drilled (proposed/completed) in Form -J in Sukrungi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Camp Officer
Chirigunia Prospecting Camp

Memo No. /OMC/CPC/2011 Date.

Copy to Dy. General Manager (Geo), HO, Bhubaneswar /Sr. Manager(Geo), Prospecting Division, J.K Road for kind information.

Camp Officer
Chirigunia Prospecting Camp

Annexure-26

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

Reg No: M 000253(10 OR 12011

MINE CODE _____

To

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.
2. The Controller of Mines, Indian Bureau of Mines, PIN 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 751016, Bhubaneswar
4. State Government concerned.

1. Name of prospect/mine and mineral worked/prospected. Chirigunda Prospecting Camp (Sukhuagi Chromite Mines)
2. Name and address of licensee. M/S Orissa Mining Corporation Limited Bhubaneswar-1
3. Location
   (i) Toposheet Number 73 G/16
   (ii) Village - Sukuagi, Sonuabil, Ostapal, Tailanga, Kamanda
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre-40 metres indicating the precise location of the shaft/borehole). 9 nos. of boreholes (List of boreholes with Plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike conti. with and depth persistence of the zones
6. Type of shaft(s)/contemplated and its/their dimension(s). - NA
7. Type of drill used and size of core to be obtained. Diamond core drilling (Core Size:- HQ, NQ, BQ, HX, NX, BX
8. Intended depth upto which shaft/boreholes is to be extended. List of boreholes with intended depth attached
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. Not applicable
10. Name and qualification of the geologist or mining engineer in charge of the operation. K. C Rath, MSc (Geology) Manager (Geology)
11. Date of commencement of proposed shaft sinking/drilling operation. 13.09.2011

Place: Chirigunda Camp
Date: 13.9.11

Signature
Name in full Kalia Chandra Rath
Designation: Owner/Agent/Mining Engineer/Geologist/Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26.

PROPOSED/COMPLETED BOREHOLES FOR LOCATING CHROMITE BAND NO. III (North-Flank) OF SUKRANGI CHROMITE MINES OF M/S ORISSA MINING CORPORATION LIMITED.

SL NO.	PROPOSED/ COMPLETED BOREHOLE NO.	CHROMITE BAND	LOCATION	PROPOSED/ COMPLETED DEPTH (M)	REMARKS
1.	SKG/45	Band-III (North-flank)	500E/10S	250M	Closed on dt.6.10.11
2.	SKG/46	-do-	500E/120S	250M	Closed on dt.11.10.11
3.	SKG/47	-do-	500E/306S	130M	Closed on dt.15.10.11
4.	SKG/48	-do-	400E/100N	50M	Closed on dt.24.10.11
5.	SKG/49	-do-	200E/115N	50M	Closed on dt.27.10.11
6.	SKG/50	-do-	100E/150N	50M	Closed on dt.3.11.11
7.	SKG/51	-do-	300E/300S	140M	Running
8.	SKG/52	-do-	600E/40N	60M	Closed on dt.11.11.11
9.	SKG/53	-do-	100E/315S	150M	Running

Camp Officer
Chiriganin Camp

Annex. 26.

FORM-J

(Notice of sinking shafts and boreholes)
(See Rule 47)

RQD No : MOOO25/BHU OR 1201

MINE CODE _____

To

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.
2. The Controller of Mines, Indian Bureau of Mines, PIN 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 754116, Bhubaneswar
4. State Government concerned.

1. Name of prospect/mine and mineral worked/ prospected. Chhatisgunda Prospecting Camp (Sukerapgi Chromite Mineral)
2. Name and address of Licensee M/s Orissa Mining Corporation Limited Bhubaneswar-1
3. Location
   (i) Toposheet Number : 73 G/16
   (ii) Village : Sukerapgi, Sarubeli, Odapali, Tallagaj, Kasarda
   (iii) Taluka : Sukruda
   (iv) District : Jajpur
   (v) State : Orissa
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre=40 metres indicating the precise location of the shaft/borehole). 4 Nos. of boreholes (List of boreholes with plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike continuity and depth persistence of ore zones
6. Type of shaft(s)/contemplated and its/their dimension(s). - NA -
7. Type of drill used and size of core to be obtained. Diamond Core drilling - Core Size : AQ, NQ, BQ, HX, NX, PX
8. Intended depth upto which shaft/boreholes is to be sunk or extended. List of boreholes with extended depth attached
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. Not applicable
10. Name and qualification of the geological or mining engineer in charge of the operation.
11. Date of commencement of proposed shaft sinking/ drilling operation. 24.11.11

Place: Chhatisgunda Camp
Date:

Signature
Name in full
Designation: Owner/ Agent/Mining Engineer/Geologist/ Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26

PROPOSED BOREHOLES OF CHROMITE BAND NO. BAND-III(NORTH- FLANK), SUKRANGI CHROMITE MINES OF M/S ORISSA MINING CORPORATION LIMITED

PROPOSED BOREHOLE NO	LOCATION		R.L. AT COLLAR	ANGLE / BEARING TRUE NORTH	PROPOSED DEPTH	DATE OF COMMEN CEMENT
	CS	LS	(M)		(M)	
1	2	3	4	5	6	7
SKG/54	300E	500S	145.535	50°	60.00	24.11.11
SKG/55	400E	780S	152.533	50°	60.00	———
SKG/56	700E	640S	153.144	50°	80.00	———
SKG/58	1000E	480S	152.570	50°	100.00	———

Annexure-26.

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No /OMC/CPC/2011 Date.

To

545 14.12.11 1. The Controller General,
Indian Bureau of mines, Nagpur,
PIN-440001.

546 14-12-11 2. The Controller of Mines,.
Indian Bureau of Mines, Nagpur,
PIN-440001.

548 14.12.11 3. The Regional Controller of Mines,
Indian Bureau of Mines, Bhubaneswar,
PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrungi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the proposed boreholes in Form -J in Sukrungi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

13/12/11

Camp Officer
Chirigunia Prospecting Camp

Memo No. 548 (5.) /OMC/CPC/2011 Date. 14.12.11

Copy to Dy. General Manager (Geo), HO, Bhubaneswar /Sr. Manager (Geo), Prospecting Division, J.K Road for kind information.

13/12/11

Camp Officer
Chirigunia Prospecting Camp

Annex. 2-b

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

R&D NO-M00026 BHU 07/20-1
MINE CODE

To

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.
2. The Controller of Mines, Indian Bureau of Mines, PIN 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 751016, Bhubaneswar
4. State Government concerned.

1. Name of prospect/mine and mineral worked/ Chitrigunta Prospecting Camp prospected, (Sukerange Chromite Mines)
2. Name and address of Licensee M/s Odisha Mining Corporation Limited Bhubaneswar - 1
3. Location
   (i) Toposheet Number 73 G/16
   (ii) Village - Sukerange, Baruabil, Ostapal, Tailange, Kamarda
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre-40 metres indicating the precise location of the shaft/borehole). - Nos. of boreholes - 4 (List of boreholes with Plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. - To prove the strike continuity and depth persistence of ore zones.
6. Type of shaft(s)/contemplated and its/their dimension(s). - N.A -
7. Type of drill used and size of core to be obtained. Diamond core drilling NX, BX, HQ, NQ
8. Intended depth upto which shaft/boreholes is to be extended. - 180.0 Mts
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. - Not applicable
10. Name and qualification of the geologist or mining engineer in charge of the operation. - K. C. Rath, MSc (Geology) Manager (Geology)
11. Date of commencement of proposed shaft sinking/ drilling operation. - 16.12.2011

Place: Chitrigunta Camp.
Date: 13.12.2011

Signature
Name in full Kali Charan Rath
Designation: Owner/ Agent/Mining Engineer/Geologist/ Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26

PROPOSED BOREHOLES OF CHROMITE BAND NO. III (South- Flank) OF SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Proposed Borehole No	Drill Hole No	Location	Proposed depth	Remarks
PDH/1	SKG/57	CS= 350W LS= 109N	180.00 mts	Borehole started on 16.12.11 and continuing
PDH/2	SKG/58	CS= 250E LS= 100N	180.00 mts	

Camp Officer
Chirigunia Prospecting Camp

By REG'D. POST

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No /OMC/CPC/2012 Date.

To,

1. The Controller General,
   Indian Bureau of mines, Nagpur,
   PIN-440001.
2. The Controller of Mines,
   Indian Bureau of Mines, Nagpur,
   PIN-440001.
3. The Regional Controller of Mines,
   Indian Bureau of Mines, Bhubaneswar,
   PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrungi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the proposed boreholes in Form -J in Sukrungi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Camp Officer
Chirigunia Prospecting Camp

Memo No. /OMC/CPC/2012 Date.

Copy to Dy. General Manager (Geo), HO, Bhubaneswar /Sr. Manager (Geo), Prospecting Division, J.K Road for kind information.

Camp Officer
Chirigunia Prospecting Camp

Annex. 26.

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

RQD Nr. MONG 25 BIU OR 1208

MINE CODE

To

1. The Controller General,
Indian Bureau of Mines,
Nagpur-440001.

2. The Controller of Mines,
Indian Bureau of Mines,
PIN 440001, Nagpur

3. The Regional Controller of Mines
Indian Bureau of Mines,
PIN 751016, Bhubaneswar

4. State Government concerned.

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

Name of prospect/mine and mineral worked/ prospected. Khairiguda Prospecting Camp (Sukinda Chromite Mines)

Name and address of Licensee - M/s Odisha Mining Corporation Limited, Bhubaneswar - 1

Location

(i) Toposheet Number - 74 B/16

(ii) Village - Sukinda, Saruabil, Ostapal, Tarkera, Kamarda

(iii) Taluka - Sukinda

(iv) District - Jajpur

(v) State - Odisha

Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre-40 metres indicating the precise location of the shaft/borehole). 2 nos of boreholes (Plan of boreholes not to be submitted)

Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the chromite reserves and Copper-pyrite mineralisation

Type of shaft(s)/contemplated and its/their dimension(s). - N/A

Type of drill used and size of core to be obtained. Diamond Core drilling - NX, BX, AQ, N/A

Intended depth upto which shaft/boreholes is to be extended. 250 mts

If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. - N/A

Name and qualification of the geologist or mining engineer in charge of the operation. K. C. Pati, M.Sc (Geology) Manager (Opers)

Date of commencement of proposed shaft sinking/ drilling operation. 16.01.2013

Place: Khairiguda
Date: 22.07.12.

Signature
Name in full
Designation: Owner/ Agent/Mining Engineer

Annex. 26

PROPOSED BOREHOLES OF CHROMITE BAND NO. IV (South- Flank) OF SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Proposed Borehole No	Drill Hole No	Location	Proposed depth	Remarks
PDH/3	SKG/60	CS= 250W LS= 200N	240.00 mts	Borehole started on 14.01.12 and continuing
PDH/4	SKG/61	CS= 250E LS= 280N	240.00 mts	Borehole started on 19.01.12 and continuing

Camp Officer
Chirigunia Prospecting Camp

Annexure. 2.6.

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

RQD NO: M/BBS/BHO/IR/2011
MINE CODE

To

1. The Controller General,
Indian Bureau of Mines,
Nagpur-440001.

2. The Controller of Mines,
Indian Bureau of Mines,
PIN 440001, Nagpur

3. The Regional Controller of Mines,
Indian Bureau of Mines,
PIN 751015, Bhubaneswar

4. State Government concerned.

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. Name of prospect/mine and mineral worked/prospected, Chhatgunda Prospecting Camp (Sukinda Chromite Mines)
2. Name and address of Licensee M/s Orissa Mining Corporation Limited Bhubaneshwar
3. Location
   (i) Toposheet Number : 73 G/16
   (ii) Village : Sukinda, Sasabil, Ostapal, Tarlagi, Kamarda
   (iii) Taluka : Sukinda
   (iv) District : Jajpur
   (v) State : Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre=40 metres indicating the precise location of the shaft/borehole). 8 Nos. Of boreholes (List of boreholes with Plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. : To prove the strike continuity & depth persistence of Seam V.
6. Type of shaft(s)/contemplated and its/their dimension(s). - NA.
7. Type of drill used and size of core to be obtained. Diamond Core drilling
   Core Size : HQ, NQ, BQ, HX, NX, BX
8. Intended depth upto which shaft/boreholes is to be extended. List of boreholes with intended depth attached.
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. : Not applicable
10. Name and qualification of the geologist or mining engineer in charge of the operation.
11. Date of commencement of proposed shaft sinking/drilling operation. : 15.3.12

Place: Chhatgunda Camp
Date:

Signature
Name in Full
Designation: Owner/Agent/Mining Engineer/Geologist/Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 2.6

PROPOSED BOREHOLES OF CHROMITE BAND NO. BAND-V, SUKRANGI CHROMITE MINES OF M/S ORISSA MINING CORPORATION LIMITED

PROPOSED BOREHOLE NO	LOCATION		R.L. AT COLLAR	ANGLE / BEARING TRUE NORTH	PROPOSED DEPTH	DATE OF COMMENCEMENT
	CS	LS	(M)		(M)	
1	2	3	4	5	6	7
SKG/62	100W	120N	196.558	45°/ S33°E	300.00	15.03.12
SKG/63	200W	70S	205.996	45°	250.00	.....
SKG/64	300W	90S	202.002	45°	250.00	.....

9-1

Annexe. 2.6

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No /OMC/CPC/2012 Date.

To

335 26/9/12 1. The Controller General,
Indian Bureau of mines, Nagpur,
PIN-440001.

336 26/9/12 2. The Controller of Mines,
Indian Bureau of Mines, Nagpur,
PIN-440001.

337 26/9/12 3. The Regional Controller of Mines,
Indian Bureau of Mines, Bhubaneswar,
PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrungi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form -J in Sukrungi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Camp Officer
Chirigunia Prospecting Camp

Encl. As above.

Memo No. 338/OMC/CPC/2012 Date. 26/9/12

Copy to the Sr. Manager (Geo), H.O. Bhubaneswar for kind information.

Camp Officer
Chirigunia Prospecting Camp

Annexure - 26 -

05

FORM-J

(Notice of sinking shafts and boreholes)

(see rule 47)

RGD NO M000025 BHU OR 120 M

MINE CODE _____

IMPORTANT

Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/ boreholes.

1. The Controller General,
Indian Bureau of Mines
Nagpur-440001

2. The Controller of Mines
Indian Bureau of Mines
PIN 440001, Nagpur

3. The Regional Controller of Mines
Indian Bureau of Mines,
PIN 751013, Bhubaneswar

4. State Government concerned

1. Name of prospect/mine and mineral worked/ prospected. Chirigania prospecting camp (Sukrungi chromite)
2. Name and address of Licensee/Lessee M/s odisha Mining Cooperation Limited, Bhubaneswar
3. Location
   (i) Toposheet Number 73 G/16
   (ii) Village Sukrungi, Sasiabil, Astapal, Tailangi, Kamarda
   (iii) Taluka Sukinda
   (iv) District Jajpur
   (v) State odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale not less than 1 centimetre = 40 metres indicating the precise location of the shaft/Borehole.) 3 nos. of boreholes (list of boreholes with plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike continuity and depth persistence of ore zone.
6. Type of shaft (s)/contemplated and its/their dimension(s). N.A
7. Type of drill used and size of core to be obtained. Diamond core drilling (NX, BX, HQ, NQ)
8. Intended depth upto which shaft/ boreholes is to be extended. 250.00 mts.
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. Not applicable
10. Name and qualification of the geologist or mining engineer incharge of the operation. K.C. Rath, Msc (Geology)
    Manager (Geology)
11. Date of commencement of proposed shaft sinking/drilling operation

Place: Chirigania
Date: 31.12.15

Signature:
Name in full: Kedar Chandra Rath
Designation/Owner Agent/Mining Engineer/ Geologist/Manager: Manager (Geo)

*This should be sent to the Controller of Mines and Regional Controller of Mines having jurisdiction the area/mine falls as notified from time to time by the Controller General of Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26.

DETAILS OF BOREHOLES OF CHROMITE BAND NO. V (South- Flank) OF SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

BOREHOLE No	Location / R.L.	Proposed depth	Remarks
SKG/65	CS= 00 LS= 80S R.L.= 201.455 mtr	250.00 mts	Borehole started on 23.07.12 and continuing
SKG/66	CS= 100E LS= 60S R.L.= 199.791 mtr	250.00 mts	Borehole started on 31.07.12 and continuing
SKG/67	CS= 100E LS= 160S R.L.= 205.039 mtr	250.00 mts	Borehole started on 14.08.12 and continuing

Camp Officer
Chirigunia Prospecting Camp

Annex. 26.

O/C

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No /OMC/CPC/2012 Date. 13.09.12

To

396 13/9/12 1. The Controller General,
Indian Bureau of mines, Nagpur,
PIN-440001.

397 13/9/12 2. The Controller of Mines,
Indian Bureau of Mines, Nagpur,
PIN-440001.

398 13/9/12 3. The Regional Controller of Mines,
Indian Bureau of Mines, Bhubaneswar,
PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrungi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form -J in Sukrungi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

13/9/12
Camp Officer
Chirigunia Prospecting Camp

Memo No. 399 /OMC/CPC/2012 Date. 13.9.12.

Copy to the Sr. Manager (Geo), H.O. Bhubaneswar for kind information.

O/C

13/9/12
Camp Officer
Chirigunia Prospecting Camp

Annex. 2-6

FORM-I

(Notice of sinking shafts and boreholes)
(see rule 17)

RQ No. M-[illegible] 2.5 BMV OR/2.001
MINE CODE _____

IMPORTANT

Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/ boreholes.

To

1. The Controller General,
Indian Bureau of Mines,
Nagpur-440001.
2. The Controller of Mines,
Indian Bureau of Mines,
PIN .....
3. The Regional Controller of Mines,
Indian Bureau of Mines.
PIN 751001.6
4. State Government concerned

1. Name of prospect/mine and mineral worked/ prospected. CHIRIGUNIA PROSPECTING CAMP (CHROMITE)
2. Name and address of Licensee/Lessee M/S ODISHA MINING CORPORATION LTD BHUBANESWAR-1
3. Location
   (i) Toposheet Number 73 G/11
   (ii) Village Sukarangi, Samabal, Osthapal, Tailangi, Kamarda
   (iii) Taluka
   (iv) District SUKINDA
   (v) State JAJPUR ODISHA
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale not less than 1 centimetre = 10 metres indicating the precise location of the shaft/borehole.) 3 nos. Bore Hole. (plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike continuity and depth persistence of ore zone.
6. Type of shaft (s)/contemplated and its/their dimension(s). N/A.
7. Type of drill used and size of core to be obtained. DIAMOND CORE DRILLING. 250 m/m (NX, HQ, NQ)
8. Intended depth upto which shaft/ boreholes is to be extended. N.A.
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk.
10. Name and qualification of the geologist or mining engineer incharge of the operation. K. C. RATH M.Sc (Appl) Geology Manager (Geo)
11. Date of commencement of proposed shaft sinking/drilling operation.

Place: CHIRIGUNIA
Date: 13.03.12

Signature: [signature] Kal. Charan Rath
Name in full:
Designation:Owner Agent/Mining Engineer/ Geologist/Manager. Manager (Geo)

*This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26

DETAILS OF BOREHOLES OF CHROMITE BAND NO. V (South- Flank) OF SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

BOREHOLE No	Location / R.L.	Proposed depth	Remarks
SKG/6 8	CS= 200E LS= 10S R.L.= 195.822 mtr	250.00 mts	Borehole started on 03.09.12 and continuing
SKG/69	CS= 100E LS= 40N R.L.= 194.795 mtr	250.00 mts	Borehole started on 12.09.12 and continuing
SKG/70	CS= 00 LS= 20S R.L.= 198.872 mtr	250.00 mts	Borehole started on 12.09.12 and continuing

Camp Officer
Chirigunia Prospecting Camp

Annexure-26
C/C

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

No 471 /OMC/CPC/2012 Date. 26/11/12.

To
1. The Controller General,
Indian Bureau of mines, Nagpur,
PIN-440001.
2. The Controller of Mines,
Indian Bureau of Mines, Nagpur,
PIN-440001.
3. The Regional Controller of Mines,
Indian Bureau of Mines, Bhubaneswar,
PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrangi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form -J in Sukrangi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Camp Officer
Chirigunia Prospecting Camp
Date. 26.11.12.

Memo No. 471(4)/OMC/CPC/2012

Copy to H.O.D (Geo), H.O, Bhubaneswar for kind information.

Camp Officer
Chirigunia Prospecting Camp

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

EQD No: MOD025 BIII 2011
MINE CODE

To

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.

2. The Controller of Mines, Indian Bureau of Mines, PIN 440001, Nagpur

3. The Regional Controller of Mines, Indian Bureau of Mines, PIN [illegible], Bhubaneswar

4. State Government concerned.

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. Name of prospect/mine and mineral worked/ Chiragunda Prospecting Camp prospected. (Chromite, diamond, Nickel)
2. Name and address of licensee - M/s. Odisha Mining Corporation Limited, Bhubaneswar-1
3. Location
   (i) Toposheet Number - 73G/11
   (ii) Village - Sukenga, Sanabil, Oathpal, Tailangi, Kamardo
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre-40 metres indicating the precise location of the shaft/borehole). - 5 Nos. of boreholes (List of boreholes with plan attached)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. - To prove the chromite contents and rock formations of Chromite Bearing Nos. IV.
6. Type of shaft(s)/contemplated and its/their dimension(s). - N.A
7. Type of drill used and size of core to be obtained. - Diamond Core drilling (BX, HQ, NQ)
8. Intended depth upto which shaft/borehole is to be extended. - 250.00mts
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. - Not applied
10. Name and qualification of the geologist or mining engineer in charge of the operation. - K.C. Pati, MSc (Applied Geology) Manager (Geology)
11. Date of commencement of proposed shaft sinking/ drilling operation. - 19.11.2012

Place: Chiragunda
Date: 16.11.2012

Signature
Name in full - Kali Charan Pati
Designation: Owner/ Agent/Mining Engg. Geologist/ Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1960.

PROPOSED BOREHOLES OF CHROMITE BAND NO. V, SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Borehole No	Location	Angle/Bearing	Proposed depth in metre	Remarks
SKG/74	CS= 300W LS= 30S	45°/N33°W	250.00	Borehole started on 12.11.2012 and continuing
SKG/75	CS= 400E LS= 100N	45°/N33°W	250.00	Borehole started on 23.11.2012 and continuing
SKG/76	CS= 500E LS= 40N	45°/N33°W	250.00	Borehole started on 24.11.2012 and continuing

Camp Officer
Chirigunia Prospecting Camp

THE ODISHA MINING CORPORATION LTD
(A GOLD CATEGORY STATE PSU)
(A Government of Odisha Undertaking)
CHIRIGUNIA PROSPECTING CAMP

Letter No. /OMC/CPC/2013 Date.

To

1. The Controller General,
   Indian Bureau of Mines, Nagpur,
   PIN - 440001.
2. The Controller of Mines,
   Indian Bureau of Mines, Nagpur,
   PIN - 440001.
3. The Regional Controller of Mines,
   Indian Bureau of Mines, Bhubaneswar,
   PIN - 751016.

Sub:- Submission of Return in Form-J in respect of Sukrangi Chromite Mines of M/s O.M.C limited.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form-J in Sukrangi Chromite Mines of M/s Odisha Mining Corporation Limited.

Yours Faithfully,

Sd/--

Camp Officer
Chirigunia Prospecting Camp

Encl. as above

Memo No. 10 /OMC/CPC/2013 Date. 04.01.13

Copy to H.O.D (Geo), H.O, Bhubaneswar for kind information.

04/1/13

Camp Officer
Chirigunia Prospecting Camp

FORM-J

(Notice of sinking shafts and boreholes)

(See rule 47)

RQD No: M00025 BH012011

MINE CODE

To

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.
2. The Controller of Mines, Indian Bureau of Mines, PIN 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 751016, Bhubaneswar
4. State Government concerned.

IMPORTANT

Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. Name of prospect/mine and mineral worked/ prospected. Chiragurnia Prospecting Camp (Camp Courtesy Shri Amit Mining Corporation Limited, Bhubaneswar)
2. Name and address of Licensee M/s Odisha Mining Corporation Limited, Bhubaneswar - 1
3. Location
   (i) Toposheet number - 73 A/16
   (ii) Village - Sukaneda, Sarubeli, Ostapal, Tainge, Kamarda
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre=40 metres indicating the precise location of the shaft/borehole). 4 Nos. of boreholes (Copy of boreholes wise plan submitted)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike continuity and depth persistence of chromite bodies No. V.
6. Type of shafts/contemplated and its/their dimension(s). N.A.
7. Type of drill used and size of core to be obtained. Diamond Core drilling (HQ, NQ)
8. Intended depth upto which shaft/boreholes is to be extended. 250.00 mts
9. If the shaft/borehole commences from underground, the depth of the level at which the shaft/borehole is sunk. Not applied
10. Name and qualification of the geologist or mining engineer in charge of the operations. K. C. Rath, MSc (Applied Geology) Jr. Manager (Geology)
11. Date of commencement of proposed shaft sinking/ drilling operation. 03.12.12

Signature
Name in full
Designation: Owner/ Agent/Mining Engr/ Geologist/ Manager

Place: Chiragurnia
Date: 03.01.2013

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annex. 26

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
CHIRIGUNIA PROSPECTING CAMP

O/C

No /OMC/CPC/2012 Date.

To

443 2-11-12 1. The Controller General,
Indian Bureau of mines, Nagpur,
PIN-440001.

444 2-11-12 2. The Controller of Mines,
Indian Bureau of Mines, Nagpur,
PIN-440001.

445 2-11-12 3. The Regional Controller of Mines,
Indian Bureau of Mines, Bhubaneswar,
PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrangi Chromite Mines of M/s O.M.C.Ltd.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form -J in Sukrangi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Camp Officer
Chirigunia Prospecting Camp
Date. 2-11-12

Encl. As above.

Memo No. 446/OMC/CPC/2012

Copy to H.O.D (Geo), H.O, Bhubaneswar for kind information.

2-11-12

Camp Officer
Chirigunia Prospecting Camp

O/C

Annexure - 2b

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

RGD NO. M 00025 BHU OR/2011
MINE CODE

To

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. The Controller General, Indian Bureau of Mines, Nagpur-440001.
2. The Controller of Mines, Indian Bureau of Mines, PIN: 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 751016, Bhubaneswar
4. State Government concerned.

1. Name of prospect/mine and mineral worked/prospected. Chinaguda Prospecting Camp (Sukrangi Chromite Mines)
2. Name and address of Licencee - M/s Odisha Mining Corporation Limited, Bhubaneswar-1
3. Location
   (i) Toposheet number - 73G/16
   (ii) Village - Sukrangi, Sarubali, Ostapal, Tailangi, Kumarda
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre = 40 metres indicating the precise location of the shaft/borehole). 3 Nos. of boreholes (List of boreholes with plan enclosed)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the strike continuity & depth persistence of chromite bearing No. 'E'
6. Type of shaft(s)/contemplated and its/their dimension(s). - N.A
7. Type of drill used and size of core to be obtained. Diamond core drilling (BX, NQ, NQ)
8. Intended depth upto which shaft/borehole is to be extended. 250.00 mts
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. - Not applicable
10. Name and qualification of the geologist or mining engineer in charge of the operation. K. C. Rath, MSc (Applied Geology) Manager (Geology)
11. Date of commencement of proposed shaft sinking/drilling operation. 09-10-2012

Place: Chinaguda
Date: 29.10.2012

Signature
Name in full Kali Charan Rath
Designation: Owner/Agent/Mining Engineer/Geologist/Manager

This should be sent to the Controller of Mines and Regional Controller of Mines in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 62 of the Mineral Conservation and Development Rules, 1988.

Annexure-2b

PROPOSED BOREHOLES OF CHROMITE BAND NO. V , SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Proposed Borehole No	Drill Hole No	Location	Angle/Bearing	Proposed depth in metre	Remarks
PBH/1	SKG/71	CS= 200W LS= 10N	60^0/N33^{0}W	250.00	Borehole started on 09.10.2012 and continuing
PBH/2	SKG/72	CS= 300E LS= 20N	60^0/N33^{0}W	250.00	Borehole started on 15.10.2012 and continuing
PBH/3	SKG/73	CS= 400E LS= 40N	60^0/N33^{0}W	250.00	Borehole started on 20.10.2012 and continuing

Camp Officer
Chirigunia Prospecting Camp

BOREHOLE ASSAY - BAND IV (NORTH)

BAND/BHID	Depth From	Depth To	Cr_2O_3	Total Fe	SiO_2	Cr:Fe	Core Rec. (%)
4N/SKG-19	0	36	-	-	-	-	30
4N/SKG-19	36	40.5	14.27	10.2	35.47	0.957	21.1
4N/SKG-19	40.5	40.6	-	-	-	-	70
4N/SKG-19	40.6	45	38.31	29.65	2.23	0.883	16.6
4N/SKG-19	45	46.5	51.07	21.4	0.8	1.632	16.7
4N/SKG-19	46.5	71.5	-	-	-	-	-
4N/SKG-19	71.5	73.5	49.92	10.08	6.2	3.387	20
4N/SKG-19	73.5	78.5	-	-	-	-	31.5
4N/SKG-19	78.5	80	47.58	12.88	7.25	2.526	-
4N/SKG-19	80	81	26.08	6.46	26.1	2.982	30
4N/SKG-19	81	82.5	-	-	-	-	16.7
4N/SKG-19	82.5	85	46.97	19.32	4.6	1.663	-
4N/SKG-19	85	86.5	38.22	16.24	8.2	1.81	-
4N/SKG-19	86.5	88	24.96	13.44	22.25	1.27	-
4N/SKG-19	88	94	-	-	-	-	1.33
4N/SKG-20	0	18.5	-	-	-	-	90
4N/SKG-20	18.5	21	13.88	5.32	40.9	1.784	12
4N/SKG-20	21	24	47.36	20.16	2.2	1.607	5
4N/SKG-20	24	27.5	-	-	-	-	16
4N/SKG-20	27.5	28.5	48.32	19.88	0.9	1.662	5
4N/SKG-20	28.5	33	44.52	13.81	5.82	2.205	30
4N/SKG-20	33	55	-	-	-	-	-
4N/SKG-21	0	18	-	-	-	-	75
4N/SKG-21	18	21	20.6	22.4	20.8	0.626	-
4N/SKG-21	21	25.5	-	-	-	-	16
4N/SKG-21	25.5	28.5	17.01	12.44	31.58	0.935	87
4N/SKG-21	28.5	33	-	-	-	-	-
4N/SKG-21	33	36	18.66	16.68	25.8	0.823	-
4N/SKG-21	36	39	-	-	-	-	10
4N/SKG-21	39	40.5	21.41	3.92	33.5	3.736	-
4N/SKG-21	40.5	45	9.94	4.48	42.6	1.517	-
4N/SKG-21	45	49	14.94	7.63	39.1	1.339	-
4N/SKG-21	49	53	-	-	-	-	10
4N/SKG-21	53	56	7.29	7	44.45	-	6.6
4N/SKG-21	56	58.5	17.67	6.72	38	1.8	-
4N/SKG-21	58.5	59	-	-	-	-	20
4N/SKG-21	59	60	11.05	12.32	38.4	-	-
4N/SKG-21	60	63	-	-	-	-	-
4N/SKG-21	63	66	35.32	8.92	37.25	0.621	-
4N/SKG-21	66	69	18.34	12.32	30.65	1.108	-
4N/SKG-21	69	79	-	-	-	-	-
4N/SKG-21	79	81	-	-	-	-	10
4N/SKG-22	0	34.5	-	-	-	-	70
4N/SKG-22	34.5	37	16.5	30.6	15.74	0.37	-
4N/SKG-22	37	39	38.36	15.12	10.2	1.735	15
4N/SKG-22	39	51	-	-	-	-	1.2
4N/SKG-23	0	18	-	-	-	-	75
4N/SKG-24	0	14.5	-	-	-	-	80
4N/SKG-24	14.5	22	22.39	17.77	20.57	0.862	-
4N/SKG-24	22	28.8	-	-	-	-	31.8
4N/SKG-24	28.8	30.3	-	-	-	-	13.3
4N/SKG-24	30.3	33.2	-	-	-	-	-
4N/SKG-24	33.2	45	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/3	0	1.45	-	-	-	-	-
4S/3	1.45	13.1	-	-	-	-	-
4S/3	13.1	15	24.54	-	31.21	8.25	0.768
4S/3	15	17.7	-	-	-	-	-
4S/3	17.7	18.05	6.84	-	45.11	16.4	0.148
4S/3	18.05	19.6	-	-	-	-	-
4S/3	19.6	24.75	16.7	-	38.82	12.07	0.42
4S/3	24.75	27.6	-	-	-	-	-
4S/3	27.6	28.6	21	-	38.37	14.5	0.536
4S/3	28.6	29	-	-	-	-	-
4S/3	29	29.25	14.71	-	39.34	14.5	0.365
4S/3	29.25	30.85	-	-	-	-	-
4S/3	30.85	31.55	34.78	-	25.82	8.2	1.317
4S/3	31.55	32.55	-	-	-	-	-
4S/3	32.55	33.55	22.18	-	29.67	-	0.731
4S/3	33.55	35	-	-	-	-	-
4S/3	35	40.85	-	-	-	-	-
4S/3	40.85	44.4	-	-	-	-	-
4S/3	44.4	46.1	44.97	-	20	7.6	2.198
4S/3	46.1	46.4	-	-	-	-	-
4S/3	46.4	50.85	42.76	-	22.36	7.8	1.87
4S/3	50.85	56.2	-	-	-	-	-
4S/3	56.2	57.7	-	-	-	-	-
4S/3	57.7	58.35	-	-	-	-	-
4S/3	58.35	60.35	46.1	-	17.05	8.6	2.643
4S/3	60.35	75.35	-	-	-	-	-
4S/3	75.35	80.55	-	-	-	-	-
4S/3	80.55	98.3	-	-	-	-	-
4S/44	0	0.8	-	-	-	-	-
4S/44	0.8	8.3	-	-	-	-	-
4S/44	8.3	17.75	-	-	-	-	-
4S/44	17.75	18	30	22.98	2.53	3.49	1.128
4S/44	18	19.9	-	-	-	-	-
4S/44	19.9	20.7	27.03	26.94	3.06	4.5	0.8
4S/44	20.7	23.7	-	-	-	-	-
4S/44	23.7	25.05	38.69	17.64	1.96	8.67	1.754
4S/44	25.05	29.1	-	-	-	-	-
4S/44	29.1	29.4	-	-	-	-	-
4S/44	29.4	30.1	40.69	17.48	2.71	8.6	1.797
4S/44	30.1	32.75	46.2	10.75	5.16	8.35	2.64
4S/44	32.75	35.35	53.62	8.67	7.54	4.3	3.013
4S/44	35.35	41.4	-	-	-	-	-
4S/44	41.4	42.1	15.59	6.7	42	18	0.308
4S/44	42.1	42.65	8.28	6.7	46.2	11	0.145
4S/44	42.65	47	-	-	-	-	-
4S/10	0	0.35	-	-	-	-	-
4S/10	0.35	2.75	-	-	-	-	-
4S/10	2.75	13.05	-	-	-	-	-
4S/10	13.05	48.7	-	-	-	-	-
4S/10	48.7	52.7	15.38	-	53.52	8.77	0.28
4S/10	52.7	53.05	-	-	-	-	-
4S/10	53.05	57.05	20.9	-	16.98	13.87	1.203
4S/10	57.05	58.4	30.26	-	19.32	12.83	2.032
4S/10	58.4	59.75	46.05	-	19.07	9.45	2.36
4S/10	59.75	62.8	18	-	33.56	5.9	0.524
4S/10	62.8	65.8	-	-	-	-	-
4S/10	65.8	70.65	12.15	-	56.92	10.98	0.208
4S/10	70.65	73.8	45.36	-	24.86	6.76	1.784

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/10	73.8	74.05	-	-	-	-	-
4S/10	74.05	76.5	36.61	-	30.17	10.64	1.182
4S/10	76.5	77.4	25.6	-	47.99	9.9	0.521
4S/10	77.4	78.05	47.22	-	21.65	9.05	2.131
4S/10	78.05	82.25	52.63	-	17.32	7.25	2.964
4S/10	82.25	83.25	30	-	26.26	23.4	1.116
4S/10	83.25	83.8	54.46	-	16.31	5.86	3.263
4S/10	83.8	84.55	35.26	-	31.77	8.5	1.084
4S/10	84.55	86.55	52.67	-	17.75	8.23	2.896
4S/10	86.55	88.55	36.53	-	21.22	19.26	1.683
4S/10	88.55	89.55	12.58	-	22.21	6.2	0.553
4S/10	89.55	93.55	4.12	-	24.65	42.33	0.163
4S/10	93.55	99.8	-	-	-	-	-
4S/10	99.8	101.75	27.07	-	21.66	26.97	1.222
4S/10	101.75	109.35	-	-	-	-	-
4S/10	109.35	130.45	-	-	-	-	-
4S/10	130.45	141.25	-	-	-	-	-
4S/45	0	4.6	-	-	-	-	-
4S/45	4.6	15	18.08	4.3	35.06	3.77	0.443
4S/45	15	25.65	-	-	-	-	-
4S/45	25.65	27	23.54	6.64	22.29	2.5	0.775
4S/45	27	29.9	-	-	-	-	-
4S/45	29.9	31.9	22.05	5.18	34.94	2.51	0.53
4S/45	31.9	35.55	-	-	-	-	-
4S/45	35.55	36.5	22.54	4.9	29.05	9.15	0.638
4S/45	36.5	45.3	-	-	-	-	-
4S/45	45.3	46.05	35.35	8	18.97	8.2	1.24
4S/45	46.05	48	52.77	12.3	3.72	4	2.967
4S/45	48	52.25	41.95	14.35	8.9	6.38	1.65
4S/45	52.25	53.6	52.43	14.86	0.86	4.97	2.947
4S/45	53.6	54.35	37.3	6.36	14.43	5.92	1.788
4S/45	54.35	56.55	53	11.12	1.81	3.92	3.658
4S/45	56.55	58.7	40.96	4.97	17.77	7.92	1.719
4S/45	58.7	59.2	-	-	-	-	-
4S/45	59.2	60.7	32.05	3.71	29.32	13.3	0.936
4S/45	60.7	67.75	-	-	-	-	-
4S/46	0	1	-	-	-	-	-
4S/46	1	6.1	-	-	-	-	-
4S/46	6.1	42.25	-	-	-	-	-
4S/46	42.25	51.35	-	-	-	-	-
4S/46	51.35	53.35	26.28	4.54	23.44	12.43	0.902
4S/46	53.35	54.35	34.61	5.82	20.83	12	1.239
4S/46	54.35	57.3	49.9	9.34	7	6.22	2.807
4S/46	57.3	71	-	-	-	-	-
4S/46	71	79	36.37	5.66	16.39	10.65	1.567
4S/46	79	84.45	21.16	4.3	32.88	11.44	0.66
4S/46	84.45	86.45	39.93	8.16	14.66	7.5	1.645
4S/46	86.45	90.6	43.96	7.74	10.07	4.93	2.302
4S/46	90.6	98.6	50.7	10.21	4.78	3.49	3.074
4S/46	98.6	102.2	44.92	11.36	4.56	8.19	2.556
4S/46	102.2	102.4	-	-	-	-	-
4S/18	0	1.8	-	-	-	-	-
4S/18	1.8	12.75	-	-	-	-	-
4S/18	12.75	16.7	-	-	-	-	-
4S/18	16.7	29.7	22.91	19.62	16.58	19.17	0.684
4S/18	29.7	33.9	-	-	-	-	-
4S/18	33.9	37.9	-	-	-	-	-
4S/18	37.9	42.9	26.27	6.55	21.78	8.78	0.883

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/18	42.9	45.9	40.44	8.55	12.75	7.02	1.77
4S/18	45.9	46.9	46.03	2.75	25.58	4.35	1.571
4S/18	46.9	49.9	33.74	5.22	16.26	5.3	1.495
4S/18	49.9	52.7	24.23	2.34	38.77	3.63	0.572
4S/18	52.7	61	-	-	-	-	-
4S/18	61	61.75	39.72	9.34	20.41	7.95	1.261
4S/18	61.75	62.75	47.96	8.62	14.76	7.6	1.926
4S/18	62.75	65.05	52.4	10.62	10.58	6.2	2.288
4S/18	65.05	66.05	36.41	15.74	4.23	6.7	1.638
4S/18	66.05	70.06	49.8	13.22	4.02	5.59	2.602
4S/18	70.06	71.05	57.34	11.24	1.19	6.05	4.1
4S/18	71.05	71.35	37.05	11.16	18.29	6.75	1.18
4S/18	71.35	100.35	-	-	-	-	-
4S/48	0	13.9	-	-	-	-	-
4S/48	13.9	21.4	-	-	-	-	-
4S/48	21.4	23.1	-	-	-	-	-
4S/48	23.1	26.25	-	-	-	-	-
4S/48	26.25	32.7	-	-	-	-	-
4S/48	32.7	33.45	-	-	-	-	-
4S/48	33.45	40	-	-	-	-	-
4S/48	40	41	40.83	7.09	18.8	10.36	1.496
4S/48	41	41.95	47.78	10.39	8.62	10.15	2.316
4S/48	41.95	44.95	51.56	10.73	4.68	10.1	3.036
4S/48	44.95	45.85	26.79	4.9	24.8	21.2	0.866
4S/48	45.85	48.45	35.9	11.06	12.9	14.06	1.393
4S/48	48.45	49.3	18.21	2.8	28.95	21.9	0.555
4S/48	49.3	51.1	46.65	13.59	3.36	7.52	2.471
4S/48	51.1	51.9	50.47	14.16	1.47	6.8	2.868
4S/48	51.9	52.75	19.85	8.24	41.98	14.16	0.303
4S/48	52.75	68	-	-	-	-	-
4S/53	0	10.55	-	-	-	-	-
4S/53	10.55	21.7	-	-	-	-	-
4S/53	21.7	34.65	-	-	-	-	-
4S/53	34.65	50.9	-	-	-	-	-
4S/53	50.9	53.5	51.17	19.78	21.93	1.95	1.783
4S/53	53.5	54.5	42.95	25.25	28.03	2.6	1.497
4S/53	54.5	55.5	51.7	15.89	17.62	2.3	2.863
4S/53	55.5	56.6	55.11	15.89	17.62	2.12	3.052
4S/53	56.6	61	51.32	15.16	16.94	2.29	2.961
4S/53	61	61.7	37.63	24.56	27.23	2.8	1.348
4S/53	61.7	62.4	46.9	18.76	20.82	2.5	2.294
4S/53	62.4	64.55	38.48	22.71	25.17	3.49	1.491
4S/53	64.55	70.7	-	-	-	-	-
4S/53	70.7	72	34.25	23.03	25.53	8.96	1.308
4S/53	72	77.1	45.46	17.87	19.82	8.19	2.238
4S/53	77.1	83.4	-	-	-	-	-
4S/53	83.4	84.4	44.48	16.62	18.42	5.9	2.356
4S/53	84.4	89.7	50.73	16.3	18.07	5.4	2.738
4S/53	89.7	95	-	-	-	-	-
4S/29	0	0.75	-	-	-	-	-
4S/29	0.75	3.25	-	-	-	-	-
4S/29	3.25	16.65	-	-	-	-	-
4S/29	16.65	18.65	8.63	-	60.23	1.83	0.14
4S/29	18.65	21.2	11.57	-	53.87	2.64	0.21
4S/29	21.2	30.7	8.64	-	62.8	14.1	0.134
4S/29	30.7	34.85	44.54	-	21.82	4.46	1.995
4S/29	34.85	38.85	41.44	-	24.63	8.82	1.644
4S/29	38.85	39.45	16.88	-	52.91	8.91	0.321

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/29	39.45	40.7	44.77	-	21.24	5.58	2.06
4S/29	40.7	43.6	50.34	-	21.9	6.18	2.246
4S/29	43.6	44.6	10.45	-	65.03	6.9	0.157
4S/29	44.6	56.75	-	-	-	-	-
4S/29	56.75	57.8	-	-	-	-	-
4S/29	57.8	68.8	49.56	-	16.59	8.3	2.92
4S/29	68.8	59.8	39.22	-	20.3	9.9	1.888
4S/29	59.8	62.8	45.07	-	18.05	6.71	2.44
4S/29	62.8	64.8	50.15	-	18	4.98	2.723
4S/29	64.8	66.2	46.88	-	20.94	6.39	2.189
4S/29	66.2	66.6	24.62	-	50.6	10.22	0.475
4S/29	66.6	70.1	47.67	-	18.79	7.28	2.48
4S/29	70.1	72.7	-	-	-	-	-
4S/50	0	5.5	-	-	-	-	-
4S/50	5.5	8.25	-	-	-	-	-
4S/50	8.25	9.95	-	-	-	-	-
4S/50	9.95	11.95	40.62	7.08	18.64	3.75	1.6
4S/50	11.95	16.65	45.21	8.6	11.87	4.82	2.063
4S/50	16.65	17.45	32.13	4.37	19.01	7.25	1.316
4S/50	17.45	17.75	-	-	-	-	-
4S/50	17.75	18	35.95	1.24	28.37	5.1	1.181
4S/50	18	37.8	-	-	-	-	-
4S/50	37.8	43.65	34.93	2.91	22.98	9.52	1.302
4S/50	43.65	44.25	52.8	5.5	11.57	4.17	2.92
4S/50	44.25	45.9	46.41	2.19	16.35	6	2.415
4S/50	45.9	46.3	51.8	3.12	15.09	4.2	2.728
4S/50	46.3	47.3	46.61	4.48	13.45	6.82	2.472
4S/50	47.3	50.05	33.32	2.6	23.26	5.24	1.245
4S/50	50.05	50.45	-	-	-	-	-
4S/50	50.45	60	-	-	-	-	-
4S/52	0	1.05	-	-	-	-	-
4S/52	1.05	13.7	-	-	-	-	-
4S/52	13.7	52	-	-	-	-	-
4S/52	52	52.6	44.62	0.36	22.44	4.8	1.91
4S/52	52.6	54.1	-	-	-	-	-
4S/52	54.1	56.1	47.53	10.43	9.87	3.65	2.165
4S/52	56.1	57.75	49.8	12.77	7.22	4.06	2.274
4S/52	57.75	58	-	-	-	-	-
4S/52	58	60	50.16	12.36	4.28	3.5	2.722
4S/52	60	63	44.24	8.42	10.51	4.65	2.177
4S/52	63	65.45	40.79	6.91	14.04	4.01	1.836
4S/52	65.45	69.55	26.9	3.66	24.25	8.93	0.928
4S/52	69.55	71.35	-	-	-	-	-
4S/52	71.35	84	-	-	-	-	-
4S/55	0	14.25	-	-	-	-	-
4S/55	14.25	15.65	39.52	6.05	20.17	10.5	1.436
4S/55	15.65	18.75	53.63	11.89	2.64	5.25	3.304
4S/55	18.75	19	-	-	-	-	-
4S/55	19	20.25	62	12.78	2.41	4.42	3.061
4S/55	20.25	20.8	-	-	-	-	-
4S/55	20.8	21.2	52.52	12.64	2.69	5.5	3.068
4S/55	21.2	29	-	-	-	-	-
4S/56	0	3.4	-	-	-	-	-
4S/56	3.4	29.75	-	-	-	-	-
4S/56	29.75	32.75	-	-	-	-	-
4S/56	32.75	33.75	32.63	2.35	21.89	9	0.903
4S/56	33.75	34.75	41.08	7.66	17.85	8	1.523
4S/56	34.75	37.25	25.74	9.2	29.43	7.92	0.834

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/56	37.25	45.25	31.75	5.67	20.37	6.83	1.163
4S/56	45.25	46.15	29.2	5.32	21.61	5	1.037
4S/56	46.15	52.8	-	-	-	-	-
4S/56	52.8	56.4	-	-	-	-	-
4S/56	56.4	57.3	56.45	11.24	2.6	3.5	3.657
4S/56	57.3	57.5	-	-	-	-	-
4S/56	57.5	59.8	52.28	12.28	3.02	2.74	3.034
4S/56	59.8	60.8	66.73	10.78	1.6	2	4.086
4S/56	60.8	61.8	60.17	13.18	1.2	5.53	3.096
4S/56	61.8	62	-	-	-	-	-
4S/56	62	66.75	51.15	13.56	1.66	6.5	3
4S/56	66.75	68.1	45.78	14.83	4.24	7.04	2.16
4S/56	68.1	68.8	52.04	13.54	0.8	4.34	3.211
4S/56	68.8	70.05	20.22	7.24	10.62	10.84	1.06
4S/56	70.05	73.954	-	-	-	-	-
4S/57	0	0.4	-	-	-	-	-
4S/57	0.4	8	16.73	3.71	28.61	10.5	0.5
4S/57	8	12	33.16	3.2	23.42	3.81	1.201
4S/57	12	14	42.28	2.36	19.52	7.5	1.866
4S/57	14	22	38.4	2.13	21.2	5.79	1.51
4S/57	22	23	48.16	3.24	17.73	4.01	2.207
4S/57	23	25	37.44	0.84	23.14	6.05	1.52
4S/57	25	27	20.41	1.98	35.76	11.12	0.525
4S/57	27	35.75	-	-	-	-	-
4S/57	35.75	36.15	26.28	7.04	41.58	6.5	0.52
4S/57	36.15	40	52.61	11.96	4.38	3.64	2.911
4S/57	40	40.85	44.56	10.31	13.95	4.5	1.714
4S/57	40.85	43.7	52.01	11.97	4.8	2.88	2.81
4S/57	43.7	44.2	32.86	6.54	20.8	7	1.144
4S/57	44.2	46.9	-	-	-	-	-
4S/57	46.9	47.15	-	-	-	-	-
4S/57	47.15	48.15	19.18	4.2	47.4	10	0.36
4S/57	48.15	54.25	-	-	-	-	-
4S/SKG/11	0	34	-	-	-	-	-
4S/SKG/11	34	39	25.12	22.74	-	10.02	7.766
4S/SKG/11	39	46.6	32.25	18.72	-	6.6	1.176
4S/SKG/11	46.6	47.3	28.8	20.3	-	7.21	1.103
4S/SKG/11	47.3	57	-	-	-	-	-
4S/SKG/11	57	58.2	56.25	10.55	-	3.5	3.647
4S/SKG/11	58.2	58.7	-	-	-	-	-
4S/SKG/11	58.7	60.8	50.04	14.01	-	3.1	2.443
4S/SKG/11	60.8	61.6	56.35	10.92	-	1.8	3.53
4S/SKG/11	61.6	62.6	50.04	14.01	-	3.1	2.443
4S/SKG/11	62.6	63	-	-	-	-	-
4S/SKG/11	63	67.5	54	11.85	-	2.13	3.117
4S/SKG/11	67.5	69	45.7	14.48	-	7.06	2.158
4S/SKG/11	69	70.25	51.8	13.24	-	3.15	2.676
4S/SKG/11	70.25	72.5	24.22	24.56	-	8.5	0.674
4S/SKG/11	72.5	81	-	-	-	-	-
4S/SKG/15	0	25	-	-	-	-	-
4S/SKG/15	25	46.5	-	-	-	-	-
4S/SKG/15	46.5	54	15.89	30.8	-	18.65	0.353
4S/SKG/15	54	57	50.65	15.12	-	4.55	2.291
4S/SKG/15	57	60	40.72	20.16	-	9.05	1.381
4S/SKG/15	60	63	43.97	19.04	-	3.2	1.58
4S/SKG/15	63	79.5	-	-	-	-	-
4S/SKG/15	79.5	81	31.67	10.64	-	18.5	2.036
4S/SKG/15	81	87	51.06	17.3	-	2.28	2.064

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/15	87	90	-	-	-	-	-
4S/SKG/15	90	96	52.09	16.6	-	2.2	2.121
4S/SKG/15	96	101	-	-	-	-	-
4S/SKG/15	101	102	51.8	17.35	-	2.3	2.042
4S/SKG/15	102	106.2	-	-	-	-	-
4S/11	0	6.7	-	-	-	-	-
4S/11	6.7	7.25	-	-	-	-	-
4S/11	7.25	10	45.55	-	59.87	10.11	0.074
4S/11	10	28.8	-	-	-	-	-
4S/11	28.8	29.3	22.32	-	58.82	4	0.371
4S/11	29.3	40	-	-	-	-	-
4S/11	40	43	18.71	-	58.57	3.66	0.312
4S/11	43	44.45	-	-	-	-	-
4S/11	44.45	45.45	41.33	-	26.85	3.75	1.504
4S/11	45.45	47.95	43.24	-	23.94	3.3	1.765
4S/11	47.95	51.95	52.44	-	19.3	2.2	2.655
4S/11	51.95	53.95	45.88	-	21.27	3.13	2.108
4S/11	53.95	55.6	41.85	-	23.41	4.35	1.747
4S/11	55.6	56.6	52.63	-	16.14	4.98	3.187
4S/11	56.6	57.6	56.5	-	15.73	4.96	3.511
4S/11	57.6	59.6	53.59	-	15.43	6.07	3.394
4S/11	59.6	61	29.35	-	24.43	7.12	1.174
4S/11	61	66.25	-	-	-	-	-
4S/11	66.25	67	7.9	-	40.76	28.26	0.19
4S/11	67	75.5	-	-	-	-	-
4S/11	75.5	76.5	55.08	-	15.32	2.84	3.614
4S/11	76.5	77.95	53.41	-	17.28	6.88	3.021
4S/11	77.95	78.15	-	-	-	-	-
4S/11	78.15	79.15	55.98	-	17.09	5	3.201
4S/11	79.15	81.15	51.14	-	18.76	6	2.664
4S/11	81.15	82.15	41.02	-	23.41	13.5	1.713
4S/11	82.15	83.15	53.44	-	17.07	8.6	3.06
4S/11	83.15	84	43.6	-	17.09	12	2.5
4S/11	84	84.35	30	-	36.85	14.5	0.818
4S/11	84.35	90.1	-	-	-	-	-
4S/11	90.1	150.2	-	-	-	-	-
4S/47	0	1.1	-	-	-	-	-
4S/47	1.1	3.35	-	-	-	-	-
4S/47	3.35	13.85	-	-	-	-	-
4S/47	13.85	38.5	-	-	-	-	-
4S/47	38.5	40.2	-	-	-	-	-
4S/47	40.2	42.2	24.48	4.08	36.86	7.78	0.578
4S/47	42.2	45.2	-	-	-	-	-
4S/47	45.2	47.2	36.6	8.15	13.73	4.43	1.67
4S/47	47.2	48.2	45.63	8.24	10.74	5.9	2.242
4S/47	48.2	49.2	52.76	9.6	6.63	9	3.001
4S/47	49.2	50.2	47.63	8.18	10.81	8.65	2.336
4S/47	50.2	51.65	35.66	7	18.91	9.05	1.306
4S/47	51.65	56	48.02	8	11.25	6.5	2.33
4S/47	56	58	21.82	4.03	27.98	5.77	0.657
4S/47	58	71.8	-	-	-	-	-
4S/47	71.8	78.3	-	-	-	-	-
4S/47	78.3	85.05	-	-	-	-	-
4S/47	85.05	88.9	-	-	-	-	-
4S/47	88.9	89.9	52.29	11.36	5.34	6.71	2.846
4S/47	89.9	90.9	55.26	11.56	2	3	3.64
4S/47	90.9	91.8	50.8	12.65	5.2	6.4	2.597
4S/47	91.8	92.4	56.14	13.14	2.18	7.5	3.278

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/47	92.4	93.55	29.34	6.24	36.68	11.65	0.673
4S/47	93.55	94.24	-	-	-	-	-
4S/51	0	9.95	-	-	-	-	-
4S/51	9.95	19.7	-	-	-	-	-
4S/51	19.7	24.55	-	-	-	-	-
4S/51	24.55	27.85	25.76	6.47	21.24	8.37	0.886
4S/51	27.85	30.85	40.6	9.58	14.44	5.17	1.582
4S/51	30.85	31.85	42.57	9.67	14.78	5	1.63
4S/51	31.85	34.35	33.31	7.9	17.01	8.41	1.262
4S/51	34.35	49.9	-	-	-	-	-
4S/51	49.9	50.2	-	-	-	-	-
4S/51	50.2	51.2	47.01	14.28	5.08	4.25	2.194
4S/51	51.2	52.2	53.54	13.64	2.06	3.65	3.042
4S/51	52.2	52.45	-	-	-	-	-
4S/51	52.45	57.2	51.84	13.82	2.92	5.13	2.773
4S/51	57.2	58.7	46.21	6.1	14.8	6.53	2.093
4S/51	58.7	59.7	55.12	1.8	13.62	4	3.449
4S/51	59.7	60.7	50.75	3.96	13.62	6.65	2.753
4S/51	60.7	61.01	32.5	2.16	34.29	9.8	0.886
4S/51	61.01	64.04	52.62	2.83	13.78	6.96	3.04
4S/51	64.04	64.8	39.87	4.7	21.42	10.3	1.463
4S/51	64.8	65.9	-	-	-	-	-
4S/51	65.9	69	-	-	-	-	-
4S/SKG/18	0	21	-	-	-	-	-
4S/SKG/18	21	24.65	-	-	-	-	-
4S/SKG/18	24.65	25.9	-	-	-	-	-
4S/SKG/18	25.9	30.8	-	-	-	-	-
4S/SKG/18	30.8	34.4	-	-	-	-	-
4S/SKG/18	34.4	36	-	-	-	-	-
4S/SKG/18	36	39	24.63	26.88	-	4.65	0.626
4S/SKG/18	39	40.5	-	-	-	-	-
4S/SKG/18	40.6	41.7	36.35	20.16	-	7.65	1.233
4S/SKG/18	41.7	43.2	46.7	14.48	-	7.06	2.158
4S/SKG/18	43.2	44.1	50.45	15.12	-	3.02	2.282
4S/SKG/18	44.1	45.5	45.65	14.28	-	8.35	2.196
4S/SKG/18	45.5	49.7	37.48	16.24	-	10.8	1.678
4S/SKG/18	49.7	52	60.45	15.12	-	3.2	2.282
4S/SKG/18	52	57	-	-	-	-	-
4S/SKG/18	57	84	-	-	-	-	-
4S/SKG/18	84	87	43.03	22.96	-	2.2	1.281
4S/SKG/18	87	94	50.57	17.92	-	1.9	1.93
4S/SKG/18	94	96	26.56	15.12	-	4.65	1.201
4S/SKG/18	96	99	-	-	-	-	-
4S/SKG/18	99	105	53.07	16.8	-	1.2	2.161
4S/SKG/18	105	108	54.34	15.68	-	0.96	2.37
4S/SKG/18	108	111	42.21	16.24	-	0.95	1.777
4S/SKG/18	111	121	-	-	-	-	
4S/49	0	6.45	-	-	-	-	-
4S/49	6.45	8.1	-	-	-	-	-
4S/49	8.1	9.1	36.57	8.49	28.43	8.3	0.944
4S/49	9.1	10.1	22.09	5.31	34	6.5	0.541
4S/49	10.1	21.1	36.93	6.27	22.57	7.15	1.202
4S/49	21.1	24.1	24.18	3.92	26.82	6.3	0.758
4S/49	24.1	27.1	-	-	-	-	-
4S/49	27.1	40.1	-	-	-	-	-
4S/49	40.1	41.35	27.14	4.6	32.32	11.42	0.708
4S/49	41.35	44.36	51.71	13.77	3.26	6.05	2.725
4S/49	44.36	45.75	57.26	12.32	1.31	3.86	3.732

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/49	45.75	46.05	-	-	-	-	-
4S/49	46.05	48.25	51.24	15.38	2.12	6.64	2.608
4S/49	48.25	48.55	30.12	13.77	15.34	13.27	0.961
4S/49	48.55	56.8	-	-	-	-	-
4S/54	0	6	-	-	-	-	-
4S/54	6	24	-	-	-	-	-
4S/54	24	26.3	37.96	26.43	29.3	6	1.264
4S/54	26.3	28.5	44.8	20.1	22.66	5.83	1.952
4S/54	28.5	31.45	35.79	21.52	23.77	8.97	1.463
4S/54	31.45	35.2	29.8	24.92	27.63	11.1	1.052
4S/54	35.2	40.35	35.12	23.77	26.35	6.33	1.3
4S/54	40.35	45.45	20.52	27.6	30.65	8.87	0.654
4S/54	45.45	58.3	-	-	-	-	-
4S/54	58.3	61.3	50.68	15.53	17.22	8.6	2.872
4S/54	61.3	62.3	42.32	18.06	20.02	9.3	2.062
4S/54	62.3	63.3	50.81	15.89	17.62	7.4	2.814
4S/54	63.3	64	39.63	29.96	33.22	9.5	1.162
4S/54	64	64.3	-	-	-	-	-
4S/54	64.3	67	47.83	17.22	19.1	7.33	2.444
4S/54	67	67.45	-	-	-	-	-
4S/54	67.45	68.75	50.03	15	16.63	6.66	2.935
4S/54	68.75	72.55	-	-	-	-	-
4S/61	0	1.5	-	-	-	-	-
4S/61	1.5	47.1	-	-	-	-	-
4S/61	47.1	56.1	52.1	17.15	19.02	5.06	2.673
4S/61	56.1	59.1	46.58	17.67	19.62	4.07	2.32
4S/61	59.1	60.1	51.57	59.89	17.62	4.26	2.856
4S/61	60.1	60.8	47.13	19.5	21.62	8.88	2.127
4S/61	60.8	78.25	-	-	-	-	-
4S/61	78.25	83.7	51.93	15.03	16.66	4.94	3.04
4S/61	83.7	88.5	34.1	25.52	30.74	9.72	1.176
4S/61	88.5	89	-	-	-	-	-
4S/SKG/12	0	2	45.85	14.28	-	8.35	2.196
4S/SKG/12	2	6.4	34.93	19.14	-	9.13	1.243
4S/SKG/12	6.4	10	19.09	29.58	-	17.45	0.441
4S/SKG/12	10	18	40.39	15	-	7.98	1.842
4S/SKG/12	18	24	26.66	15.12	-	18.6	1.201
4S/SKG/12	24	39	-	-	-	-	-
4S/SKG/12	39	51	53.05	10.62	-	2.4	3.416
4S/SKG/12	51	59	39.97	14.28	-	7.4	1.914
4S/SKG/12	59	69	-	-	-	-	-
4S/SKG/13	0	13.9	-	-	-	-	-
4S/SKG/13	13.9	24.5	-	-	-	-	-
4S/SKG/13	24.5	36	49.29	10.84	-	4.38	3.11
4S/SKG/13	36	52	44.96	15.92	-	4.3	1.931
4S/SKG/13	52	55.8	48.88	13.44	-	7.05	2.487
4S/SKG/13	55.8	57.4	44.29	16.24	-	6.4	1.865
4S/SKG/13	57.4	58.2	-	-	-	-	-
4S/SKG/13	58.2	66	-	-	-	-	-
4S/SKG/13	66	79	53.01	12.6	-	3.2	2.877
4S/SKG/13	79	84	41.86	15.12	-	6.2	1.893
4S/SKG/13	84	89	-	-	-	-	-
4S/SKG/13	89	96	-	-	-	-	-
4S/22	0	5.35	-	-	-	-	-
4S/22	5.35	28.05	-	-	-	-	-
4S/22	28.05	33.5	-	-	-	-	-
4S/22	33.5	34.35	55.72	9.06	3.71	1.5	3.964
4S/22	34.35	40.8	47	8.11	10.92	5.47	2.305

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/22	40.8	41.4	52.9	9.9	7.16	6.5	2.848
4S/22	41.4	45.85	57.92	10.7	2.74	6.02	3.871
4S/22	45.85	48.5	48.64	10.77	2.87	6.25	3.205
4S/22	48.5	49.2	39.93	8.71	20.93	5.4	1.275
4S/22	49.2	54.65	50.84	15.25	3.68	3.13	2.41
4S/22	54.65	69.4	-	-	-	-	-
4S/22	69.4	75.4	-	-	-	-	-
4S/22	75.4	79.6	52.1	16.49	2.47	5.11	2.42
4S/22	79.6	80.1	23.96	16.52	19.15	14.95	0.624
4S/22	80.1	80.3	-	-	-	-	-
4S/22	80.3	81.05	40.02	8.4	17.36	8.16	1.465
4S/22	81.05	81.75	51.95	12.5	4.3	5.5	2.792
4S/22	81.75	86.95	49.98	12.78	5.15	5.93	2.525
4S/22	86.95	87.05	-	-	-	-	-
4S/22	87.05	88.05	47.59	12.12	6.34	9.5	2.366
4S/22	88.05	88.15	-	-	-	-	-
4S/22	88.15	88.6	45.59	16.95	1.11	8.55	2.235
4S/22	88.6	89.45	4.43	-	38.95	-	0.111
4S/22	89.45	89.75	22.94	33.44	1.04	16.06	0.587
4S/22	89.75	90.65	41.3	6.78	13.62	18.15	1.908
4S/22	90.65	90.85	50.84	13.28	2	9.85	2.966
4S/22	90.85	91.1	-	-	-	-	-
4S/22	91.1	94.45	47.06	8.05	7.73	7.72	2.76
4S/22	94.45	95.15	39.25	7.12	13.43	14.75	1.798
4S/22	95.15	101.35	-	-	-	-	-
4S/58	0	3.5	-	-	-	-	-
4S/58	3.5	54.5	-	-	-	-	-
4S/58	54.5	58.15	-	-	-	-	-
4S/58	58.15	59.15	43.47	20.58	22.82	6.72	1.858
4S/58	59.15	61.15	49.91	15.89	18.24	5.25	2.674
4S/58	61.15	62.5	55.92	13.45	14.91	4.82	3.57
4S/58	62.5	63	43.47	13.44	14.9	11.02	2.846
4S/58	63	66.7	54.69	13.45	14.9	4.37	3.587
4S/58	66.7	68.4	52.25	15.17	16.82	5.07	3.031
4S/58	68.4	72.4	45.41	16.61	18.42	6.54	2.406
4S/58	72.4	76.4	37.1	18.29	20.28	11.22	1.785
4S/58	76.4	77.8	51	14.9	16.53	7.2	3.012
4S/58	77.8	79.5	-	-	-	-	-
4S/58	79.5	81.05	-	-	-	-	-
4S/59	0	6.4	-	-	-	-	-
4S/59	6.4	7.3	-	-	-	-	-
4S/59	7.3	13	32.7	24.64	27.32	2.22	1.168
4S/59	13	14.25	44.91	20.95	23.22	1.74	1.886
4S/59	14.25	16.65	35.37	27.01	28.33	5.32	1.152
4S/59	16.65	17.55	29.08	21.59	23.93	1.96	1.185
4S/59	17.55	19.2	31.82	25.88	28.71	14	1.082
4S/59	19.2	19.9	48.4	19.5	21.62	1.62	2.184
4S/59	19.9	20.8	27.55	25.25	28.03	2.18	1.308
4S/59	20.8	22.6	26.19	26.24	29.54	2.63	0.865
4S/59	22.6	27	-	-	-	-	-
4S/59	27	31.4	-	-	-	-	-
4S/60	0	1	-	-	-	-	-
4S/60	1	16.35	-	-	-	-	-
4S/60	16.35	18.5	-	-	-	-	-
4S/60	18.5	20.55	22.93	-	-	-	-
4S/60	20.55	25.7	36.06	18.58	20.6	12.24	1.708
4S/60	25.7	28.15	46.96	16.5	18.29	7.74	2.604
4S/60	28.15	28.4	25.31	37.93	40.02	10.68	0.587

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/60	28.4	28.65	-	-	-	-	-
4S/60	28.66	29.25	27.62	37.56	41.64	11.02	0.647
4S/60	29.25	38.66	-	-	-	-	-
4S/62	0	3.1	-	-	-	-	-
4S/62	3.1	11.3	-	-	-	-	-
4S/62	11.3	18.4	24	-	-	-	-
4S/62	18.4	34.8	-	-	-	-	-
4S/62	34.8	35.8	40.02	14.81	16.42	4.92	2.378
4S/62	35.8	36.8	51.82	15.17	16.82	3.6	3.006
4S/62	36.8	37.8	42.95	14.09	15.61	5.66	2.682
4S/62	37.8	40.8	51.66	14.32	15.88	4.11	3.174
4S/62	40.8	41.8	43.94	17.05	18.9	6.9	2.267
4S/62	41.8	45.36	50.27	15.95	17.68	4.98	2.773
4S/62	45.36	46.35	25.86	20.7	34.03	13.5	0.741
4S/62	46.35	74.8	-	-	-	-	-
4S/SKG/17	0	17.6	-	-	-	-	-
4S/SKG/17	17.6	24.5	-	-	-	-	-
4S/SKG/17	24.5	26.5	-	-	-	-	-
4S/SKG/17	26.5	30.5	59.68	14.68	-	0.66	2.751
4S/SKG/17	30.5	42.5	44.36	11.76	-	9.7	2.68
4S/SKG/17	42.5	45	50.3	16.24	-	3.85	2.118
4S/SKG/17	45	47.5	55.93	13.16	-	2.6	2.907
4S/SKG/17	47.5	48.5	44.23	14.02	-	6.5	2.157
4S/SKG/17	48.5	51.5	69.11	11.76	-	1.5	3.438
4S/SKG/17	51.5	55	50.48	15.12	-	3.2	2.282
4S/SKG/17	55	58	45.63	14.56	-	5.25	2.143
4S/SKG/17	58	63	41.49	22.67	-	6.4	1.252
4S/SKG/17	63	66	49.75	13.44	-	6.8	2.531
4S/SKG/17	66	75	-	-	-	-	-
4S/SKG/17	75	94.5	-	-	-	-	-
4S/SKG/17	94.5	106.8	-	-	-	-	-
4S/65	0	27.75	-	-	-	-	-
4S/65	27.75	28	35.86	28.63	31.63	1.12	1.106
4S/65	28	29	52.56	21.67	24.02	0.92	2.134
4S/65	29	33	42.76	18.6	21.07	1.4	2.023
4S/65	33	37	39.5	21.02	23.17	1.67	1.653
4S/65	37	40	27.45	24.92	27.63	2.01	0.97
4S/65	40	64.65	-	-	-	-	-
4S/65	64.65	66.6	48.94	15.2	16.84	5.5	2.833
4S/66	66.6	66.85	39.38	16.61	18.42	6.12	2.086
4S/65	66.85	70	-	-	-	-	-
4S/65	70	70.5	41.81	18.78	20.82	9.8	1.96
4S/65	70.5	72.15	63.74	14.16	15.7	4.21	3.34
4S/65	72.15	75	40.7	19.71	21.84	10.71	1.817
4S/65	75	79.6	52.62	14.22	15.77	5.75	3.256
4S/65	79.6	82.5	-	-	-	-	-
4S/66	0	3.5	-	-	-	-	-
4S/66	3.5	8.6	-	-	-	-	-
4S/66	8.6	9.6	33.45	23.52	33.61	8.3	0.97
4S/66	9.6	9.8	-	-	-	-	-
4S/66	9.8	10.7	-	-	-	-	-
4S/66	10.7	12.65	23.08	23.74	33.96	9.35	0.665
4S/66	12.65	23.45	-	-	-	-	-
4S/66	23.45	24.95	22.42	20.36	29.09	10.32	0.753
4S/66	24.95	25.35	-	-	-	-	-
4S/66	25.35	26.1	27.83	17.78	25.4	11.5	1.071
4S/66	26.1	40.7	-	-	-	-	-
4S/66	40.7	41.7	30.23	25.95	37.01	13.66	0.797

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/66	41.7	42.7	49.38	13.16	18.9	5.6	2.56
4S/66	42.7	50.7	-	-	-	-	-
4S/66	50.7	65.9	-	-	-	-	-
4S/66	65.9	82.55	-	-	-	-	-
4S/67	0	1.85	-	-	-	-	-
4S/67	1.85	13.15	-	-	-	-	-
4S/67	13.15	25.6	-	-	-	-	-
4S/67	25.6	26.1	52.3	13.02	17.8	5.25	2.747
4S/67	26.1	51.6	-	-	-	-	-
4S/67	51.6	53.8	-	-	-	-	-
4S/67	53.8	56.2	-	-	-	-	-
4S/69	0	3	-	-	-	-	-
4S/69	3	14	-	-	-	-	-
4S/69	14	54.2	-	-	-	-	-
4S/69	54.2	55.2	26.16	28	30.81	8.8	0.64
4S/69	55.2	56.2	34.3	20.66	29.01	7.6	1.124
4S/69	56.2	66.2	44.7	14.66	12.61	8.3	2.085
4S/69	66.2	71.5	40.94	13.89	10.64	11.85	2.016
4S/69	71.5	72.4	-	-	-	-	-
4S/69	72.4	75.4	49.28	11.95	9.37	8.3	2.821
4S/69	75.4	77.4	38.21	14.28	20.41	17.87	1.83
4S/69	77.4	79.3	45.42	12.75	18.22	15.74	2.436
4S/69	79.3	80	-	-	-	-	-
4S/69	80	87.8	50.3	11.37	16.27	10.62	3.026
4S/69	87.8	91.9	-	-	-	-	-
4S/SKG/14	0	17	-	-	-	-	-
4S/SKG/14	17	20	25.45	24.63	-	4.62	0.701
4S/SKG/14	20	21	31.84	20.16	-	3.55	1.08
4S/SKG/14	21	22	45.22	15.12	-	6.7	2.045
4S/SKG/14	22	26	41.33	14.77	-	7.6	1.914
4S/SKG/14	26	33	29.11	21.26	-	15.25	0.935
4S/SKG/14	33	39	-	-	-	-	-
4S/SKG/14	39	49	-	-	-	-	-
4S/SKG/14	49	50	40.12	20.72	-	3.5	1.324
4S/SKG/14	50	51	27.64	27.15	-	7.2	0.696
4S/SKG/14	51	53	-	-	-	-	-
4S/SKG/14	53	54	16.39	26.32	-	20.75	0.426
4S/SKG/14	54	57	52.61	12.88	-	2.8	2.793
4S/SKG/14	57	63	40.1	19.04	-	5.5	1.44
4S/SKG/14	63	80	-	-	-	-	-
4S/SKG/14	80	81	45.4	10.68	-	7.8	2.907
4S/SKG/14	81	84	8.39	49.28	-	7.2	-
4S/SKG/14	84	90	-	-	-	-	-
4S/SKG/16	0	22	-	-	-	-	-
4S/SKG/16	22	27	43.25	20.96	-	1.5	1.411
4S/SKG/16	27	36.25	41.49	22.69	-	1.6	1.252
4S/SKG/16	36.25	38	-	-	-	-	-
4S/SKG/16	38	43.75	20.74	24.36	-	20.35	0.582
4S/SKG/16	43.75	61	-	-	-	-	-
4S/SKG/16	61	66	53	14.45	-	4.13	2.508
4S/SKG/16	66	69	31.19	12.88	-	15.45	1.656
4S/SKG/16	69	82.5	-	-	-	-	-
4S/12	0	0.6	-	-	-	-	-
4S/12	0.6	20.25	-	-	-	-	-
4S/12	20.25	21.35	32.02	-	35.57	1.9	0.88
4S/12	21.35	22.25	18.99	-	43.66	2.3	0.425
4S/12	22.25	24.4	40.25	-	27.04	2.6	1.428
4S/12	24.4	27.2	20.44	-	34.1	5.02	0.586

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/12	27.2	30.4	34.04	-	27.08	4.86	1.228
4S/12	30.4	37.5	23.12	-	30.78	6.86	0.734
4S/12	37.5	51.85	-	-	-	-	-
4S/12	51.85	53.75	56.87	-	15	5.26	3.705
4S/12	53.75	54.65	63.23	-	17.71	7.5	2.938
4S/12	54.65	58.05	-	-	-	-	-
4S/12	58.05	83.4	-	-	-	-	-
4S/12	83.4	90.8	-	-	-	-	-
4S/12	90.8	92.45	-	-	-	-	-
4S/12	92.45	102.1	-	-	-	-	-
4S/12	102.1	115.9	-	-	-	-	-
4S/63	0	2.5	-	-	-	-	-
4S/63	2.5	31.4	-	-	-	-	-
4S/63	31.4	34	-	-	-	-	-
4S/63	34	39	21.94	26.86	30.44	4.58	0.718
4S/63	39	43.35	34.2	22.82	26.9	2.07	1.318
4S/63	43.35	44	-	-	-	-	-
4S/63	44	45.3	31.4	22.39	26.23	2.93	1.193
4S/63	45.3	47.3	39.02	20.6	22.82	2.39	1.666
4S/63	47.3	47.65	19.38	-	31.64	4.6	0.598
4S/63	47.65	48.1	37.38	19.87	22.02	1.9	1.665
4S/63	48.1	51.1	45.53	18.06	20.02	2.41	2.218
4S/63	51.1	51.45	19.51	-	30.88	3.02	0.617
4S/63	51.45	55.85	-	-	-	-	-
4S/63	55.85	60.5	-	-	-	-	-
4S/63	60.5	64.7	-	-	-	-	-
4S/63	64.7	74.1	-	-	-	-	-
4S/64	0	6.4	-	-	-	-	-
4S/64	6.4	7.7	-	-	-	-	-
4S/64	7.7	8.7	21.29	-	-	-	-
4S/64	8.7	19.7	37.21	22.03	24.42	1.98	1.486
4S/64	19.7	25.7	26.51	27.27	30.23	1.68	0.823
4S/64	25.7	27.05	-	-	-	-	-
4S/64	27.05	40.05	-	-	-	-	-
4S/64	40.05	42.05	54.18	15.17	17.78	1.2	3.088
4S/64	42.05	43.05	38.93	22.79	25.26	2.33	1.503
4S/64	43.05	47.85	-	-	-	-	-
4S/68	0	7.1	-	-	-	-	-
4S/68	7.1	8.1	18.05	27.3	38.21	8.5	0.452
4S/68	8.1	31.25	-	-	-	-	-
4S/68	31.25	33	29.76	20.96	21.28	3.9	0.671
4S/68	33	34.3	-	-	-	-	-
4S/68	34.3	39.5	-	-	-	-	-
4S/28	0	3.6	-	-	-	-	-
4S/28	3.6	6.85	-	-	-	-	-
4S/28	6.86	9.85	-	-	-	-	-
4S/28	9.85	26.3	-	-	-	-	-
4S/28	26.3	27.3	9.45	-	57.53	13.52	0.16
4S/28	27.3	27.9	24.93	-	29.98	21.06	0.812
4S/28	27.9	41.3	37.27	-	21.24	11.77	1.715
4S/28	41.3	42.3	14.19	-	25.71	4.5	0.64
4S/28	42.3	43.45	52.79	-	23.22	8.23	2.222
4S/28	43.45	48.75	-	-	-	-	-
4S/28	48.75	55.8	-	-	-	-	-
4S/28	55.8	56.8	8.82	-	44.81	44	0.192
4S/28	56.8	57	11.51	-	41.23	24.6	0.273
4S/28	57	59.15	-	-	-	-	-
4S/28	59.15	59.85	37.59	-	21.22	10.25	1.731

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/28	59.85	60.85	-	-	-	-	-
4S/28	60.85	64	37.82	-	21.66	11.64	1.706
4S/28	64	80	-	-	-	-	-
4S/28	80	80.2	-	-	-	-	-
4S/SKG/10	0	2.4	-	-	-	-	-
4S/SKG/10	2.4	6.5	-	-	-	-	-
4S/SKG/10	6.5	7	-	-	-	-	-
4S/SKG/10	7	13.5	-	-	-	-	-
4S/4	0	0.6	-	-	-	-	-
4S/4	0.6	34	-	-	-	-	-
4S/4	34	38.6	-	-	-	-	-
4S/4	38.6	44	-	-	-	-	-
4S/4	44	53.04	-	-	-	-	-
4S/4	53.04	64.25	-	-	-	-	-
4S/4	64.25	64.75	37.17	-	24.68	7.75	1.472
4S/4	64.75	67.75	53.04	-	15.64	3.76	3.314
4S/4	67.75	74.25	56.6	-	14.64	1.96	3.778
4S/4	74.25	79	18.09	-	32.98	20.07	0.536
4S/4	79	80	-	-	-	-	-
4S/4	80	83.3	43.76	-	19.8	6.69	2.16
4S/4	83.3	85.4	51.35	-	16.01	1.89	3.135
4S/4	85.4	86	33.53	-	20.69	9.2	1.584
4S/4	86	92.75	-	-	-	-	-
4S/4	92.75	96.25	-	-	-	-	-
4S/4	96.25	97.3	40.18	-	10.03	27.8	3.915
4S/4	97.3	100.6	-	-	-	-	-
4S/4	100.6	109.8	30.71	-	10.32	38.67	2.006
4S/4	109.8	116.25	-	-	-	-	-
4S/4	116.25	122.5	-	-	-	-	-
4S/SKG/9	0	6.4	-	-	-	-	-
4S/SKG/9	6.4	33	-	-	-	-	-
4S/SKG/9	33	35.7	-	-	-	-	-
4S/SKG/9	35.7	36.5	6.6	-	46.75	6.8	0.1
4S/SKG/9	36.5	40.5	-	-	-	-	-
4S/SKG/9	40.5	41	15.93	-	33.88	10.65	0.32
4S/SKG/9	41	46	-	-	-	-	-
4S/6	0	3	-	-	-	-	-
4S/6	3	5.4	-	-	-	-	-
4S/6	5.4	6.5	-	-	-	-	-
4S/6	6.5	9.5	-	-	-	-	-
4S/6	9.5	11	-	-	-	-	-
4S/6	11	12.7	-	-	-	-	-
4S/6	12.7	13.7	4.9	-	8.25	10.5	-
4S/6	13.7	14.7	4.19	-	6.75	13.25	-
4S/6	14.7	15.7	6.55	39.62	7.5	11.5	-
4S/6	15.7	16.7	9.3	42.4	7.75	11.5	-
4S/6	16.7	17.5	18.61	35.36	5.5	10.75	0.46
4S/6	17.5	18.5	31.57	31.14	5.25	9.2	0.99
4S/6	18.5	18.95	16.15	25.11	5.75	16.15	0.62
4S/6	18.95	20.65	-	-	-	-	-
4S/6	20.65	21.65	32.83	32.01	4.75	5.75	1
4S/6	21.65	22.65	40.61	27.62	6.25	6.25	1.43
4S/6	22.65	23.65	39.96	27.38	5.25	5.25	1.42
4S/6	23.65	24.65	30.45	27.38	7	-	1.08
4S/6	24.65	25.65	28.26	28.28	7.15	-	0.97
4S/6	25.65	26.4	30.14	25.58	6.2	-	1.15
4S/6	26.4	27.4	49.29	17.64	8.75	-	2.73
4S/6	27.4	28.3	49.29	18.54	9	-	2.62

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/6	28.3	29.2	40.29	21.7	7.6	8.25	1.81
4S/6	29.2	29.8	45.38	19.16	5.25	7.6	2.32
4S/6	29.8	30.4	48.06	17.4	4.5	4.15	2.69
4S/6	30.4	31	34.41	31.37	7.75	6.5	1.07
4S/6	31	31.6	-	-	-	-	-
4S/6	31.6	32.6	11.06	63.56	5.5	9.75	0.17
4S/6	32.6	33.45	17.34	57.15	8.75	6.6	0.29
4S/6	33.45	34.15	9.23	55.59	8.25	11.25	0.16
4S/6	34.15	35.15	8.83	59.88	6.6	10.2	0.14
4S/6	35.15	36.15	16.46	44.08	10.6	12.5	0.36
4S/6	36.15	36.85	35.75	33.08	8.25	8.76	1.05
4S/6	36.85	37.85	35.85	26.28	-	-	1.33
4S/6	37.85	38.85	39.5	25.45	-	-	1.51
4S/6	38.85	39.85	49.75	20.75	6.5	6.16	2.34
4S/6	39.85	40.85	35.75	31.6	11.6	9.75	1.06
4S/6	40.85	41.85	45.48	22.03	7.8	7.6	2.01
4S/6	41.85	42.85	49.12	17.4	5.1	6.25	2.76
4S/6	42.85	43.85	49.03	17.89	5.3	5.9	2.6
4S/6	43.85	44.85	32.04	38.8	7.5	8.2	0.8
4S/6	44.85	45.85	11.56	55.3	13.9	9.5	0.2
4S/6	45.85	46.85	12.31	55.26	13.3	12.75	0.21
4S/6	46.85	47.85	15.33	58.63	16.8	9.75	0.3
4S/6	47.85	48.4	12.44	49.19	23.4	8.25	0.24
4S/6	48.4	49.1	3.67	40.96	31.25	4.75	0.07
4S/6	49.1	54.6	-	-	-	-	-
4S/6	54.6	63.4	-	-	-	-	-
4S/6	63.4	66.85	-	-	-	-	-
4S/6	66.85	70	-	-	-	-	-
4S/6	70	70.5	49.34	20.36	4.5	2.25	2.37
4S/6	70.5	72.1	-	-	-	-	-
4S/6	72.1	72.75	18.24	-	11.25	6.5	0.41
4S/6	72.75	141	-	-	-	-	-
4S/13	0	2.5	-	-	-	-	-
4S/13	2.5	5.5	-	-	-	-	-
4S/13	5.5	14.5	-	-	-	-	-
4S/13	14.5	17	-	-	-	-	-
4S/13	17	19.75	-	-	-	-	-
4S/13	19.75	20.65	-	-	-	-	-
4S/13	20.65	23.95	-	-	-	-	-
4S/13	23.95	26.6	-	-	-	-	-
4S/13	26.6	28.1	-	-	-	-	-
4S/13	28.1	29.25	-	-	-	-	-
4S/13	29.25	33.05	-	-	-	-	-
4S/13	33.05	34.05	-	-	-	-	-
4S/13	34.05	35	-	-	-	-	-
4S/13	35	37	-	-	-	-	-
4S/13	37	39.5	-	-	-	-	-
4S/13	39.5	41	-	-	-	-	-
4S/13	41	42.85	-	-	-	-	-
4S/13	42.85	43.5	-	-	-	-	-
4S/13	43.5	44.5	-	-	-	-	-
4S/13	44.5	46	-	-	-	-	-
4S/13	46	47.8	-	-	-	-	-
4S/13	47.8	49.5	-	-	-	-	-
4S/13	49.5	50	-	-	-	-	-
4S/13	50	52.8	-	-	-	-	-
4S/13	52.8	54	-	-	-	-	-
4S/13	54	55.2	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/13	55.2	61.5	-	-	-	-	-
4S/13	61.5	68.2	-	-	-	-	-
4S/13	68.2	68.2	-	-	-	-	-
4S/13	68.2	73.5	-	-	-	-	-
4S/13	73.5	74.9	-	-	-	-	-
4S/13	74.9	78	-	-	-	-	-
4S/13	78	79.8	-	-	-	-	-
4S/13	79.8	86	-	-	-	-	-
4S/13	86	100.2	-	-	-	-	-
4S/13	100.2	101	-	-	-	-	-
4S/13	101	102	-	-	-	-	-
4S/13	102	105	-	-	-	-	-
4S/13	105	106	7.51	38.43	16.26	-	1.866
4S/13	106	107	11.09	39.69	16.75	-	0.27
4S/13	107	107.9	10.61	47.83	15.55	-	0.22
4S/13	107.9	108.9	17.66	45.22	19.55	-	0.38
4S/13	108.9	109.9	16.34	43.79	16.25	-	0.26
4S/13	109.9	110	33.08	29.78	13.25	-	1.09
4S/13	110	110.6	41.25	22.28	10.5	-	1.81
4S/13	110.5	111.15	41.51	22.68	11.75	-	1.78
4S/13	111.15	112.15	49.62	18.4	8	-	2.64
4S/13	112.15	112.55	40.72	22.08	15.5	-	1.81
4S/13	112.55	113.55	50.17	18.19	8.5	-	2.7
4S/13	113.55	113.85	46.84	18.8	11.75	-	2.44
4S/13	113.85	114.15	51.15	16.76	10.25	-	2.99
4S/13	114.15	114.35	49.55	15.87	5.5	-	3.06
4S/13	114.35	114.65	43.89	18.33	10.55	-	2.34
4S/13	114.65	115	46.05	16.63	8.5	-	2.7
4S/13	115	115.4	43.62	16.44	14.5	-	2.59
4S/13	115.4	115.8	43.38	15	18	-	2.27
4S/13	115.8	116.1	45.78	16.44	10.5	-	2.72
4S/13	116.1	116.6	41.6	19.27	8.5	-	2.11
4S/13	116.6	117	41.7	21.16	9	-	2.92
4S/13	117	118	34.47	29.1	11	-	1.15
4S/13	118	118.5	33.79	34.96	8.05	-	0.94
4S/13	118.5	118.9	49.12	20.25	5	-	2.97
4S/13	118.9	119.4	49.73	22.27	5.55	-	2.18
4S/13	119.4	119.9	57	14.77	9	-	3.77
4S/13	119.9	120.5	51.23	14.77	9	-	3.99
4S/13	120.5	121	54.5	16	6.5	-	3.33
4S/13	121	121.5	48.35	17.82	11.6	-	2.65
4S/13	121.5	122	49.67	18.23	8	-	2.39
4S/13	122	122.5	41.32	20.03	8	-	1.52
4S/13	122.5	123.5	42.29	26.52	13	-	1.11
4S/13	123.5	124.5	42.29	37.06	13	-	1.11
4S/13	124.5	125.5	31.2	27.87	13.44	-	1.09
4S/13	125.5	126.5	37.81	24.88	15.36	-	1.49
4S/13	126.5	127.5	39	21.52	17.3	-	1.177
4S/13	127.5	128.3	40.19	18.16	20.24	-	2.11
4S/13	128.3	129.3	37.67	18.72	22	-	1.97
4S/13	129.3	130.75	-	-	-	-	-
4S/13	130.75	131.3	16.94	34.83	24.45	-	0.4
4S/13	131.3	163.9	-	-	-	-	-
4S/5	0	6.9	-	-	-	-	-
4S/5	6.9	13.7	-	-	-	-	-
4S/5	13.7	19.8	-	-	-	-	-
4S/5	19.8	22.1	-	-	-	-	-
4S/6	22.1	24.4	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/5	24.4	32.9	-	-	-	-	-
4S/5	32.9	35.4	-	-	-	-	-
4S/5	35.4	45	-	-	-	-	-
4S/5	45	46.45	-	-	-	-	-
4S/5	46.45	49.6	-	-	-	-	-
4S/5	49.5	50.15	18.02	38.63	16	-	0.48
4S/5	50.15	50.65	35.76	26.35	6.5	-	1.32
4S/5	50.65	51.15	51.14	17.57	5	-	2.85
4S/5	51.15	51.9	52.4	17.37	4.75	-	2.96
4S/5	51.9	52.8	42.96	18.36	5	-	2.42
4S/5	52.8	53.3	44.06	18.64	6.5	-	2.33
4S/5	53.3	53.6	-	-	-	-	-
4S/5	53.6	54.6	45.74	18.96	6.25	-	2.36
4S/5	54.6	55.6	51.29	16.97	3.6	-	2.96
4S/5	55.6	55.9	51.85	17.37	2.25	-	2.92
4S/5	55.9	56.15	-	-	-	-	-
4S/5	56.15	57	52.21	17.17	2.5	-	2.97
4S/5	57	57.8	57.11	14.97	3.75	-	3.73
4S/5	57.8	58.7	56.11	15.58	3.6	-	3.62
4S/5	58.7	59.3	55.84	15.1	3.5	-	3.6
4S/5	59.3	59.95	56.26	15.97	3.5	-	3.68
4S/5	59.95	60.5	54.7	14.48	3.75	-	3.7
4S/5	60.5	61.05	48.76	14.57	5.75	-	3.27
4S/5	61.05	61.55	49.97	14.57	4.5	-	3.3
4S/5	61.55	61.85	56.4	14.77	3.25	-	3.74
4S/5	61.85	62.5	53.86	15.37	5.25	-	3.48
4S/5	62.5	63.3	52.5	17.67	4.25	-	2.92
4S/5	63.3	63.9	54.77	16.37	4	-	3.27
4S/5	63.9	64.65	55.93	15.97	5.75	-	3.43
4S/5	64.65	65.5	56.1	21.36	8.25	-	3.46
4S/5	65.5	66.25	44.1	21.36	8.25	-	2.02
4S/5	66.25	66.8	56.8	14.57	4.75	-	3.81
4S/5	66.8	67.1	-	-	-	-	-
4S/5	67.1	67.95	53.95	16.37	4	-	3.22
4S/5	67.95	68.65	55.28	17.37	3	-	3.11
4S/5	68.65	70.6	-	-	-	-	-
4S/5	70.6	71.2	20.73	39.4	10.25	-	0.62
4S/5	71.2	71.8	-	-	-	-	-
4S/5	71.8	72.4	51.76	21.09	3.25	-	2.39
4S/5	72.4	72.8	56.76	14.72	2.68	-	3.83
4S/5	72.8	74	-	-	-	-	-
4S/5	74	81.9	-	-	-	-	-
4S/5	81.9	86.15	-	-	-	-	-
4S/5	86.15	86.89	55.07	15.92	5.25	-	3.37
4S/5	86.89	89.8	-	-	-	-	-
4S/5	89.8	93.6	-	-	-	-	-
4S/5	93.6	94.5	-	-	-	-	-
4S/5	94.5	94.7	-	-	-	-	-
4S/5	94.7	95.1	-	-	-	-	-
4S/5	95.1	95.3	-	-	-	-	-
4S/5	95.3	95.85	-	-	-	-	-
4S/5	95.85	96.25	-	-	-	-	-
4S/5	96.25	97.7	-	-	-	-	-
4S/5	97.7	97.85	-	-	-	-	-
4S/5	97.85	98.7	-	-	-	-	-
4S/5	98.7	100.35	-	-	-	-	-
4S/8	0	8.9	-	-	-	-	-
4S/8	8.9	16.2	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/8	16.2	18.1	-	-	-	-	-
4S/8	18.1	19.1	11.9	57.96	4	-	0.2
4S/8	19.1	20.1	10.21	58.75	8	-	0.17
4S/8	20.1	21.1	10.09	59.6	5.25	-	0.16
4S/8	21.1	22	10.91	53.59	3.69	-	0.27
4S/8	22	23	10.91	53.39	3.59	-	0.2
4S/8	23	24	15.12	49.63	7.5	-	0.29
4S/8	24	25	17.6	39.48	11.06	-	0.43
4S/8	25	26	20.41	35.34	12.52	-	0.78
4S/8	26	27	32.61	25.56	11.04	-	1.25
4S/8	27	28	34.73	16.17	9.12	-	2.1
4S/8	28	29	39.06	23.28	8.02	-	1.64
4S/8	29	30	36.08	24.06	8.16	-	1.47
4S/8	30	31	40.63	22.96	10.25	3.1	1.73
4S/8	31	32	30.08	26.75	13.5	3.65	1.1
4S/8	32	32.75	29.93	26.95	14.25	3.8	10.08
4S/8	32.75	33.35	19	27.15	21.75	5.25	0.68
4S/8	33.35	34.35	23.14	21.96	16.5	4.3	0.9
4S/8	34.35	35.3	22.3	27.25	14.35	-	1.27
4S/8	35.3	36.3	15.52	18.22	18.05	-	0.83
4S/8	36.3	37.25	49.09	16.74	16.9	-	0
4S/8	37.25	38	16.95	27.63	17.6	-	0.68
4S/8	38	39	16.3	25.02	18.1	-	0.63
4S/8	39	39.6	12.73	30.43	22.75	-	0.41
4S/8	39.6	40.6	28.67	21.41	13.75	-	0.31
4S/8	40.6	41.3	49.12	26.03	6.85	-	1.75
4S/8	41.3	42.3	50.98	24.22	3.95	-	2.06
4S/8	42.3	43.3	51.41	30.23	4.8	-	1.66
4S/8	43.3	44.3	45.99	21.36	7.5	7.5	2.11
4S/8	44.3	45.3	47.01	21.18	6.75	1.8	2.16
4S/8	45.3	46.55	46.13	20.56	6.25	1.95	2.2
4S/8	46.55	47.35	-	-	-	-	-
4S/8	47.35	48.35	42.24	19.56	9.6	2.75	2.11
4S/8	48.35	49.35	46.56	19.16	8.25	1.9	2.38
4S/8	49.35	50.35	49.16	18.77	5.25	1.6	2.56
4S/8	50.35	51.35	53.03	16.67	4.25	1.25	3.13
4S/8	51.35	52.35	53.76	15.97	4.1	1.35	3.29
4S/8	52.35	53.35	54.93	16.01	3.6	1.05	3.36
4S/8	53.35	54.15	54.79	16.01	3.75	1.1	3.35
4S/8	54.15	54.65	50.21	14.19	5.5	-	3.46
4S/8	54.65	55.3	50.08	15.37	3.95	-	3.19
4S/8	55.3	55.6	52.72	15.8	4.95	-	3.26
4S/8	55.6	56.45	46.85	16.2	4.68	-	2.83
4S/8	56.45	57.35	50.23	14.39	4.95	-	3.26
4S/8	57.35	57.6	51.89	13.59	4.08	-	2.83
4S/8	57.6	58.1	48.65	14.39	4	-	3.31
4S/8	58.1	58.55	46.87	14.99	4.5	-	3.06
4S/8	58.55	60.36	-	-	-	-	-
4S/8	60.35	65.75	-	-	-	-	-
4S/8	65.75	66.4	-	-	-	-	-
4S/8	66.4	73.2	-	-	-	-	-
4S/8	73.2	76	-	-	-	-	-
4S/8	76	76.15	-	-	-	-	-
4S/8	76.15	77.8	-	-	-	-	-
4S/8	77.8	79.7	-	-	-	-	-
4S/8	79.7	80.65	31.65	25.2	16.5	-	1.23
4S/8	80.65	81.6	-	-	-	-	-
4S/8	81.6	89.05	-	-	-	-	-

Annexure-26

PROPOSED BOREHOLES OF CHROMITE BAND NO.V, SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Borehole No	Location	Angle/Bearing	Proposed depth in metre	Remarks
SKG/77	CS = 300E LS = 80N	60^0 / N33^{0}W	250.00	Borehole started on 03.12.12 and closed on 28.12.12.
SKG/78	CS = 200E LS = 70N	45^0 / N33^{0}W	250.00	Borehole started on 29.12.12 and continuing.
SKG/79	CS = 500E LS = 120N	60^0 / N33^{0}W	250.00	Borehole started on 29.12.12 and continuing.
SKG/80	CS = 100W LS = 40S	60^0 / N33^{0}W	250.00	Borehole started on 31.12.12 and continuing.

31/1/13

Camp Officer
Chirigunia Prospecting Camp

Annex. 2.6

OMC

THE ODISHA MINING CORPORATION LIMITED
(A GOVT. OF ODISHA UNDERTAKING)
(A Gold Category State PSU)
CHIRIGUNIA PROSPECTING CAMP

No 906(3)/OMC/CPC/2013 Date. 21.06.2013

To

1. The Controller General,
   Indian Bureau of mines, Nagpur,
   PIN-440001.
2. The Controller of Mines,
   Indian Bureau of Mines, Nagpur,
   PIN-440001.
3. The Regional Controller of Mines,
   Indian Bureau of Mines, Bhubaneswar,
   PIN-751016.

Sub: - Submission of Return in Form-J in respect of Sukrangi Chromite Mines of M/s O.M.C. Ltd.

Sir,

Enclosed please find herewith the information regarding the boreholes drilled in Form -J in Sukrangi chromite Mines of M/s Odisha Mining Corporation Limited.

Yours faithfully,

Encl. As above.

Camp Officer
Chirigunia Prospecting Camp

Memo No. 907/OMC/CPC/2013 Date. 21.06.2013

Copy to Sr. Manager(Geo)-I, H.O, Bhubaneswar for kind information.

Camp Officer
Chirigunia Prospecting Camp

Camp Office
Mining Corporation Ltd.
Chirigunia Prospecting Camp

FORM-J

(Notice of sinking shafts and boreholes)
(See rule 47)

RGD NO. M00025 BHU/2011
MINE CODE

To

1. The Controller General, Indian Bureau of Mines, Nagpur-440 001.
2. The Controller of Mines, Indian Bureau of Mines, PIN: 440001, Nagpur
3. The Regional Controller of Mines, Indian Bureau of Mines, PIN 751016, Bhubaneswar
4. State Government concerned.

IMPORTANT
Notice in this form shall be sent to the concerned authorities within fifteen days after the commencement of sinking shafts/boreholes.

1. Name of prospect/mine and mineral worked/ prospected. Cherigumia Prospecting Comp (Sukinda Chromite Mine)
2. Name and address of licensee. M/s Odisha Mining Corporation Ltd. Bhubaneswar
3. Location
   (i) Toposheet Number - 73 G/16
   (ii) Village - Sukinda, Samakhol, Ostapa, Tolanga, Kan...
   (iii) Taluka - Sukinda
   (iv) District - Jajpur
   (v) State - Odisha
4. Number of shafts/boreholes intended to be sunk or extended (Attach a plan on a scale less than 1 centimetre=40 metres indicating the precise location of the shaft/borehole). 11 Nos of boreholes (List of boreholes with plan enclosed)
5. Purpose for which each of the shafts/boreholes is intended to be sunk or extended. To prove the chromite ore body and depth persistence of chromite Bed/Body. Proving of Reserve area.
6. Type of shaft(s)/contemplated and size/their dimension(s). N.A
7. Type of drill used and size of core to be obtained. Diamond core drilling (BX, HQ, NQ, BQ)
8. Intended depth upto which shaft/borehole is to be extended. 250M. to 300m.
9. If the shaft/borehole commences from underground the depth of the level at which the shaft/borehole is sunk. Not Applicable
10. Name and qualification of the geologist or mining engineer in charge of the operation. B.B Mishra M.Sc (Geology) Manager (Geology)
11. Date of commencement of proposed shaft sinking/ drilling operation. 28-1-2013

Place: Bhubaneswar
Date: 10-6-2013

Signature
Name in full
Designation: Owner/ Agent/Mining Engineer/Manager/Geologist/ Regional Exploring Comp Manager

This should be sent to the Controller of Mines and Regional Controller of ... in whose territorial jurisdiction the area/mine falls as notified from time to time by the Controller General, Indian Bureau of Mines, under rule 61 of Mineral Conservation and Development Rules, 1988.

Annexure-2(b)

PROPOSED BOREHOLES OF SUKRANGI CHROMITE MINES OF M/S ODISHA MINING CORPORATION LIMITED.

Borehole No	Location	Angle/Bearing	Proposed depth in metre	Remarks
CHROMITE BAND NO.V				
SKG/81	CS= 100W LS= 100S	60^0/N33^0W	300.00	Borehole started on 23.01.13.
SKG/82	CS= 100E LS= 210N	45^0/N33^0W	250.00	Borehole started on 1.2.13.
SKG/83	CS= 400W LS= 80S	60^0/N33^0W	300.00	Borehole started on 12.3.13.
SKG/84	CS= 300E LS=270N	60^0/N33^0W	250.00	Borehole started on 15.3.13.
SKG/85	CS= 500E LS= 210N	60^0/N33^0W	250.00	Borehole started on 4.4.13.
SKG/87	CS= 300E LS= 30S	60^0/N33^0W	300.00	Borehole started on 27.4.13.
SKG/88	CS= 400E LS= 10S	60^0/N33^0W	300.00	Borehole started on 9.5.13.
SKG/89	CS= 400E LS= 200N	60^0/N33^0W	250.00	Borehole started on 18.5.13.
SKG/90	CS= 600E LS= 120N	60^0/N33^0W	250.00	Borehole started on 22.5.13.
SKG/91	CS= 570E LS= 400N	90^0	250.00	Borehole started on 22.5.13.
CHROMITE BAND NO.IV(SOUTH FLANK)				
SKG/86	CS=150W LS= 210N	60^0/S33^0E	300.00	Borehole started on 10.4.13.

25/6/2013

Camp Officer
Chrigunia Prospecting Camp
Orissa Mining Corporation Ltd.
Chrigunia Prospecting Camp

BOREHOLE COLLAR

BAND/BHID	Northing	Easting	Elevation	Max. Depth	Dip	Azimuth
3N/DMG-71	869.26	509.64	154.68	21.4	-90	0
3N/SKG-1	868.42	509.11	154.68	42	-45	32.14
3N/SKG-2	851.43	498.44	155.31	66.5	-60	32.14
3N/SKG-3	887.27	491.34	154.52	55.5	-45	32.14
3N/SKG-4	870.29	480.67	154.68	70	-45	32.14
3N/SKG-5	855.08	530.34	154.97	63	-45	32.14
3N/SKG-6	838.51	519.93	155.47	72	-45	32.14
3N/SKG-7	896.79	467.71	153.58	60	-45	32.14
3N/SKG-8	911.65	477.05	153.66	40.5	-45	32.14
3S/DMG-14	550.1	-191.54	154.65	96.4	-45	172.75
3S/DMG-15	567.89	7.81	154.26	90.3	-45	172.75
3S/DMG-17	536.29	-391.39	156.01	91.2	-45	172.75
3S/DMG-19	609.97	204.07	155.48	100.06	-45	172.75
3S/DMG-24	693.3	646.29	157	80.3	-45	172.75
3S/DMG-25	496.33	-638.32	157.94	101.35	-50	172.75
3S/DMG-26	484.14	-535.97	158.6	135.7	-50	172.75
3S/DMG-27	490.16	-385.53	156.01	64.7	-90	0
3S/DMG-32	572.77	208.8	156.56	66.25	-50	172.75
3S/DMG-33	672.47	548.94	157.59	45	-45	172.75
3S/DMG-35	534.65	12.04	156.93	57.65	-45	172.75
3S/DMG-36	682.67	446.84	155.28	65.65	-50	172.75
3S/DMG-37	570.58	108.27	155.08	64.35	-50	172.75
3S/DMG-38	541.88	-89.69	154.35	70.8	-50	172.75
3S/DMG-39	534.52	-290.36	156.89	76.9	-50	172.75
3S/DMG-40	715.6	565.03	157.89	72.45	-45	172.75
3S/DMG-41	516.37	-187.25	155.47	55.3	-45	172.75
3S/DMG-43	620.1	303.59	156	63.1	-45	172.75
3S/SKG-57	641.29	351.3	156.28	180	-50	172.75
3S/SKG-59	618.49	243.31	155.03	180	-60	172.75
4N/SKG-19	1767.97	426.54	145.5	94	-45	57.7
4N/SKG-20	1826.36	425.43	145.7	55	-45	57.7
4N/SKG-21	1826.36	425.43	145.7	81	-70	57.7
4N/SKG-22	1872.69	405.26	146	51	-50	57.7
4N/SKG-23	1917.04	381.94	145.5	18	-55	57.7
4N/SKG-24	1852.11	419.44	146	45	-50	57.7
4S/3	125.5	50	215.118	98.3	-60	180
4S/44	119	100	212.64	47	-80	180
4S/10	189	100	194.79	141.25	-45	180
4S/45	143	100	207.04	67.75	-60	180
4S/46	192	100	193.79	102.4	-60	180
4S/18	168.25	150	194.33	100.35	-60	180
4S/48	141.5	150	196.43	58	-60	180
4S/53	187.5	150	187.29	95	-60	180
4S/29	189	200	183.67	72.7	-60	180
4S/50	163	200	191.3	60	-60	180
4S/52	212.75	200	178.81	84	-60	180
4S/55	162.75	250	175	29	-60	180
4S/56	205	250	176.2	73.95	-60	180
4S/57	182.5	250	178	54.25	-60	180
4S/SKG/11	210	250	172.6	81	-55	180
4S/SKG/15	210	250	172.6	108.2	-80	180
4S/SKG/61	280	250	170.231	230	-60	180
4S/11	242	300	173.59	150.25	-45	180
4S/47	252	300	172.07	94.25	-60	180

Camp Officer
Odisha Mining Corporation Ltd.
Chirigumia prospecting Camp

BOREHOLE COLLAR

BAND/BHID	Northing	Easting	Elevation	Max. Depth	Dip	Azimuth
4S/61	205	300	177.09	69	-60	180
4S/SKG/18	241	300	171	121	-70	180
4S/49	109.5	350	192.65	56.8	-60	180
4S/54	220.25	350	188.39	72.55	-60	180
4S/61	254.5	350	164.48	89	-45	180
4S/SKG/12	206	350	166.7	69	-75	180
4S/SKG/13	232	350	174.5	96	-70	180
4S/22	262.6	400	175.756	101.35	-45	180
4S/58	264	400	175.5	81.05	-60	180
4S/59	216	400	191.5	31.4	-60	180
4S/60	181	400	198.5	38.65	-60	180
4S/62	206.5	400	194	74.8	-60	180
4S/SKG/17	251	400	174.5	106.8	-70	180
4S/65	251	450	176.39	82.5	-60	180
4S/66	226	450	185.682	82.55	-60	180
4S/67	201	450	195.78	56	-60	180
4S/69	283	450	172.383	91.9	-60	180
4S/SKG/14	241	450	175	90	-55	180
4S/SKG/16	241	450	175	82.5	-75	180
4S/12	254	500	179.05	115.9	-45	180
4S/63	265	500	174.871	74.1	-60	180
4S/64	232.5	500	186.678	47.85	-60	180
4S/28	271.5	550	183.77	80.2	-60	180
4S/6	150	0	203.89	141	-45	180
4S/13	217	0	183.66	153.9	-50	180
4S/6	166.5	-100	191.268	100.35	-45	180
4S/SKG/10	167.5	-200	190.5	13.5	-60	180
4S/4	147	-200	191.85	122.5	-60	180
4S/SKG/9	156	-250	185.5	48	-60	180
4S/8	141	-300	189.74	150.25	-45	180
4S/16	187	-300	176.13	151	-45	180
4S/SKG/25	147	-350	182.5	83	-55	180
4S/SKG/37	155	-350	180	108	-65	180
4S/SKG/28	156	-400	186.5	72	-50	180
4S/SKG/29	182	-400	183.2	104	-50	180
4S/7	135	-400	188.45	151	-45	180
4S/SKG/26	145	-450	185.5	75	-60	180
4S/SKG/27	163	-450	182.5	90	-60	180
4S/SKG/30	160	-500	181.5	119	-55	180
4S/SKG/31	140	-550	175.2	66	-55	180
4S/SKG/32	180	-550	174.5	116	-50	180
4S/SKG/33	155	-600	172	104	-45	180
4S/SKG/34	180	-600	171	108	-50	180
4S/SKG/35	150	-650	176	69	-50	180
4S/SKG/36	172.52	-650	177.5	117	-55	180
4S/SKG/41	125	-650	175	54	-60	180
4S/SKG/38	109	-700	182	72	-45	180
4S/SKG/39	154	-700	177.5	70	-45	180
4S/SKG/42	154	-700	177.5	136	-65	180
4S/SKG/40	144.5	-750	176.5	99	-50	180
4S/SKG/43	104.6	-750	184	66	-60	0
4S/SKG/44	104.6	-750	184	96	-80	0
4S/9	145	-600	178.42	131.1	-45	180
4S/68	202	600	197.683	39.6	-60	180

BOREHOLE COLLAR

BAND/BHID	Northing	Easting	Elevation	Max. Depth	Dip	Azimuth
4S/SKG/60	200	-250	174.319	290	-60	180
5/SKG-62	-270.786	-100	196.558	300	-45	0
5/SKG-63	-460.786	-200	205.996	250	-45	0
5/SKG-64	-480.786	-300	202.002	250	-45	0
5/SKG-65	-470.786	0	201.465	330	-45	0
5/SKG-66	-450.786	100	199.791	300	-45	0
5/SKG-67	-550.786	100	205.039	260	-45	0
5/SKG-68	-400.786	200	195.822	300	-45	0
5/SKG-69	-350.786	100	194.795	200	-45	0
5/SKG-70	-410.786	0	198.872	220	-45	0
5/SKG-71	-380.786	-200	202.679	280	-45	0
5/SKG-72	-370.786	300	193.096	225	-60	0
5/SKG-73	-350.786	400	191.068	260	-60	0
5/SKG-74	-420.786	-300	202.946	180	-45	0
5/SKG-75	-290.786	400	189.17	260	-60	0
5/SKG-76	-360.786	500	189.234	260	-60	0
5/SKG-77	-310.786	300	191.317	250	-60	0
5/SKG-78	-320.786	200	193.343	250	-45	0
5/SKG-79	-270.786	500	186.724	280	-60	0
5/SKG-80	-430.786	-100	200.377	220	-60	0
5/SKG-81	-490.786	-100	203.141	300	-60	0
5/SKG-82	-180.786	100	192.326	300	-45	0
5/SKG-83	-470.786	-400	201.08	300	-60	0
5/SKG-84	-120.786	300	187.376	300	-60	0
5/SKG-85	-180.786	500	184.569	300	-60	0
5/SKG-86	-180.786	-150	180.514	330	-60	0
5/SKG-87	-420.786	300	194.845	300	-60	0
5/SKG-88	-400.786	400	192.849	300	-60	0
5/SKG-89	-190.786	400	186.757	300	-60	0
5/SKG-90	-270.786	600	184.861	260	-60	0
5/SKG-91	9.214	570	181.479	130	-90	0
5/DMG-30	-440.786	-100	200.111	29.96	-60	0
5/DMG-23	-446.786	-200	205.445	73.55	-60	0
5/DMG-20	-440.786	-300	202.13	99.6	-60	0
5/DMG-31	-450.786	-350	202.991	70	-60	0
5/DMG-34	-446.786	-500	193.68	55	-60	0

Camp Officer
Odisha Mining Corporation Ltd.
Chromite prospecting Camp

BOREHOLE ASSAY - BAND III (NORTH)

BAND/BHID	Depth From	Depth To	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe	Core Rec. (%)
3N/SKG-5	0	7.5	-	-	-	-	-	100
3N/SKG-5	7.5	8.2	35.56	4.31	23.46	18.9	1.23	100
3N/SKG-5	8.2	8.8	16.83	2.87	24.7	19.05	0.589	100
3N/SKG-5	8.8	42	-	-	-	-	-	63
3N/SKG-5	42	43.5	14.6	2.15	32.67	23.75	0.407	100
3N/SKG-5	43.5	49	14.9	1.9	18.06	30.42	0.726	53
3N/SKG-5	49	54	4.03	2	8.11	35.83	-	30
3N/SKG-5	54	63	-	-	-	-	-	75
3N/SKG-6	0	7.5	-	-	-	-	-	99
3N/SKG-6	7.5	9.9	36.97	10.55	9.48	13.62	1.704	100
3N/SKG-6	9.9	72	-	-	-	-	-	51
3N/SKG-1	0	7.5	-	-	-	-	-	98.66
3N/SKG-1	7.5	10.5	36.2	12.65	7.64	16.26	1.631	96
3N/SKG-1	10.5	12.1	-	-	-	-	-	100
3N/SKG-1	12.1	13.5	28.87	8.81	15.05	21.2	1.136	100
3N/SKG-1	13.5	14.4	36.47	10.97	7.04	20.56	1.854	100
3N/SKG-1	14.4	27	-	-	-	-	-	86
3N/SKG-1	27	33	51.31	11.86	2.66	4.62	3.167	14
3N/SKG-1	33	42	-	-	-	-	-	86.55
3N/SKG-2	0	18.4	-	-	-	-	-	89
3N/SKG-2	18.4	20.7	30.56	10.49	6.27	21.02	1.666	97
3N/SKG-2	20.7	66.5	-	-	-	-	-	45.19
3N/DMG-71	0	4.4	-	-	-	-	-	-
3N/DMG-71	4.4	5.15	35.69	-	11.34	15.5	3.076	-
3N/DMG-71	5.15	21.4	-	-	-	-	-	-
3N/SKG-7	0	39	-	-	-	-	-	72
3N/SKG-7	39	40.5	47.26	12.13	4.47	7.33	2.57	7
3N/SKG-7	40.5	45	50.67	12.53	2.5	4.67	3.02	17
3N/SKG-7	45	60	-	-	-	-	-	56
3N/SKG-8	0	17	-	-	-	-	-	100
3N/SKG-8	17	18	47.63	11.93	4.31	7.55	2.651	10
3N/SKG-8	18	34	-	-	-	-	-	7.5
3N/SKG-8	34	37	15.82	4.85	6.96	38.61	1.253	97
3N/SKG-8	37	40.5	-	-	-	-	-	62
3N/SKG-3	0	16.1	-	-	-	-	-	100
3N/SKG-3	16.1	17.3	31.44	9.65	8.49	20.9	1.6	100
3N/SKG-3	17.3	18.3	43.38	9.46	4.3	12.45	2.863	100
3N/SKG-3	18.3	19.2	-	-	-	-	-	100
3N/SKG-3	19.2	20.3	37.18	7.68	7.68	15.58	2.241	100
3N/SKG-3	20.3	31.6	-	-	-	-	-	85
3N/SKG-3	31.6	32.5	11.74	2.81	3.7	66.28	1.662	20
3N/SKG-3	32.5	33.5	52.77	12.97	2.6	3.3	3.033	20
3N/SKG-3	33.5	55.5	-	-	-	-	-	53.18
3N/SKG-4	0	24	-	-	-	-	-	96
3N/SKG-4	24	27.5	26.2	8.92	11.57	22.08	1.192	100
3N/SKG-4	27.5	29.2	33.15	10.78	6.3	18.18	1.772	100
3N/SKG-4	29.2	30.3	45.78	12.63	4.5	8.13	2.414	100
3N/SKG-4	30.3	31.8	26.4	9.25	11.24	22.95	1.2	100
3N/SKG-4	31.8	34	47.28	11.48	2.33	6.73	3.064	11
3N/SKG-4	34	70	-	-	-	-	-	13

BOREHOLE ASSAY - BAND III (SOUTH)

BAND/BHID	Depth_From	Depth_To	Cr_2O_3	Total Fe	Fe_2O_3	SiO_2	MgO	Cr:Fe
3S/DMG-25	0	67.2	-	-	-	-	-	-
3S/DMG-25	67.2	68.2	31.48	-	12.45	15.9	1.29	2.49
3S/DMG-25	68.2	68.8	34.58	-	15.67	21.2	1.24	2.17
3S/DMG-25	68.8	74.35	-	-	-	-	-	-
3S/DMG-25	74.35	75.35	-	-	-	-	-	-
3S/DMG-26	75.35	75.9	42.06	-	22.47	25.65	2.05	1.84
3S/DMG-25	75.9	77.25	-	-	-	-	-	-
3S/DMG-25	77.25	77.85	13.93	-	12.47	30.7	5.05	-
3S/DMG-25	77.85	80.15	-	-	-	-	-	-
3S/DMG-25	80.15	80.95	10.58	-	11.14	36.75	6.25	-
3S/DMG-25	80.95	83.2	-	-	-	-	-	-
3S/DMG-25	83.2	84.2	16.77	-	12.77	36.7	4.26	-
3S/DMG-25	84.2	84.45	16.25	-	11.52	27.8	4.21	-
3S/DMG-25	84.45	85.35	-	-	-	-	-	-
3S/DMG-25	85.35	86.35	17.8	-	12.68	23.2	3.24	-
3S/DMG-25	86.35	87.35	17.8	-	13	20	3.24	-
3S/DMG-25	87.35	101.35	-	-	-	-	-	-
3S/DMG-26	0	20.05	-	-	-	-	-	-
3S/DMG-26	20.05	21.05	31.76	-	16.44	30	1.087	1.89
3S/DMG-26	21.05	22.2	-	-	-	-	-	-
3S/DMG-26	22.2	22.95	35.58	-	20.18	24	1.18	1.72
3S/DMG-26	22.95	24.95	-	-	-	-	-	-
3S/DMG-26	24.95	25.95	39.87	-	19.99	22	1.37	1.95
3S/DMG-26	25.95	39.1	-	-	-	-	-	-
3S/DMG-26	39.1	41.7	-	-	-	-	-	-
3S/DMG-26	41.7	135.7	-	-	-	-	-	-
3S/DMG-17	0	68.77	-	-	-	-	-	-
3S/DMG-17	68.77	69.15	44.99	-	26.01	-	-	1.69
3S/DMG-17	69.15	69.95	31.07	-	27.95	-	-	1.09
3S/DMG-17	69.95	71.6	-	-	-	-	-	-
3S/DMG-17	71.6	72.65	29.12	-	22.12	-	-	1.29
3S/DMG-17	72.65	72.75	32.74	-	29.14	-	-	1.1
3S/DMG-17	72.75	91.2	-	-	-	-	-	-
3S/DMG-27	0	54.7	-	-	-	-	-	-
3S/DMG-39	0	58	-	-	-	-	-	-
3S/DMG-39	58	59	15.96	-	42.2	52.52	3.84	-
3S/DMG-39	59	60	18.98	-	47.28	25.66	0.98	-
3S/DMG-39	60	61	19.26	-	37.25	39.48	0.28	-
3S/DMG-39	61	62	17.88	-	37.44	36.3	2.43	-
3S/DMG-39	62	62.45	17.44	-	39.9	40.14	1.96	-
3S/DMG-39	62.45	65.5	5.56	-	-	-	-	-
3S/DMG-39	65.5	66.35	32.32	-	29.98	20.88	3.95	1.21
3S/DMG-39	66.35	67.55	-	-	-	-	-	-
3S/DMG-39	67.65	68.55	26.59	-	34.98	13.92	3.68	1.02
3S/DMG-39	68.55	69.1	30.03	-	16.26	12.25	0.5	1.84
3S/DMG-39	69.1	76.9	-	-	-	-	-	-
3S/DMG-14	0	85.45	-	-	-	-	-	-
3S/DMG-14	85.45	86.75	31.86	-	29.47	11.5	-	1.06
3S/DMG-14	86.75	96.4	-	-	-	-	-	-
3S/DMG-41	0	42.6	-	-	-	-	-	-
3S/DMG-41	42.6	43.6	36.1	-	15.42	28.75	0.27	2.34
3S/DMG-41	43.6	44.6	31.49	-	17.79	41.5	0.45	1.77
3S/DMG-41	44.6	44.85	18.19	-	19.57	40	0.36	-
3S/DMG-41	44.85	45.25	-	-	-	-	-	-

SOREHOLE ASSAY - BAND III (SOUTH)

BAND/BHID	Depth_From	Depth_To	Cr_2O_3	Total Fe	Fe_2O_3	SiO_2	MgO	Cr:Fe
3S/DMG-41	45.25	46.25	22.94	-	40.53	27	0.543	-
3S/DMG-41	46.25	47	11.47	-	35.58	39	0.36	-
3S/DMG-41	47	49.8	-	-	-	-	-	-
3S/DMG-41	49.8	50.15	37.22	-	24.52	28.5	0.41	1.52
3S/DMG-41	50.15	54.25	-	-	-	-	-	-
3S/DMG-41	54.25	54.45	21.82	-	17.01	38.5	0.45	1.28
3S/DMG-41	54.45	55.3	-	-	-	-	-	-
3S/DMG-38	0	44.3	-	-	-	-	-	-
3S/DMG-38	44.3	45.3	38.56	-	17.76	28.75	-	2.14
3S/DMG-38	45.3	46.3	38.42	-	19.05	24.5	-	2
3S/DMG-38	46.3	46.75	39.19	-	19.34	21	-	2
3S/DMG-38	46.75	54.3	-	-	-	-	-	-
3S/DMG-38	54.3	56.3	37.55	-	30.61	16.6	3.66	1.2
3S/DMG-38	56.3	56.15	-	-	-	-	-	-
3S/DMG-38	56.15	57.15	39.2	-	26.24	10.62	3.98	1.06
3S/DMG-38	57.15	57.4	44.84	-	35.26	8.12	4.93	1.26
3S/DMG-38	57.4	70.8	-	-	-	-	-	-
3S/DMG-15	0	72.46	-	-	-	-	-	-
3S/DMG-15	72.46	72.6	36.97	-	25.69	14.5	5.2	-
3S/DMG-15	72.6	73.1	51.98	-	18.74	4.5	0.63	-
3S/DMG-15	73.1	73.6	48.94	-	21.05	4.5	1.28	-
3S/DMG-15	73.6	73.95	42.69	-	21.43	12.25	1.72	-
3S/DMG-15	73.95	90.3	-	-	-	-	-	-
3S/DMG-35	0	36.25	-	-	-	-	-	-
3S/DMG-35	36.25	36.75	36.1	-	16.28	7.44	3.63	2.1
3S/DMG-35	36.75	37.55	35.37	-	15.67	10.1	3.59	2.21
3S/DMG-35	37.55	57.65	-	-	-	-	-	-
3S/DMG-37	0	52.05	-	-	-	-	-	-
3S/DMG-37	52.65	53.65	24.03	-	12.04	36.6	3.32	1.95
3S/DMG-37	53.65	54.65	38.68	-	16.57	18.75	3.22	2.44
3S/DMG-37	54.65	55.95	-	-	-	-	-	-
3S/DMG-37	55.95	56.45	45.65	-	17.34	10	-	2.5
3S/DMG-37	56.45	57.45	49.34	-	15.33	8	-	3.17
3S/DMG-37	57.45	57.65	39.98	-	12.89	14	-	3.06
3S/DMG-37	57.65	64.35	-	-	-	-	-	-
3S/DMG-19	0	59.1	-	-	-	-	-	-
3S/DMG-19	59.1	59.4	39.82	-	14.95	-	-	2.65
3S/DMG-19	59.4	59.45	-	-	-	-	-	-
3S/DMG-19	59.45	60.1	31.31	-	13.93	-	-	2.19
3S/DMG-19	60.1	100.05	-	-	-	-	-	-
3S/DMG-32	0	28.05	-	-	-	-	-	-
3S/DMG-32	28.05	28.75	27.57	-	12.29	30.69	12.28	0.7
3S/DMG-32	28.75	29.6	42.96	-	15.91	12.3	10.2	2.64
3S/DMG-32	29.6	33.8	-	-	-	-	-	-
3S/DMG-32	33.8	34.4	19.03	-	13.01	27.46	19.07	1.43
3S/DMG-32	34.4	56.25	-	-	-	-	-	-
3S/DMG-43	0	54.75	-	-	-	-	-	-
3S/DMG-43	54.75	55.75	45.65	-	19.22	13	-	2.17
3S/DMG-43	55.75	56.6	41.6	-	15.15	8.2	-	2.42
3S/DMG-43	56.6	63.1	-	-	-	-	-	-
3S/DMG-36	0	54.2	-	-	-	-	-	-
3S/DMG-36	54.2	54.75	13.61	-	24.35	29.9	1.9	-
3S/DMG-36	54.75	55.65	24.67	-	20.92	24.75	2.33	-
3S/DMG-36	55.65	56.65	27.22	-	23.78	20.75	2.19	-

BOREHOLE ASSAY - BAND III (SOUTH)

BAND/BHID	Depth_From	Depth_To	Cr_2O_3	Total Fe	Fe_2O_3	SiO_2	MgO	Cr:Fe
3S/DMG-36	56.65	62	-	-	-	-	-	-
3S/DMG-36	62	62.85	22.12	-	9.68	38.85	-	-
3S/DMG-36	62.85	65.65	-	-	-	-	-	-
3S/DMG-24	0	52.25	-	-	-	-	-	-
3S/DMG-24	52.25	52.9	45.02	-	16.82	18	-	2.62
3S/DMG-24	52.9	54.45	-	-	-	-	-	-
3S/DMG-24	54.45	55.25	37.97	-	16.44	23	-	2.26
3S/DMG-24	55.25	56.25	46.56	-	16.82	18	-	2.7
3S/DMG-24	56.25	57.25	48.71	-	16.82	12	-	2.96
3S/DMG-24	57.25	57.65	25.31	-	16.07	32.5	-	1.64
3S/DMG-24	57.65	59.15	-	-	-	-	-	-
3S/DMG-24	59.15	60.15	32.23	-	18.31	29.5	-	1.72
3S/DMG-24	60.15	80.3	-	-	-	-	-	-
3S/DMG-33	0	34.5	-	-	-	-	-	-
3S/DMG-33	34.5	35.5	49.54	-	16.27	5.82	6.77	2.98
3S/DMG-33	35.5	36.5	38.9	-	15.54	12.97	8.56	2.45
3S/DMG-33	36.5	37.5	21.27	-	19.16	20.01	6.35	1.09
3S/DMG-33	37.5	37.8	10.53	-	13.45	30.76	4.03	0.77
3S/DMG-33	37.8	45	-	-	-	-	-	-
3S/DMG-40	0	21.65	-	-	-	-	-	-
3S/DMG-40	21.65	22.25	34.14	-	15.81	31.5	0.81	2.16
3S/DMG-40	22.25	22.75	33.64	-	15.81	39	1.36	2.12
3S/DMG-40	22.75	23.4	-	-	-	-	-	-
3S/DMG-40	23.4	23.9	40.16	-	15.42	23	1.27	2.6
3S/DMG-40	23.9	24.1	50.79	-	20.75	21	0.76	2.44
3S/DMG-40	24.1	54.8	-	-	-	-	-	-
3S/DMG-40	54.8	55.25	30.22	-	13.25	31	1.09	2.23
3S/DMG-40	55.25	72.45	-	-	-	-	-	-
3S/SKG-57	0	82.3	-	-	-	-	-	-
3S/SKG-57	83.2	84	29.55	-	-	-	-	-
3S/SKG-57	84	84.9	31.09	17.43	-	22.32	-	-
3S/SKG-57	84.9	85.3	42.11	15.23	-	7.54	-	-
3S/SKG-57	85.3	86.8	43.73	11.23	-	7.58	-	-
3S/SKG-57	86.8	88	48.69	11.54	-	5.51	-	-
3S/SKG-57	88	143	-	-	-	-	-	-
3S/SKG-57	143	145	17.28	-	-	-	-	-
3S/SKG-57	145	180	-	-	-	-	-	-
3S/SKG-59	0	72	-	-	-	-	-	-
3S/SKG-59	72	75	10.53	-	-	-	-	-
3S/SKG-59	75	76.2	26.98	-	-	-	-	-
3S/SKG-59	76.2	78	49.72	11.9	-	5.39	-	-
3S/SKG-59	78	78.1	53.12	12.06	-	4.46	-	-
3S/SKG-59	78.1	80.2	-	-	-	-	-	-
3S/SKG-59	80.2	81	15.15	-	-	-	-	-
3S/SKG-59	81	81.7	9.08	-	-	-	-	-
3S/SKG-59	81.7	83	-	-	-	-	-	-
3S/SKG-59	83	84	21.64	-	-	-	-	-
3S/SKG-59	84	84.45	36.38	10.17	-	12.84	-	-
3S/SKG-59	84.45	103.5	-	-	-	-	-	-
3S/SKG-59	103.5	103.9	30.41	-	-	-	-	-
3S/SKG-59	103.9	111	-	-	-	-	-	-
3S/SKG-59	111	114	10.62	-	-	-	-	-
3S/SKG-59	114	180	-	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/8	89.05	91.05	-	-	-	-	-
4S/8	91.05	101.05	-	-	-	-	-
4S/8	101.05	107.45	-	-	-	-	-
4S/8	107.45	109.65	-	-	-	-	-
4S/8	109.65	112.4	-	-	-	-	-
4S/8	112.4	115.35	-	-	-	-	-
4S/8	115.35	121.2	-	-	-	-	-
4S/8	121.2	124	-	-	-	-	-
4S/8	124	124.85	-	-	-	-	-
4S/8	124.85	125.3	49.84	14.59	4.68	-	3.34
4S/8	125.3	125.7	41.94	14.7	5.85	-	2.79
4S/8	125.7	126	34.85	18.19	24.05	-	1.87
4S/8	126	126.95	-	-	-	-	-
4S/8	126.95	127.95	29.84	14.59	36.58	-	-
4S/8	127.95	128.2	-	-	-	-	-
4S/8	128.2	134	-	-	-	-	-
4S/8	134	135	-	-	-	-	-
4S/8	135	135.7	-	-	-	-	-
4S/8	135.7	137.1	-	-	-	-	-
4S/8	137.1	139.75	-	-	-	-	-
4S/8	139.75	150.35	-	-	-	-	-
4S/16	0	0.45	-	-	-	-	-
4S/16	0.45	3.9	-	-	-	-	-
4S/16	3.9	8.5	-	-	-	-	-
4S/16	8.5	10.05	-	-	-	-	-
4S/16	10.05	21.45	-	-	-	-	-
4S/16	21.46	24.9	-	-	-	-	-
4S/16	24.9	28.9	-	-	-	-	-
4S/16	28.9	31.5	-	-	-	-	-
4S/16	31.5	33.7	-	-	-	-	-
4S/16	33.7	37.4	-	-	-	-	-
4S/16	37.4	39.65	-	-	-	-	-
4S/16	39.65	47.7	-	-	-	-	-
4S/16	47.7	48.2	-	-	-	-	-
4S/16	48.2	49.2	-	-	-	-	-
4S/16	49.2	70	-	-	-	-	-
4S/16	70	71.1	-	-	-	-	-
4S/16	71.1	81.75	-	-	-	-	-
4S/16	81.75	84.3	-	-	-	-	-
4S/16	84.3	90	-	-	-	-	-
4S/16	90	99	-	-	-	-	-
4S/16	99	104.8	-	-	-	-	-
4S/16	104.8	105.75	7.9	52.65	-	-	0.146
4S/16	105.75	106.65	25.81	36.69	-	-	0.687
4S/16	106.65	107.65	51.3	17.14	-	-	2.76
4S/16	107.65	108.65	54.21	16.85	-	-	3.2
4S/16	108.65	109	52.76	16.95	-	-	3
4S/16	109	109.8	66.02	16.36	-	-	3
4S/16	109.8	110.65	55.05	15.55	-	-	3.5
4S/16	110.65	111	57.11	15.96	-	-	3.46
4S/16	111	112	57.15	14.75	-	-	3.5
4S/16	112	112.85	55.5	15.75	-	-	3.44
4S/16	112.85	113.05	-	-	-	-	-
4S/16	113.05	114.05	56.37	15.52	-	-	3.55
4S/16	114.05	115.05	54.06	16.49	-	-	3.4
4S/16	115.05	116.05	56.12	15.72	-	-	3.49
4S/16	116.05	116.86	55.36	15.78	-	-	3.44
4S/16	116.85	117.45	18.11	27.11	39.5	-	0.65

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/16	117.45	121.85	-	-	-	-	-
4S/16	121.85	128.7	-	-	-	-	-
4S/16	128.7	137.1	-	-	-	-	-
4S/16	137.1	138.1	37.38	23.53	15.85	-	1.58
4S/16	138.1	139.1	29.11	30.88	21	-	0.94
4S/16	139.1	140.1	21.08	19.63	44.7	-	1.07
4S/16	140.1	151	-	-	-	-	-
4S/7	0	3.7	-	-	-	-	-
4S/7	3.7	4.15	4.25	35.66	24.95	10.27	0.12
4S/7	4.15	4.3	-	-	-	-	-
4S/7	4.3	5.3	2.93	55.96	23.47	9.85	0.07
4S/7	5.3	5.6	3.19	45.15	20.35	8.25	0.77
4S/7	5.6	14.85	-	-	-	-	-
4S/7	14.85	16.85	30.32	25.17	18.5	2.12	1.18
4S/7	16.85	16.85	30.32	25.17	13.5	2.12	1.15
4S/7	16.85	17.85	30.59	25.17	13.6	2.12	1.15
4S/7	17.85	18.65	39.63	23.98	19.43	1.4	1.02
4S/7	18.65	19.4	44.43	20.89	8.99	1.26	2.07
4S/7	19.4	20.3	37.77	23.98	8.12	1.62	1.54
4S/7	20.3	20.6	27.66	27.97	12.43	3.1	0.85
4S/7	20.6	21.4	19.15	38.29	14.07	3.45	0.43
4S/7	21.4	21.9	12.95	43.72	18.25	4.2	0.28
4S/7	21.9	22.9	18.87	39.13	14.75	3.75	0.48
4S/7	22.9	23.9	22.97	35.84	12.75	5.4	0.39
4S/7	23.9	24.9	34.21	29.64	13.6	2.75	1.15
4S/7	24.9	25.6	21.6	39.53	13.75	3.75	0.53
4S/7	25.6	25.85	-	-	-	-	-
4S/7	25.85	26.65	16.37	43.92	14.5	4.27	0.36
4S/7	26.65	27.45	16.37	43.92	14.5	4.25	0.36
4S/7	27.45	28.05	-	-	-	-	-
4S/7	28.05	28.7	12.32	36.72	26.75	2.25	0.32
4S/7	28.7	29.9	-	-	-	-	-
4S/7	29.9	30.9	11.46	39.75	20.25	3.1	0.28
4S/7	30.9	31.55	13.11	36.34	17.75	3.2	0.36
4S/7	31.55	32.45	-	-	-	-	-
4S/7	32.45	33.25	19.81	32.55	18.25	3.7	0.59
4S/7	33.25	33.55	-	-	-	-	-
4S/7	33.55	34.35	20.42	48.29	13	5.5	0.53
4S/7	34.35	34.8	-	-	-	-	-
4S/7	34.8	35.8	11.48	76.79	9.5	4.5	0.23
4S/7	35.8	36.05	9.01	73.73	10.56	4	0.15
4S/7	36.05	38.6	-	-	-	-	-
4S/7	38.6	40.6	-	-	-	-	-
4S/7	40.6	47.9	-	-	-	-	-
4S/7	47.9	48.9	20.02	46.74	19.5	5	0.53
4S/7	48.9	51.5	-	-	-	-	-
4S/7	51.5	52.5	-	-	-	-	-
4S/7	52.5	54.95	-	-	-	-	-
4S/7	54.95	55.85	-	-	-	-	-
4S/7	55.85	65.95	-	-	-	-	-
4S/7	65.95	68.7	-	-	-	-	-
4S/7	68.7	70	-	-	-	-	-
4S/7	70	71	4.35	26.19	13	2.5	0.2
4S/7	71	72	3.05	38.59	12	7.5	0.12
4S/7	72	72.35	17.37	38.02	26.5	3.5	0.57
4S/7	72.35	73.25	-	-	-	-	-
4S/7	73.25	74.25	-	-	-	-	-
4S/7	74.25	82.2	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/7	82.2	83.15	-	-	-	-	-
4S/7	83.15	84.15	4.25	29.27	2.5	0.5	0.18
4S/7	84.15	84.55	4.07	28.77	12.5	1	0.17
4S/7	84.55	89.9	-	-	-	-	-
4S/7	89.9	95	-	-	-	-	-
4S/7	95	101.5	-	-	-	-	-
4S/7	101.5	111.5	-	-	-	-	-
4S/7	111.5	120.05	-	-	-	-	-
4S/7	120.05	125.85	-	-	-	-	-
4S/7	125.85	130.8	-	-	-	-	-
4S/7	130.8	131.8	3.88	17.02	27.5	-	2.5
4S/7	131.8	132.8	-	-	-	-	-
4S/7	132.8	135.2	-	-	-	-	-
4S/7	135.2	137.35	-	-	-	-	-
4S/7	137.35	140.55	-	-	-	-	-
4S/7	140.55	141.55	24.18	16.78	-	-	1.49
4S/7	141.55	143.35	-	-	-	-	-
4S/7	143.35	145.2	-	-	-	-	-
4S/7	146.2	146.45	-	-	-	-	-
4S/7	146.45	151	-	-	-	-	-
4S/SKG/25	0	4	-	-	-	-	-
4S/SKG/25	4	7	-	-	-	-	-
4S/SKG/25	7	10	-	-	-	-	-
4S/SKG/25	10	11	-	-	-	-	-
4S/SKG/25	11	14	-	-	-	-	-
4S/SKG/25	14	19	-	-	-	-	-
4S/SKG/25	19	21	-	-	-	-	-
4S/SKG/25	21	30	-	-	-	-	-
4S/SKG/25	30	33	-	-	-	-	-
4S/SKG/25	33	34	-	-	-	-	-
4S/SKG/25	34	35.7	-	-	-	-	-
4S/SKG/25	35.7	40	-	-	-	-	-
4S/SKG/25	40	43	-	-	-	-	-
4S/SKG/25	43	44	-	-	-	-	-
4S/SKG/25	44	45	24.22	-	-	-	-
4S/SKG/25	45	48	33.03	-	-	-	-
4S/SKG/25	48	49	29.98	30.25	-	12.7	-
4S/SKG/25	49	50	18.17	30.8	-	21.15	-
4S/SKG/25	50	51	27.33	-	-	-	-
4S/SKG/25	51	54	53.76	12.32	-	3.45	-
4S/SKG/25	54	55.5	36.79	-	-	-	-
4S/SKG/25	55.5	56.7	19.2	33.04	-	17.08	-
4S/SKG/25	56.7	58	-	-	-	-	-
4S/SKG/25	58	60	-	-	-	-	-
4S/SKG/25	60	63	-	-	-	-	-
4S/SKG/25	63	64.5	-	-	-	-	-
4S/SKG/25	64.5	66	11.26	37.62	-	22.05	-
4S/SKG/25	66	67.5	45.56	17.36	-	8.3	-
4S/SKG/25	67.5	68.5	44.56	-	-	-	-
4S/SKG/25	68.5	70	44.43	-	-	-	-
4S/SKG/25	70	72	51.2	15.66	-	4.25	-
4S/SKG/25	72	73.5	8.5	-	-	-	-
4S/SKG/25	73.5	75	8.63	-	-	-	-
4S/SKG/25	75	78	-	-	-	-	-
4S/SKG/25	78	81	-	-	-	-	-
4S/SKG/25	81	82.5	-	-	-	-	-
4S/SKG/25	82.5	83	-	-	-	-	-
4S/SKG/37	0	4	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/37	4	7	-	-	-	-	-
4S/SKG/37	7	11	-	-	-	-	-
4S/SKG/37	11	14	-	-	-	-	-
4S/SKG/37	14	17	-	-	-	-	-
4S/SKG/37	17	30	-	-	-	-	-
4S/SKG/37	30	33	-	-	-	-	-
4S/SKG/37	33	40	-	-	-	-	-
4S/SKG/37	40	43	-	-	-	-	-
4S/SKG/37	43	49	-	-	-	-	-
4S/SKG/37	49	51	-	-	-	-	-
4S/SKG/37	51	54	-	-	-	-	-
4S/SKG/37	54	75	-	-	-	-	-
4S/SKG/37	75	78	53.16	-	-	-	-
4S/SKG/37	78	80	59.07	7.68	-	1.38	-
4S/SKG/37	80	81	56.66	12.36	-	2.6	-
4S/SKG/37	81	83	58.45	10.94	-	1.8	-
4S/SKG/37	83	84	60.19	11.02	-	0.97	-
4S/SKG/37	84	85.5	59.77	10.3	-	1.4	-
4S/SKG/37	85.5	87	60.89	10.26	-	0.8	-
4S/SKG/37	87	88.5	60.4	10.76	-	0.96	-
4S/SKG/37	88.5	90	57.03	12.81	-	1.42	-
4S/SKG/37	90	90.5	21.3	30.75	-	14.9	-
4S/SKG/37	90.5	91.5	20.95	26.58	-	17.72	-
4S/SKG/37	91.5	93	24	22.61	-	21.07	-
4S/SKG/37	93	99	24	22.61	-	21.07	-
4S/SKG/37	99	108	-	-	-	-	-
4S/SKG/28	0	1.95	-	-	-	-	-
4S/SKG/28	1.95	14	-	-	-	-	-
4S/SKG/28	14	20	-	-	-	-	-
4S/SKG/28	20	21	-	-	-	-	-
4S/SKG/28	21	22	9.69	-	-	-	-
4S/SKG/28	22	24	8.41	-	-	-	-
4S/SKG/28	24	28	9.79	-	-	-	-
4S/SKG/28	28	29	17.25	26.6	-	16.15	-
4S/SKG/28	29	31	10.16	28.56	-	12.75	-
4S/SKG/28	31	32.5	13.77	26.88	-	14.5	-
4S/SKG/28	32.5	34.5	12.61	30.19	-	16.65	-
4S/SKG/28	34.5	36	13.54	14.56	-	12.28	-
4S/SKG/28	36	38	12.17	15.68	-	14.79	-
4S/SKG/28	38	40	13.48	31.36	-	8.35	-
4S/SKG/28	40	41	12.64	-	-	-	-
4S/SKG/28	41	42	21.38	23.24	-	19.55	-
4S/SKG/28	42	44	20.07	23.24	-	15.35	-
4S/SKG/28	44	45	14.5	26.59	-	16	-
4S/SKG/28	45	47	36.2	-	-	-	-
4S/SKG/28	47	49	36.58	-	-	-	-
4S/SKG/28	49	51	35.47	-	-	-	-
4S/SKG/28	51	54	-	-	-	-	-
4S/SKG/28	54	57	9.3	-	-	-	-
4S/SKG/28	57	60	9.2	-	-	-	-
4S/SKG/28	60	63	41.5	15.48	-	2.6	-
4S/SKG/28	63	66	41.6	-	-	-	-
4S/SKG/28	66	69	42	-	-	-	-
4S/SKG/28	69	72	-	-	-	-	-
4S/SKG/29	0	1.6	-	-	-	-	-
4S/SKG/29	1.6	2	-	-	-	-	-
4S/SKG/29	2	3	7.11	28	-	17	-
4S/SKG/29	3	4.1	5.82	26.32	-	16.9	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/29	4.1	4.7	-	-	-	-	-
4S/SKG/29	4.7	6	-	-	-	-	-
4S/SKG/29	6	9	-	-	-	-	-
4S/SKG/29	9	12	-	-	-	-	-
4S/SKG/29	12	14.1	-	-	-	-	-
4S/SKG/29	14.1	17.2	-	-	-	-	-
4S/SKG/29	17.2	24	-	-	-	-	-
4S/SKG/29	24	27	-	-	-	-	-
4S/SKG/29	27	38.4	-	-	-	-	-
4S/SKG/29	38.4	40.1	-	-	-	-	-
4S/SKG/29	40.1	44	-	-	-	-	-
4S/SKG/29	44	54	-	-	-	-	-
4S/SKG/29	54	56	-	-	-	-	-
4S/SKG/29	56	78	-	-	-	-	-
4S/SKG/29	78	104	-	-	-	-	-
4S/SKG/26	0	0.6	-	-	-	-	-
4S/SKG/26	0.6	1.8	11.47	-	-	-	-
4S/SKG/26	1.8	3	-	-	-	-	-
4S/SKG/26	3	5	-	-	-	-	-
4S/SKG/26	5	8.5	10	-	-	-	-
4S/SKG/26	8.5	14	-	-	-	-	-
4S/SKG/26	14	15	20.37	-	-	-	-
4S/SKG/26	15	16.5	9.68	-	-	-	-
4S/SKG/26	16.5	17	7.66	-	-	-	-
4S/SKG/26	17	19	11.22	-	-	-	-
4S/SKG/26	19	21	11.47	-	-	-	-
4S/SKG/26	21	24	4.79	32.48	-	25.1	-
4S/SKG/26	24	27	7.71	30.52	-	31	-
4S/SKG/26	27	30	2.87	30.24	-	28.06	-
4S/SKG/26	30	33	36.5	20.44	-	12.55	1.221
4S/SKG/26	33	36	37.59	-	-	-	-
4S/SKG/26	36	39	-	-	-	-	-
4S/SKG/26	39	42	-	-	-	-	-
4S/SKG/26	42	45	-	-	-	-	-
4S/SKG/26	45	48	-	-	-	-	-
4S/SKG/26	48	63	-	-	-	-	-
4S/SKG/26	63	75	-	-	-	-	-
4S/SKG/27	0	1	-	-	-	-	-
4S/SKG/27	1	10	-	-	-	-	-
4S/SKG/27	10	14.3	-	-	-	-	-
4S/SKG/27	14.3	16.5	-	-	-	-	-
4S/SKG/27	16.5	18.5	-	-	-	-	-
4S/SKG/27	18.5	23.5	-	-	-	-	-
4S/SKG/27	23.5	27	-	-	-	-	-
4S/SKG/27	27	28.5	-	-	-	-	-
4S/SKG/27	28.5	30	-	-	-	-	-
4S/SKG/27	30	39	-	-	-	-	-
4S/SKG/27	39	42	15.07	-	-	-	-
4S/SKG/27	42	45	16.07	-	-	-	-
4S/SKG/27	45	48	19.25	37.6	-	10.55	0.348
4S/SKG/27	48	51	41.86	16.26	-	8.48	-
4S/SKG/27	51	54	41.82	-	-	-	-
4S/SKG/27	54	57	41.89	-	-	-	-
4S/SKG/27	57	60	41.91	-	-	-	-
4S/SKG/27	60	63	41.96	-	-	-	-
4S/SKG/27	63	66	41.8	16.24	-	8.45	-
4S/SKG/27	66	69	41.84	-	-	-	-
4S/SKG/27	69	72	46.4	-	-	-	-

BOREHOLE ASSAY - BAND iV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/27	72	75	-	-	-	-	-
4S/SKG/27	75	78	47.21	-	-	-	-
4S/SKG/27	78	81	-	-	-	-	-
4S/SKG/27	81	84	47.52	-	-	-	-
4S/SKG/27	84	87	-	-	-	-	-
4S/SKG/27	87	90	-	-	-	-	-
4S/SKG/30	0	3	-	-	-	-	-
4S/SKG/30	3	5	-	-	-	-	-
4S/SKG/30	5	6	-	-	-	-	-
4S/SKG/30	6	8	-	-	-	-	-
4S/SKG/30	8	11	-	-	-	-	-
4S/SKG/30	11	15	-	-	-	-	-
4S/SKG/30	16	19	-	-	-	-	-
4S/SKG/30	19	20	-	-	-	-	-
4S/SKG/30	20	24	-	-	-	-	-
4S/SKG/30	24	27	-	-	-	-	-
4S/SKG/30	27	29.6	-	-	-	-	-
4S/SKG/30	29.6	33	15.23	-	-	-	-
4S/SKG/30	33	34.5	-	-	-	-	-
4S/SKG/30	34.5	35.5	24.25	25.2	-	11.65	-
4S/SKG/30	35.5	39	40.95	-	-	-	-
4S/SKG/30	39	39.5	43.46	-	-	-	-
4S/SKG/30	39.5	40.5	27.46	-	-	-	-
4S/SKG/30	40.5	42	29.5	16.8	-	8.1	-
4S/SKG/30	42	46.5	29.35	-	-	-	-
4S/SKG/30	46.5	49.5	43.8	12.32	-	3	-
4S/SKG/30	49.5	52	41.5	16.7	-	9.92	-
4S/SKG/30	52	56	-	-	-	-	-
4S/SKG/30	56	58	-	-	-	-	-
4S/SKG/30	58	60	-	-	-	-	-
4S/SKG/30	60	63	-	-	-	-	-
4S/SKG/30	63	66	-	-	-	-	-
4S/SKG/30	66	69	-	-	-	-	-
4S/SKG/30	69	78	-	-	-	-	-
4S/SKG/30	78	85	-	-	-	-	-
4S/SKG/30	85	94	-	-	-	-	-
4S/SKG/30	94	100	-	-	-	-	-
4S/SKG/30	100	106	-	-	-	-	-
4S/SKG/30	106	119	-	-	-	-	-
4S/SKG/31	0	1.2	-	-	-	-	-
4S/SKG/31	1.2	3.6	24.74	-	-	-	-
4S/SKG/31	3.6	7.3	-	-	-	-	-
4S/SKG/31	7.3	10	-	-	-	-	-
4S/SKG/31	10	13.4	-	-	-	-	-
4S/SKG/31	13.4	15	-	-	-	-	-
4S/SKG/31	15	18	-	-	-	-	-
4S/SKG/31	18	21	-	-	-	-	-
4S/SKG/31	21	28	-	-	-	-	-
4S/SKG/31	28	29	29.49	20.16	-	19.2	-
4S/SKG/31	29	30	36.15	16.8	-	11.55	-
4S/SKG/31	30	31.5	38.24	16.24	-	10.45	-
4S/SKG/31	31.5	33	42.33	-	-	-	-
4S/SKG/31	33	35	42.85	-	-	-	-
4S/SKG/31	35	36.7	43.76	-	-	-	-
4S/SKG/31	36.7	38	66.58	-	-	-	-
4S/SKG/31	38	40	58.35	-	-	-	-
4S/SKG/31	40	42	47.76	15.15	-	6	-
4S/SKG/31	42	46.5	60.56	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/31	46.5	48	-	-	-	-	-
4S/SKG/31	48	51	-	-	-	-	-
4S/SKG/31	51	56	-	-	-	-	-
4S/SKG/31	56	62	-	-	-	-	-
4S/SKG/31	62	66	-	-	-	-	-
4S/SKG/32	0	4	-	-	-	-	-
4S/SKG/32	4	11	-	-	-	-	-
4S/SKG/32	11	24	-	-	-	-	-
4S/SKG/32	24	37	-	-	-	-	-
4S/SKG/32	37	46	-	-	-	-	-
4S/SKG/32	46	48	-	-	-	-	-
4S/SKG/32	48	51	-	-	-	-	-
4S/SKG/32	51	57	-	-	-	-	-
4S/SKG/32	57	61.5	-	-	-	-	-
4S/SKG/32	61.5	78	-	-	-	-	-
4S/SKG/32	78	80	-	-	-	-	-
4S/SKG/32	80	93	-	-	-	-	-
4S/SKG/32	93	96	-	-	-	-	-
4S/SKG/32	96	97.5	46.3	-	-	-	-
4S/SKG/32	97.5	98	46.3	-	-	-	-
4S/SKG/32	98	98.5	46.3	9.48	-	3.65	-
4S/SKG/32	98.5	99	46.3	8.5	-	1.76	-
4S/SKG/32	99	100	50.2	-	-	-	-
4S/SKG/32	100	101	50.2	-	-	-	-
4S/SKG/32	101	102	50.2	-	-	-	-
4S/SKG/32	102	103	50.2	9.48	-	3.6	-
4S/SKG/32	103	104	50.2	-	-	-	-
4S/SKG/32	104	105	50.2	-	-	-	-
4S/SKG/32	105	106	47.2	9.76	-	3.6	-
4S/SKG/32	106	107	47.2	-	-	-	-
4S/SKG/32	107	108	47.2	-	-	-	-
4S/SKG/32	108	109	47.2	9.76	-	3.6	-
4S/SKG/32	109	115	-	-	-	-	-
4S/SKG/33	0	4	-	-	-	-	-
4S/SKG/33	4	6	-	-	-	-	-
4S/SKG/33	6	7	-	-	-	-	-
4S/SKG/33	7	10	-	-	-	-	-
4S/SKG/33	10	13	-	-	-	-	-
4S/SKG/33	13	20	-	-	-	-	-
4S/SKG/33	20	20.5	-	-	-	-	-
4S/SKG/33	20.5	22	-	-	-	-	-
4S/SKG/33	22	25.5	-	-	-	-	-
4S/SKG/33	25.5	27	-	-	-	-	-
4S/SKG/33	27	30	-	-	-	-	-
4S/SKG/33	30	43.5	-	-	-	-	-
4S/SKG/33	43.5	45	34.24	14.91	-	21.11	-
4S/SKG/33	45	48	39.5	14.82	-	12.94	-
4S/SKG/33	48	49	56.32	12.14	-	5.07	-
4S/SKG/33	49	50	55.26	12.18	-	6.22	-
4S/SKG/33	50	51	57.18	14.3	-	4.19	-
4S/SKG/33	51	52	60.24	12.07	-	4.63	-
4S/SKG/33	52	53	59.29	11.78	-	3.8	-
4S/SKG/33	53	54.5	58.16	11.48	-	3.53	-
4S/SKG/33	54.5	56	57.54	13.96	-	2.91	-
4S/SKG/33	56	57	58.84	11.22	-	3.2	-
4S/SKG/33	57	58.5	60.43	10.89	-	4.7	-
4S/SKG/33	58.5	61.5	62.84	12.46	-	2.51	-
4S/SKG/33	61.5	104	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/34	0	6	-	-	-	-	-
4S/SKG/34	6	9	-	-	-	-	-
4S/SKG/34	9	12	-	-	-	-	-
4S/SKG/34	12	15	-	-	-	-	-
4S/SKG/34	15	18.3	-	-	-	-	-
4S/SKG/34	18.3	22	-	-	-	-	-
4S/SKG/34	22	25.5	-	-	-	-	-
4S/SKG/34	25.5	29.5	-	-	-	-	-
4S/SKG/34	29.5	48	-	-	-	-	-
4S/SKG/34	48	72	-	-	-	-	-
4S/SKG/34	72	73	47.5	10.12	-	2.25	-
4S/SKG/34	73	74	47.5	9.8	-	0.34	-
4S/SKG/34	74	75	47.5	10.25	-	0.38	-
4S/SKG/34	75	76	47.5	-	-	-	-
4S/SKG/34	76	77	47.5	-	-	-	-
4S/SKG/34	77	78	47.5	-	-	-	-
4S/SKG/34	78	79	52	-	-	-	-
4S/SKG/34	79	80	52	-	-	-	-
4S/SKG/34	80	81	62.7	11.3	-	0.3	-
4S/SKG/34	81	82	61.9	-	-	-	-
4S/SKG/34	82	83	59.85	-	-	-	-
4S/SKG/34	83	84	61.69	-	-	-	-
4S/SKG/34	84	85	60.48	-	-	-	-
4S/SKG/34	85	86	62.9	10.32	-	0.33	-
4S/SKG/34	86	87	60.56	-	-	-	-
4S/SKG/34	87	88	60.35	9.54	-	0.2	-
4S/SKG/34	88	89	61.48	-	-	-	-
4S/SKG/34	89	90	60.22	10.53	-	2.21	-
4S/SKG/34	90	91	60.1	8.6	-	0.25	-
4S/SKG/34	91	92	61.61	-	-	-	-
4S/SKG/34	92	93	59.76	9.26	-	0.66	-
4S/SKG/34	93	94	61.61	-	-	-	-
4S/SKG/34	94	95	61.74	-	-	-	-
4S/SKG/34	95	96	62.44	10.12	-	0.45	-
4S/SKG/34	96	97	62.5	-	-	-	-
4S/SKG/34	97	98	61.61	-	-	-	-
4S/SKG/34	98	99	62.73	10.39	-	1.28	-
4S/SKG/34	99	100	62.57	-	-	-	-
4S/SKG/34	100	101	61.28	11.02	-	0.72	-
4S/SKG/34	101	102	29.21	10.57	-	39.93	-
4S/SKG/34	102	108	-	-	-	-	-
4S/SKG/35	0	8	-	-	-	-	-
4S/SKG/35	8	9	-	-	-	-	-
4S/SKG/35	9	16	-	-	-	-	-
4S/SKG/35	16	18	-	-	-	-	-
4S/SKG/35	18	48	-	-	-	-	-
4S/SKG/35	48	51	45.5	10.75	-	1.29	-
4S/SKG/35	51	52	45.6	10.48	-	1.03	-
4S/SKG/35	52	53	42	12.75	-	4.7	-
4S/SKG/35	53	54	42	13.58	-	6.4	-
4S/SKG/35	54	60	-	-	-	-	-
4S/SKG/35	60	64	-	-	-	-	-
4S/SKG/36	0	0.5	-	-	-	-	-
4S/SKG/36	0.5	1	-	-	-	-	-
4S/SKG/36	1	7	-	-	-	-	-
4S/SKG/36	7	9	-	-	-	-	-
4S/SKG/36	9	14	-	-	-	-	-
4S/SKG/36	14	14.4	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/36	14.4	16	-	-	-	-	-
4S/SKG/36	16	27	-	-	-	-	-
4S/SKG/36	27	34	-	-	-	-	-
4S/SKG/36	34	38	-	-	-	-	-
4S/SKG/36	38	39	-	-	-	-	-
4S/SKG/36	39	50	-	-	-	-	-
4S/SKG/36	50	54	-	-	-	-	-
4S/SKG/36	54	63	-	-	-	-	-
4S/SKG/36	63	74	-	-	-	-	-
4S/SKG/36	74	77	-	-	-	-	-
4S/SKG/36	77	79.5	-	-	-	-	-
4S/SKG/36	79.5	90.5	-	-	-	-	-
4S/SKG/36	90.5	92.5	-	-	-	-	-
4S/SKG/36	92.5	101	-	-	-	-	-
4S/SKG/36	101	103	42	-	-	-	-
4S/SKG/36	103	107	43.56	-	-	-	-
4S/SKG/36	107	114	52	-	-	-	-
4S/SKG/36	114	117	-	-	-	-	-
4S/SKG/41	0	2.2	-	-	-	-	-
4S/SKG/41	2.2	3	33.65	16.35	-	15.15	-
4S/SKG/41	3	4.5	42.2	14.41	-	-	-
4S/SKG/41	4.5	6.1	-	-	-	-	-
4S/SKG/41	6.1	7.3	48.87	12.81	-	7.56	-
4S/SKG/41	7.3	9	46.21	13.35	-	8.62	-
4S/SKG/41	9	9.7	49.1	14.97	-	-	-
4S/SKG/41	9.7	11	52.15	13.28	-	-	-
4S/SKG/41	11	11.4	-	-	-	-	-
4S/SKG/41	11.4	13	47.96	14.75	-	8.06	-
4S/SKG/41	13	14	51.55	12.16	-	-	-
4S/SKG/41	14	16	45.92	19.63	-	-	-
4S/SKG/41	16	18	46.42	-	-	-	-
4S/SKG/41	18	21	47.92	-	-	-	-
4S/SKG/41	21	23	47.42	-	-	-	-
4S/SKG/41	23	26	47.56	-	-	-	-
4S/SKG/41	26	29	47.32	-	-	-	-
4S/SKG/41	29	36	-	-	-	-	-
4S/SKG/41	36	42	-	-	-	-	-
4S/SKG/41	42	45	-	-	-	-	-
4S/SKG/41	45	54	-	-	-	-	-
4S/SKG/38	0	3.3	-	-	-	-	-
4S/SKG/38	3.3	6.1	-	-	-	-	-
4S/SKG/38	6.1	7	-	-	-	-	-
4S/SKG/38	7	9.6	-	-	-	-	-
4S/SKG/38	9.6	10	-	-	-	-	-
4S/SKG/38	10	11.5	-	-	-	-	-
4S/SKG/38	11.5	12.5	-	-	-	-	-
4S/SKG/38	12.5	18	-	-	-	-	-
4S/SKG/38	18	19.6	-	-	-	-	-
4S/SKG/38	19.6	25.5	-	-	-	-	-
4S/SKG/38	25.5	28.5	-	-	-	-	-
4S/SKG/38	28.5	39	-	-	-	-	-
4S/SKG/38	39	45	-	-	-	-	-
4S/SKG/38	45	57	-	-	-	-	-
4S/SKG/38	57	72	-	-	-	-	-
4S/SKG/39	0	3	-	-	-	-	-
4S/SKG/39	3	23.75	-	-	-	-	-
4S/SKG/39	23.75	24.2	17.45	21.15	-	-	-
4S/SKG/39	24.2	27	-	-	-	-	-

SOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/39	27	28	9.08	39.45	-	12.84	-
4S/SKG/39	28	29	10.37	37.85	-	13.63	-
4S/SKG/39	29	30	12.06	36.28	-	-	-
4S/SKG/39	30	31	21.69	31.24	-	11.08	-
4S/SKG/39	31	33	24.15	29.05	-	10.43	-
4S/SKG/39	33	35.5	24.62	25.76	-	-	-
4S/SKG/39	35.5	36	24.1	26.32	-	-	-
4S/SKG/39	36	37.5	21.14	30.31	-	13.18	-
4S/SKG/39	37.5	39	20.43	28.84	-	-	-
4S/SKG/39	39	40.3	34.44	19.52	-	-	-
4S/SKG/39	40.3	41.3	39.81	17.36	-	-	-
4S/SKG/39	41.3	43	36.74	19.16	-	10.09	-
4S/SKG/39	43	44.3	43.07	16.75	-	7.32	-
4S/SKG/39	44.3	45	42.17	16.24	-	-	-
4S/SKG/39	45	46	45.48	12.66	-	6.19	-
4S/SKG/39	46	48	46.5	13.75	-	8.38	-
4S/SKG/39	48	50	48.82	12.7	-	7.62	-
4S/SKG/39	50	51	49.75	13.86	-	7.31	-
4S/SKG/39	51	52	53.17	12.88	-	-	-
4S/SKG/39	52	53	53.4	11.76	-	-	-
4S/SKG/39	53	54	52.03	11.48	-	-	-
4S/SKG/39	54	56	53.31	12.88	-	-	-
4S/SKG/39	56	58	51.58	12.88	-	-	-
4S/SKG/39	58	60	50.84	12.88	-	-	-
4S/SKG/39	60	62	51.45	14.1	-	6.82	-
4S/SKG/39	62	64	51.83	12.04	-	-	-
4S/SKG/39	64	65	47.3	13.44	-	-	-
4S/SKG/39	65	66	25.31	17.36	-	-	-
4S/SKG/39	66	67.5	23.26	15.12	-	-	-
4S/SKG/39	67.5	70	-	-	-	-	-
4S/SKG/42	0	0.5	-	-	-	-	-
4S/SKG/42	0.5	2	-	-	-	-	-
4S/SKG/42	2	8	-	-	-	-	-
4S/SKG/42	8	14	-	-	-	-	-
4S/SKG/42	14	17	-	-	-	-	-
4S/SKG/42	17	21.3	-	-	-	-	-
4S/SKG/42	21.3	21.9	38.77	18.97	-	-	-
4S/SKG/42	21.9	25.5	-	-	-	-	-
4S/SKG/42	25.6	30.5	-	-	-	-	-
4S/SKG/42	30.5	43.5	-	-	-	-	-
4S/SKG/42	43.5	52	-	-	-	-	-
4S/SKG/42	52	66	-	-	-	-	-
4S/SKG/42	66	84	-	-	-	-	-
4S/SKG/42	84	87	58.69	11.99	-	-	-
4S/SKG/42	87	90	-	-	-	-	-
4S/SKG/42	90	93	58.16	11.99	-	-	-
4S/SKG/42	93	99	-	-	-	-	-
4S/SKG/42	99	102	60.79	10.88	-	-	-
4S/SKG/42	102	108	-	-	-	-	-
4S/SKG/42	108	111	58.92	9.2	-	-	-
4S/SKG/42	111	117	-	-	-	-	-
4S/SKG/42	117	120	59.18	10.32	-	-	-
4S/SKG/42	120	126	-	-	-	-	-
4S/SKG/42	126	129	59.71	9.48	-	-	-
4S/SKG/42	129	136	-	-	-	-	-
4S/SKG/40	0	5	-	-	-	-	-
4S/SKG/40	5	6	27.57	22.79	-	-	-
4S/SKG/40	6	8	36.23	18.07	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/40	8	9	35.38	17.82	-	-	-
4S/SKG/40	9	11	37.39	17.45	-	11.51	-
4S/SKG/40	11	12.6	36.32	18.18	-	-	-
4S/SKG/40	12.6	14.5	35.64	17.15	-	16.5	-
4S/SKG/40	14.5	16	38.04	17.32	-	-	-
4S/SKG/40	16	17	42.01	16.08	-	9.48	-
4S/SKG/40	17	19	41.73	18.45	-	9.6	-
4S/SKG/40	19	21	44.52	16.59	-	-	-
4S/SKG/40	21	22	47.21	14.58	-	-	-
4S/SKG/40	22	24	48.29	14.77	-	6.48	-
4S/SKG/40	24	26	49.02	12.61	-	-	-
4S/SKG/40	26	27	50.44	12.54	-	-	-
4S/SKG/40	27	29	50.65	12.63	-	-	-
4S/SKG/40	29	31	51.18	12.86	-	5.72	-
4S/SKG/40	31	33	52.85	11.41	-	-	-
4S/SKG/40	33	35	50.76	-	-	5.19	-
4S/SKG/40	35	36	50.57	13.48	-	-	-
4S/SKG/40	36	39	57.18	11.86	-	-	-
4S/SKG/40	39	40	48.46	13.61	-	6.8	-
4S/SKG/40	40	41	36.67	16.42	-	-	-
4S/SKG/40	41	43	41.86	17.71	-	-	-
4S/SKG/40	43	45	48.95	13.76	-	-	-
4S/SKG/40	45	46	50.1	12.89	-	-	-
4S/SKG/40	46	48	53.3	11.97	-	-	-
4S/SKG/40	48	52	-	-	-	-	-
4S/SKG/40	52	53	57.74	10.48	-	-	-
4S/SKG/40	53	71	-	-	-	-	-
4S/SKG/40	71	72	59.88	10.21	-	-	-
4S/SKG/40	72	99	-	-	-	-	-
4S/SKG/43	0	0.5	-	-	-	-	-
4S/SKG/43	0.5	2	-	-	-	-	-
4S/SKG/43	2	5.2	-	-	-	-	-
4S/SKG/43	5.2	6.5	-	-	-	-	-
4S/SKG/43	6.5	7	-	-	-	-	-
4S/SKG/43	7	7.8	-	-	-	-	-
4S/SKG/43	7.8	11	-	-	-	-	-
4S/SKG/43	11	14	-	-	-	-	-
4S/SKG/43	14	16	-	-	-	-	-
4S/SKG/43	16	20	-	-	-	-	-
4S/SKG/43	20	21	47.47	12.88	-	8.6	-
4S/SKG/43	21	27	39.5	14.56	-	14	-
4S/SKG/43	27	28	41.94	15.96	-	11.25	-
4S/SKG/43	28	30	35.35	19.25	-	-	-
4S/SKG/43	30	32	44.91	14.22	-	-	-
4S/SKG/43	32	35	39.15	18.14	-	-	-
4S/SKG/43	35	37	47.86	15.96	-	7.2	-
4S/SKG/43	37	39	52.99	13.44	-	3.06	-
4S/SKG/43	39	40	51.98	12.27	-	-	-
4S/SKG/43	40	45	58.79	10.04	-	-	-
4S/SKG/43	45	47	44.71	15.68	-	8.25	-
4S/SKG/43	47	49	43	17.64	-	2.5	-
4S/SKG/43	49	53	-	-	-	-	-
4S/SKG/43	53	66	-	-	-	-	-
4S/SKG/44	0	5	-	-	-	-	-
4S/SKG/44	5	7	-	-	-	-	-
4S/SKG/44	7	10	-	-	-	-	-
4S/SKG/44	10	13	-	-	-	-	-
4S/SKG/44	13	19	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/44	19	21	-	-	-	-	-
4S/SKG/44	21	39	-	-	-	-	-
4S/SKG/44	39	42	47.28	11.2	-	-	-
4S/SKG/44	42	45	33.07	8.68	-	28	-
4S/SKG/44	45	46	39.9	8.68	-	21.9	-
4S/SKG/44	46	47	44.88	10.64	-	-	-
4S/SKG/44	47	48	44.35	40.64	-	-	-
4S/SKG/44	48	49	46.59	10.68	-	10.2	-
4S/SKG/44	49	50	50.24	10.64	-	8.3	-
4S/SKG/44	50	51	54.32	13.64	-	-	-
4S/SKG/44	51	52	51.92	10.67	-	7.2	-
4S/SKG/44	52	53	54.38	11.76	-	-	-
4S/SKG/44	53	54	57.4	11.76	-	-	-
4S/SKG/44	54	58	47.1	11.76	-	1.2	-
4S/SKG/44	58	61	47.84	11.2	-	3	-
4S/SKG/44	61	64	47.99	12.32	-	0.25	-
4S/SKG/44	64	70	-	-	-	-	-
4S/SKG/44	70	71	47.99	12.35	-	-	-
4S/SKG/44	71	74	47.52	12.4	-	-	-
4S/SKG/44	74	78	46.95	14.09	-	-	-
4S/SKG/44	78	81	29.6	22.39	-	-	-
4S/SKG/44	81	84	29.88	22.45	-	-	-
4S/SKG/44	84	96	-	-	-	-	-
4S/9	0	0.6	-	-	-	-	-
4S/9	0.6	15.6	-	-	-	-	-
4S/9	15.6	16.05	-	-	-	-	-
4S/9	16.05	17.05	21.21	-	32.24	20.85	-
4S/9	17.05	18.05	35.18	-	23.39	16.2	-
4S/9	18.05	19.05	31.83	-	22.99	19	-
4S/9	19.05	20.05	19.4	-	27.71	23.9	-
4S/9	20.05	20.2	24.97	-	23.35	23.8	-
4S/9	20.2	21.2	31.96	-	23.98	17.25	1.3
4S/9	21.2	22.15	25.31	-	23.2	-	1.06
4S/9	22.15	23.1	17.44	-	25.64	-	0.66
4S/9	23.1	23.95	52.56	-	16.11	8.9	3.17
4S/9	23.95	24.35	-	-	-	-	-
4S/9	24.35	25.35	33.75	-	21.23	18.75	1.56
4S/9	25.35	25.55	42.05	-	20.44	16.65	2.01
4S/9	25.55	26.45	26.31	-	24.85	-	1.03
4S/9	26.45	27.4	32.46	-	22.88	-	1.39
4S/9	27.4	28.4	46.64	-	19.3	11.64	2.37
4S/9	28.4	29.1	41.28	-	21.45	13.4	1.88
4S/9	29.1	30	29.45	-	29.2	-	0.98
4S/9	30	31	24.16	-	38.26	-	0.81
4S/9	31	32	16.87	-	39.71	-	0.35
4S/9	32	33	12.58	-	52.47	-	0.23
4S/9	33	34	11.44	-	43	-	0.26
4S/9	34	34.7	24.88	-	31.95	-	0.76
4S/9	34.7	35.7	40.24	-	20.47	14.52	1.92
4S/9	35.7	36.7	46.31	-	17.74	10.68	2.55
4S/9	36.7	37.7	46.88	-	15.69	10.26	2.94
4S/9	37.7	38.7	48.37	-	15.79	10.66	3
4S/9	38.7	39.7	45.68	-	15.74	10.76	2.84
4S/9	39.7	40.7	47.62	-	17.55	9.24	2.66
4S/9	40.7	41.25	32.48	-	33.14	-	0.96
4S/9	41.25	42	-	-	-	-	-
4S/9	42	42.6	48.23	-	20.2	-	2.33
4S/9	42.6	43	-	-	-	-	-

BOREHOLE ASSAY - BAND IV (SOUTH)

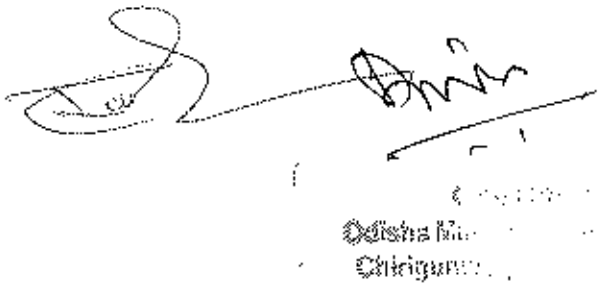
BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/9	43	46	-	-	-	-	-
4S/9	46	48	-	-	-	-	-
4S/9	48	48.4	-	-	-	-	-
4S/9	48.4	61.95	-	-	-	-	-
4S/9	61.95	63.8	-	-	-	-	-
4S/9	63.8	64.2	35.56	-	21.64	19	1.74
4S/9	64.2	73.3	-	-	-	-	-
4S/9	73.3	76.2	-	-	-	-	-
4S/9	76.2	78.9	-	-	-	-	-
4S/9	78.9	88.55	-	-	-	-	-
4S/9	88.55	89.25	-	-	-	-	-
4S/9	89.25	90.25	-	-	-	-	-
4S/9	90.25	97.75	-	-	-	-	-
4S/9	97.75	106	-	-	-	-	-
4S/9	106	107.6	-	-	-	-	-
4S/9	107.6	119.8	-	-	-	-	-
4S/9	119.8	123.6	-	-	-	-	-
4S/9	123.6	125.1	-	-	-	-	-
4S/9	125.1	131.1	-	-	-	-	-
4S/SKG/61	0	43	-	-	-	-	-
4S/SKG/61	43	45	11.52	-	-	-	-
4S/SKG/61	45	46.5	-	-	-	-	-
4S/SKG/61	46.5	48	21.02	-	-	-	-
4S/SKG/61	48	63	-	-	-	-	-
4S/SKG/61	63	63.7	18.67	-	-	-	-
4S/SKG/61	63.7	68.7	-	-	-	-	-
4S/SKG/61	68.7	69	15.51	-	-	-	-
4S/SKG/61	69	69.3	-	-	-	5.51	-
4S/SKG/61	69.3	70	47.16	-	-	5.36	-
4S/SKG/61	70	71	48.8	-	-	6.18	-
4S/SKG/61	71	72	44.01	-	-	15.24	-
4S/SKG/61	72	73	36.46	-	-	18.27	-
4S/SKG/61	73	74	38.14	-	-	0.69	-
4S/SKG/61	74	75	51.53	-	-	0.57	-
4S/SKG/61	75	76	52.92	-	-	5.39	-
4S/SKG/61	76	77	48.11	-	-	15.73	-
4S/SKG/61	77	78	37.66	-	-	12.17	-
4S/SKG/61	78	79	31.46	-	-	10.47	-
4S/SKG/61	79	80	48.23	-	-	5.59	-
4S/SKG/61	80	81	45.89	-	-	9.42	-
4S/SKG/61	81	82	49.69	-	-	5.63	-
4S/SKG/61	82	83	44.25	-	-	9.64	-
4S/SKG/61	83	84	49.31	-	-	9.32	-
4S/SKG/61	84	85	49.88	-	-	4.77	-
4S/SKG/61	85	86	52.03	-	-	6.23	-
4S/SKG/61	86	87	50.77	-	-	5.54	-
4S/SKG/61	87	88	55.97	-	-	7.68	-
4S/SKG/61	88	89	53.87	-	-	9.22	-
4S/SKG/61	89	90	51.59	-	-	8.82	-
4S/SKG/61	90	91	51.08	-	-	4.25	-
4S/SKG/61	91	92	53.65	-	-	7.42	-
4S/SKG/61	92	93	42.66	-	-	8.21	-
4S/SKG/61	93	94	53.52	-	-	3.24	-
4S/SKG/61	94	95	66.02	-	-	12.44	-
4S/SKG/61	95	96	54.71	-	-	11.14	-
4S/SKG/61	96	97	53.27	-	-	8.44	-
4S/SKG/61	97	97.7	53.71	-	-	7.23	-
4S/SKG/61	97.7	98.35	50.58	-	-	8.72	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/61	98.35	99.3	53.65	-	-	9.22	-
4S/SKG/61	99.3	100.3	54.71	-	-	7.67	-
4S/SKG/61	100.3	101.3	53.03	-	-	9.23	-
4S/SKG/61	101.3	102.3	49.78	-	-	8.44	-
4S/SKG/61	102.3	103.3	51.91	-	-	8.56	-
4S/SKG/61	103.3	104.3	50.78	-	-	5.42	-
4S/SKG/61	104.3	105.3	48.21	-	-	9.22	-
4S/SKG/61	105.3	106.3	48.66	-	-	8.21	-
4S/SKG/61	106.3	107.3	46.53	-	-	16.41	-
4S/SKG/61	107.3	108.3	41.65	-	-	5.43	-
4S/SKG/61	108.3	109.3	53.04	-	-	11.26	-
4S/SKG/61	109.3	110	23.84	-	-	-	-
4S/SKG/61	110	111	-	-	-	-	-
4S/SKG/61	111	112.5	9.52	-	-	-	-
4S/SKG/61	112.5	114	19.68	-	-	11.27	-
4S/SKG/61	114	117	27.96	-	-	-	-
4S/SKG/61	117	118.5	25.9	-	-	-	-
4S/SKG/61	118.5	119.4	14.55	-	-	-	-
4S/SKG/61	119.4	122.45	5.85	-	-	-	-
4S/SKG/61	122.45	124	18.21	-	-	-	-
4S/SKG/61	124	126	18.86	-	-	10.14	-
4S/SKG/61	126	127.3	36.47	-	-	-	-
4S/SKG/61	127.3	132.9	-	-	-	8.42	-
4S/SKG/61	132.9	133.8	49.58	-	-	5.84	-
4S/SKG/61	133.8	134.6	55.27	-	-	-	-
4S/SKG/61	134.6	135	31.22	-	-	6.46	-
4S/SKG/61	135	136	51.35	-	-	11.64	-
4S/SKG/61	136	137	54.51	-	-	17.92	-
4S/SKG/61	137	138	18.55	-	-	37.18	-
4S/SKG/61	138	139.2	15.06	-	-	34.57	-
4S/SKG/61	139.2	140.2	22.25	-	-	-	-
4S/SKG/61	140.2	160	-	-	-	-	-
4S/SKG/61	160	230	-	-	-	-	-
4S/SKG/60	0	126.8	-	-	-	-	-
4S/SKG/60	126.8	127.6	25.43	-	-	-	-
4S/SKG/60	127.6	128.5	14.48	-	-	-	-
4S/SKG/60	128.5	129.5	12.95	-	-	-	-
4S/SKG/60	129.5	130.5	22.09	-	-	-	-
4S/SKG/60	130.5	131.5	46.73	-	-	-	-
4S/SKG/60	131.5	132.5	46.85	-	-	-	-
4S/SKG/60	132.5	133.8	51.73	-	-	-	-
4S/SKG/60	133.8	135.3	50.42	-	-	11.02	-
4S/SKG/60	135.3	136	53.61	-	-	5.5	-
4S/SKG/60	136	137	53.25	-	-	5.93	-
4S/SKG/60	137	138	53.42	-	-	5.75	-
4S/SKG/60	138	139	55.19	-	-	4.03	-
4S/SKG/60	139	140	59.4	-	-	1.23	-
4S/SKG/60	140	141	57.24	-	-	2.86	-
4S/SKG/60	141	142	57.66	-	-	3.04	-
4S/SKG/60	142	143	59.58	-	-	10.33	-
4S/SKG/60	143	144	59.46	-	-	1.24	-
4S/SKG/60	144	145	61.63	-	-	0.5	-
4S/SKG/60	145	146	60.75	-	-	0.71	-
4S/SKG/60	146	146.5	60.39	-	-	0.58	-
4S/SKG/60	146.5	147.5	60.78	-	-	0.56	-
4S/SKG/60	147.5	148.5	60.37	-	-	0.51	-
4S/SKG/60	148.5	149.5	60.26	-	-	0.45	-
4S/SKG/60	149.5	150.5	60.56	-	-	0.6	-

BOREHOLE ASSAY - BAND IV (SOUTH)

BAND/BH_ID	Depth_from	Depth_to	Cr_2O_3	FeO	Fe_2O_3	SiO_2	Cr:Fe
4S/SKG/60	150.5	151.5	60.01	-	-	0.58	-
4S/SKG/60	151.5	152.4	60.21	-	-	0.54	-
4S/SKG/60	152.4	152.8	30.94	-	-	33.25	-
4S/SKG/60	152.8	166.8	-	-	-	-	-
4S/SKG/60	166.8	160	36.98	-	-	-	-
4S/SKG/60	160	189	-	-	-	-	-
4S/SKG/60	189	196	-	-	-	-	-
4S/SKG/60	196	198	11.59	-	-	-	-
4S/SKG/60	198	210	-	-	-	-	-
4S/SKG/60	210	224.85	-	-	-	-	-
4S/SKG/60	224.85	225	54.18	-	-	-	-
4S/SKG/60	225	227.1	56.56	-	-	1.9	-
4S/SKG/60	227.1	228.3	-	-	-	-	-
4S/SKG/60	228.3	229.1	52.7	-	-	0.46	-
4S/SKG/60	229.1	230.5	-	-	-	-	-
4S/SKG/60	230.5	231	28.57	-	-	-	-
4S/SKG/60	231	250	-	-	-	-	-
4S/SKG/60	250	253	11.56	-	-	-	-
4S/SKG/60	253	259	-	-	-	-	-
4S/SKG/60	259	260	14.29	-	-	-	-
4S/SKG/60	260	261.5	14.26	-	-	28.03	-
4S/SKG/60	261.5	265	-	-	-	-	-
4S/SKG/60	265	266	10	-	-	-	-
4S/SKG/60	266	290	-	-	-	-	-



BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-73	14.1	15.2	8.39
5/SKG-73	15.2	17.8	3.85
5/SKG-73	17.8	19.5	4.2
5/SKG-73	19.6	21.6	6.81
5/SKG-73	32.4	34.2	11.83
5/SKG-73	43.1	43.7	5.23
5/SKG-73	43.7	44.2	10.72
5/SKG-73	118.1	120	3.82
5/SKG-73	120	123	3.41
5/SKG-73	123	126	2.89
5/SKG-73	139.2	141.2	3.52
5/SKG-73	141.9	144	4.12
5/SKG-73	144	145.5	4.34
5/SKG-73	145.5	147.2	5.23
5/SKG-73	147.2	149.5	3.28
5/SKG-73	149.5	150.9	4.2
5/SKG-73	150.9	153.8	3.8
5/SKG-73	153.8	155.8	2.98
5/SKG-73	155	157.1	16.78
5/SKG-73	175.4	176.2	7.92
5/SKG-73	176.2	178.6	3.12
5/SKG-73	178.6	181.6	3.96
5/SKG-73	181.6	183.6	3.75
5/SKG-73	183.6	184.6	2.98
5/SKG-73	184.6	186	6.12
5/SKG-73	186	187.6	14.34
5/SKG-73	187.6	188.4	15.32
5/SKG-73	188.4	189.5	10.77
5/SKG-73	189.5	190.8	9.12
5/SKG-73	190.8	193.8	17.78
5/SKG-73	193.8	195.8	7.96
5/SKG-73	195.8	196.7	5.71
5/SKG-73	196.7	198.4	7.2
5/SKG-73	198.4	200	7
5/SKG-73	200	202.7	6.23
5/SKG-73	202.7	204	5.16
5/SKG-73	204	206.3	6.02
5/SKG-73	206.3	209	3.12
5/SKG-73	209	211.3	5.46
5/SKG-73	211.3	214.7	3.42
5/SKG-73	214.7	217.7	4.35
5/SKG-73	217.7	220.7	2.9
5/SKG-73	229.2	232.3	2.78
5/SKG-74	0	0.5	10.72
5/SKG-74	0.5	1.6	12.85
5/SKG-74	1.6	3.3	17.2
5/SKG-74	3.3	4.7	15.31
5/SKG-74	4.7	6.3	20.35
5/SKG-74	6.3	8	18.39
5/SKG-74	8	9.9	23.34
5/SKG-74	9.9	10.9	24.92
5/SKG-74	10.9	12.9	43.21
5/SKG-74	12.9	14	38.92
5/SKG-74	14	15.2	40.2
5/SKG-74	15.2	16.2	39.16
5/SKG-74	16.2	17.1	12.36
5/SKG-74	17.1	18.9	5.36
5/SKG-74	20	21	7.29

Camp Officer
Odisha Mining Corporation Ltd.
Chiringuda ... Camp

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-74	21	23.6	13.69
5/SKG-74	23.6	29.5	10.23
5/SKG-74	31.4	33.6	15.48
5/SKG-74	28	29	12.81
5/SKG-74	31.4	33.5	11.96
5/SKG-74	39	39.9	9.28
5/SKG-74	41.4	43.4	12.72
5/SKG-74	83.2	83.9	5.1
5/SKG-74	91.3	95.7	6.28
5/SKG-74	130	132	6.39
5/SKG-74	132	135	7.2
5/SKG-74	135	141.1	6.34
5/SKG-74	141.1	143.1	6.84
5/SKG-75	21.4	23.6	3.53
5/SKG-75	23.6	25	14.38
5/SKG-75	25	27.6	12.8
5/SKG-75	27.8	30.8	3.42
5/SKG-75	33.8	36.4	11.36
5/SKG-75	35.4	37.1	10.92
5/SKG-75	41.2	42.7	30.76
5/SKG-75	65.5	67.1	40.76
5/SKG-75	67.1	69.3	36.71
5/SKG-75	69.3	70.8	42.8
5/SKG-75	70.8	72.8	6.3
5/SKG-75	72.8	73.9	4.34
5/SKG-75	73.9	75.5	38.2
5/SKG-75	75.5	77.5	28.39
5/SKG-75	77.5	79	22.63
5/SKG-75	79.8	80.3	32.87
5/SKG-75	80.3	81.7	14.38
5/SKG-75	81.7	84	8.35
5/SKG-75	84	86	6.2
5/SKG-75	86.5	88.2	43.36
5/SKG-75	88.2	90.3	38.36
5/SKG-75	90.3	91.3	44.36
5/SKG-75	91.3	93.3	40.72
5/SKG-75	93.3	96.3	28.39
5/SKG-75	96.3	98	4.39
5/SKG-75	98	100.3	14.2
5/SKG-75	100.3	101.6	5.35
5/SKG-75	101.6	103.3	2.4
5/SKG-75	103.3	104.9	5.2
5/SKG-75	104.9	107.2	6.4
5/SKG-75	107.2	109.75	7.29
5/SKG-75	109.75	112.9	3.26
5/SKG-75	112.9	116.4	7.23
5/SKG-75	116.4	118	6.62
5/SKG-75	132.2	132.8	6.39
5/SKG-75	144.9	147.9	7.12
5/SKG-75	174.9	177.9	3.92
5/SKG-75	177.9	183	6.12
5/SKG-75	217.5	223.8	1.24
5/SKG-75	223.8	226.8	6.39
5/SKG-75	226.8	230	8.24
5/SKG-75	230	233.6	4.2
5/SKG-75	233.5	236.5	7.2
5/SKG-75	236.6	240	3.82
5/SKG-75	240	245.6	4.32

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-75	245	248.6	4.26
5/SKG-75	248.6	249.8	6.12
5/SKG-76	20.9	22.2	12.85
5/SKG-76	22.2	25.3	13.92
5/SKG-76	25.3	28.65	9.43
5/SKG-76	31.9	32.8	15.05
5/SKG-76	33.4	34.3	17.12
5/SKG-76	34.3	37.5	22.85
5/SKG-76	37.5	40.9	23.98
5/SKG-76	40.9	43.2	7.12
5/SKG-76	122.01	125.15	3.45
5/SKG-76	142.6	146.1	6.15
5/SKG-76	150	151.2	7.64
5/SKG-76	151.2	151.9	9.2
5/SKG-76	151.9	153	31.36
5/SKG-76	153	154.3	28.2
5/SKG-76	154.3	155.6	26.18
5/SKG-76	155.6	156.1	22.01
5/SKG-76	166.45	167.5	26.18
5/SKG-76	166.4	171.7	8.27
5/SKG-76	171.7	175.3	18.2
5/SKG-76	175.3	178.3	7.12
5/SKG-76	180.7	181.4	4.35
5/SKG-76	188.8	191.5	7.12
5/SKG-76	191.5	192.7	14.28
5/SKG-76	192.7	194.1	12.16
5/SKG-76	194.1	195.5	14.56
5/SKG-76	195.5	197	14.72
5/SKG-76	197	198	16.39
5/SKG-76	198	199	14.58
5/SKG-76	199	200	12.36
5/SKG-76	201	203	5.35
5/SKG-77	30.4	32	7.32
5/SKG-77	33.1	34.1	7.74
5/SKG-77	38.1	40.3	32.82
5/SKG-77	87.1	88.2	22.16
5/SKG-77	88.6	89.6	24.36
5/SKG-77	89.6	90.8	42.35
5/SKG-77	90.8	92.4	43.12
5/SKG-77	92.4	94.4	42.84
5/SKG-77	94.4	95.6	42.96
5/SKG-77	95.6	97.8	48.32
5/SKG-77	97.8	99.9	47.92
5/SKG-77	99.9	102.1	36.76
5/SKG-77	102.1	103.5	43.85
5/SKG-77	103.5	105	40.38
5/SKG-77	105	105.8	38.46
5/SKG-77	105.8	107.2	45.89
5/SKG-77	107.2	109.6	23.45
5/SKG-77	110.2	112.8	11.76
5/SKG-77	114	117	6.55
5/SKG-77	117	120	8.92
5/SKG-77	123.7	124.4	17.16
5/SKG-77	124.41	126.8	11.16
5/SKG-77	127.3	128.6	24.35
5/SKG-77	129.9	132.4	18.34
5/SKG-77	132.4	136.8	14.30
5/SKG-77	136.8	139.1	12.65

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-77	139.1	141	9.34
5/SKG-77	143	146.3	20.05
5/SKG-77	146.3	149.4	16.35
5/SKG-77	149.4	152.4	14.8
5/SKG-77	152.4	154.4	12.34
5/SKG-78	18.7	19.3	7.28
5/SKG-78	36.25	37.2	43.74
5/SKG-78	37.2	38.5	45.46
5/SKG-78	38.5	40.5	24.58
5/SKG-78	40.5	41.4	32.56
5/SKG-78	41.4	42.7	28.63
5/SKG-78	46.1	46.8	32.94
5/SKG-78	46.8	48.1	36.11
5/SKG-78	48.1	49.1	45.99
5/SKG-78	49.1	50	36.99
5/SKG-78	50	51.7	50.55
5/SKG-78	51.7	53	40.35
5/SKG-78	53	54	32.25
5/SKG-78	54	55	41.62
5/SKG-78	55	56.3	35.16
5/SKG-78	56.7	58.8	10.77
5/SKG-78	58.8	60	14.57
5/SKG-78	60	61	15.36
5/SKG-78	61	62	13.49
5/SKG-78	62	63.3	16.09
5/SKG-78	63.3	65	13.37
5/SKG-78	65	66.1	14.38
5/SKG-78	66.1	67.2	8.24
5/SKG-78	67.2	69.4	20.4
5/SKG-78	69.4	70.6	18
5/SKG-78	70.6	72.6	11.59
5/SKG-78	72.6	73.6	22.3
5/SKG-78	73.6	74.6	24.12
5/SKG-78	74.6	75.8	18.28
5/SKG-78	75.8	77.5	20.06
5/SKG-78	77.6	79	18.8
5/SKG-78	79	81	19.74
5/SKG-78	81	82	16.88
5/SKG-78	82	82.8	8.34
5/SKG-78	85.6	87.1	7.8
5/SKG-78	89.2	92.2	5.88
5/SKG-78	122.6	125.6	6.44
5/SKG-78	126.7	129.2	6.02
5/SKG-78	139.2	140.7	4.08
5/SKG-78	210	220	5.88
5/SKG-79	73	75.6	8.52
5/SKG-79	81	82.6	43.04
5/SKG-79	82.6	83.9	54.26
5/SKG-79	83.9	85.3	48.72
5/SKG-79	85.3	86.4	48.6
5/SKG-79	86.4	87.9	46.76
5/SKG-79	87.9	89.3	48.72
5/SKG-79	89.3	91.2	40.37
5/SKG-79	91.2	92.5	15.2
5/SKG-79	92.5	93.7	14
5/SKG-79	93.7	95.5	20.05
5/SKG-79	95.5	96.8	13.21
5/SKG-79	96.8	98.6	18.96

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-79	98.8	99.9	14.35
5/SKG-79	99.8	101.8	32.05
5/SKG-79	101.8	102.8	28.04
5/SKG-79	102	104.9	24.32
5/SKG-79	104.9	106.2	16.32
5/SKG-79	106.2	107.2	26.2
5/SKG-79	107.2	108.1	14.4
5/SKG-79	108.1	108.7	4.36
5/SKG-79	114.9	118.65	3.91
5/SKG-79	194.9	197.9	10.36
5/SKG-79	197.9	202.2	8.28
5/SKG-79	212.4	216.2	9.26
5/SKG-79	221	224.3	8.36
5/SKG-79	224.3	227.5	10.2
5/SKG-79	227.5	230.5	7.36
5/SKG-79	230.5	237	11.6
5/SKG-79	237	243	12.16
5/SKG-79	253.4	260	10.38
5/SKG-79	263	268	12.8
5/SKG-79	269.9	272.9	8.3
5/SKG-68	17.9	19.7	8.75
5/SKG-68	19.7	22	10.13
5/SKG-68	22	24.3	13.3
5/SKG-68	24.3	27.3	17.1
5/SKG-68	27.3	29.8	16.6
5/SKG-68	29.8	32	10.78
5/SKG-68	32	34.4	6.71
5/SKG-68	34.4	36.9	16.91
5/SKG-68	36.9	39.9	3.16
5/SKG-68	39.9	42.5	18.75
5/SKG-68	42.5	44.6	19.6
5/SKG-68	190.15	190.6	28.43
5/SKG-68	190.3	197	11.26
5/SKG-68	198.3	201.4	14.4
5/SKG-68	201.4	204	12.21
5/SKG-68	204	205.5	1.78
5/SKG-68	205.5	207.7	1.59
5/SKG-68	228.1	231.1	2.97
5/SKG-68	231.1	234	7.47
5/SKG-68	234	237	1.1
5/SKG-68	237	238.7	2.03
5/SKG-68	240	242	5.07
5/SKG-68	268	270	6.59
5/SKG-68	279.1	282	1.02
5/SKG-68	282	284.3	2.53
5/SKG-68	284.3	286.3	5.83
5/SKG-68	294.8	296.4	20.53
5/SKG-69	20.2	22.3	22.43
5/SKG-69	22.3	24	17.48
5/SKG-69	24	25.1	20.27
5/SKG-69	25.1	26.4	19.77
5/SKG-69	26.4	27.4	44.41
5/SKG-69	27.4	28.5	40.06
5/SKG-69	28.5	29.5	34.53
5/SKG-69	29.5	31	36.09
5/SKG-69	31	31.7	37.08
5/SKG-69	31.7	32.2	56.2
5/SKG-69	32.2	33.2	54.86

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-69	33.2	34.5	53.24
5/SKG-69	34.5	36	64.69
5/SKG-69	36	38.4	48.44
5/SKG-69	38.4	39.4	46.36
5/SKG-69	39.4	40.8	41.2
5/SKG-69	40.8	41.8	43
5/SKG-69	41.8	43.1	41.09
5/SKG-69	43.1	44.9	32.27
5/SKG-69	44.9	47	31.75
5/SKG-69	47	48	25.12
5/SKG-69	48	50	43.7
5/SKG-69	50	51.3	43.17
5/SKG-69	51.3	51.85	18.24
5/SKG-69	53.1	59.3	24.96
5/SKG-69	59.9	61	20.53
5/SKG-69	63.9	66	6.08
5/SKG-69	67.5	69.3	3.55
5/SKG-69	69.3	72.1	3.04
5/SKG-69	74.8	77	0.96
5/SKG-69	77	78.8	2.79
5/SKG-69	83.8	86.8	1.65
5/SKG-69	89.3	92.5	6.34
5/SKG-69	124.2	127.3	2.03
5/SKG-70	80.9	82.6	4.56
5/SKG-70	95.7	98.2	3.93
5/SKG-70	98.2	101.2	4.94
5/SKG-70	101.2	102.3	5.7
5/SKG-70	102.3	103.8	13.68
5/SKG-70	112.5	114.4	39.86
5/SKG-70	114.4	116.2	34.71
5/SKG-70	116.2	117.5	41.25
5/SKG-70	117.5	118.9	37.03
5/SKG-70	118.9	119.4	28.38
5/SKG-70	121.1	121.75	39.78
5/SKG-70	123.4	125	18.58
5/SKG-70	125	126.5	17.76
5/SKG-70	126.5	127.5	19.08
5/SKG-70	127.5	128.5	19.36
5/SKG-70	128.5	129.5	20.08
5/SKG-70	129.5	131	20.59
5/SKG-70	131	132.2	15.78
5/SKG-70	132.2	133.2	19.47
5/SKG-70	133.2	134.2	17.27
5/SKG-70	134.2	135.7	18
5/SKG-70	135.7	137.2	19.39
5/SKG-70	137.2	139.5	12.42
5/SKG-70	141.8	144.4	7.22
5/SKG-70	144.4	146.5	10.64
5/SKG-70	146.5	149.5	6.34
5/SKG-70	149.5	152.5	6.58
5/SKG-70	200.2	203	0.66
5/SKG-70	203	204.5	0.91
5/SKG-70	204.6	206	1.14
5/SKG-70	206	209	1.04
5/SKG-71	17	20	3.96
5/SKG-71	21.6	22.3	6.59
5/SKG-71	25.5	26.6	6.72
5/SKG-71	30	31.5	8.74

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-71	31.5	33.6	5.25
5/SKG-71	33.6	34.5	6.67
5/SKG-71	37.9	40.8	3.93
5/SKG-71	41.4	44	9.76
5/SKG-71	44	45.9	5.19
5/SKG-71	45.9	48.7	3.8
5/SKG-71	91.8	94.1	3.29
5/SKG-71	94.1	96	4.18
5/SKG-71	96	98.4	1.33
5/SKG-71	136.9	139.4	1.46
5/SKG-71	139.4	141.7	1.39
5/SKG-71	145	147.2	3.14
5/SKG-71	154.3	156.2	4.24
5/SKG-71	171.3	175.2	3.17
5/SKG-71	180.4	183.4	1.9
5/SKG-71	183.4	184.9	4.06
5/SKG-71	189.4	193.2	5.83
5/SKG-71	193.2	194.2	3.17
5/SKG-71	194.2	195.2	10.89
5/SKG-71	195.2	196.7	3.04
5/SKG-71	200	200.8	4.56
5/SKG-71	215.9	219.1	4.05
5/SKG-71	219.1	222.1	8.87
5/SKG-71	222.1	223.1	4.43
5/SKG-71	223.1	224.4	6.59
5/SKG-71	224.4	225.4	3.8
5/SKG-71	225.4	226.4	4.18
5/SKG-71	227.8	228.8	3.93
5/SKG-71	228.8	230	3.55
5/SKG-71	230	231.1	3.93
5/SKG-71	231.1	232.1	3.04
5/SKG-71	232.1	234.7	3.42
5/SKG-71	234.7	238.1	4.56
5/SKG-71	238.1	239	4.66
5/SKG-71	239	240	3.29
5/SKG-71	240	241.3	4.18
5/SKG-71	241.3	242.8	3.8
5/SKG-71	242.8	244.8	3.04
5/SKG-71	244.8	246.8	2.66
5/SKG-71	246.8	250	2.91
5/SKG-71	250	252.2	3.04
5/SKG-72	15	16.8	8.19
5/SKG-72	16.8	18.3	4.92
5/SKG-72	18.3	21.1	8.43
5/SKG-72	21.1	24.1	10.14
5/SKG-72	24.1	25.6	6.12
5/SKG-72	25.6	27.8	7.36
5/SKG-72	27.8	30.7	7.98
5/SKG-72	30.7	32.7	6.48
5/SKG-72	32.7	34.5	8.12
5/SKG-72	34.5	36	10.05
5/SKG-72	36	38.2	9.36
5/SKG-72	38.2	40.2	12.06
5/SKG-72	40.2	41.5	9.52
5/SKG-72	41.5	42.5	7.63
5/SKG-72	42.5	44.1	7.42
5/SKG-72	44.1	46.9	6.92
5/SKG-72	166.6	169.6	4.32

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-72	169.6	171.2	4.14
5/SKG-72	171.2	172.7	4.8
5/SKG-72	210	213	0.26
5/SKG-62	12	15	2.22
5/SKG-62	60	63	12.5
5/SKG-62	92.6	95	13.95
5/SKG-62	95	98	12.71
5/SKG-62	98	101	12.32
5/SKG-62	101	104	14.06
5/SKG-62	104	107	10.9
5/SKG-62	107	110	11.94
5/SKG-62	110	113	11.87
5/SKG-62	120.6	122	37.79
5/SKG-62	122	123	28.13
5/SKG-62	123	124	24.93
5/SKG-62	124	125	20.4
5/SKG-62	125	126	30.65
5/SKG-62	126	127	3.2
5/SKG-62	127.2	129.7	16.74
5/SKG-62	174	177	3.66
5/SKG-62	207	210	2.28
5/SKG-62	228	230.5	1.36
5/SKG-62	230	231.5	9.94
5/SKG-62	231.5	232.5	28.91
5/SKG-62	232.5	234	12.5
5/SKG-62	234	235	13.07
5/SKG-62	235	236	22.61
5/SKG-62	236	237	17.51
5/SKG-62	237	238	14.04
5/SKG-62	238	239.2	14.57
5/SKG-62	239.2	239.6	55.04
5/SKG-62	239.6	241	8.91
5/SKG-62	241	243	8.47
5/SKG-62	243	245	3.18
5/SKG-62	245	248.5	5.38
5/SKG-62	250	252	3.84
5/SKG-62	252	254.7	8.57
5/SKG-62	254.7	255.9	18.97
5/SKG-62	255.9	256.7	2.64
5/SKG-62	256.7	257.7	8.3
5/SKG-62	257.7	258.5	12.77
5/SKG-62	258.5	261	5.99
5/SKG-62	261	264	6.14
5/SKG-62	264	265.1	5.94
5/SKG-62	265.1	267	7.3
5/SKG-62	267	270	7.25
5/SKG-62	270	271	11.15
5/SKG-62	271	272	9.6
5/SKG-62	272	273	8.14
5/SKG-62	273	276	4.26
5/SKG-62	276	277.4	3.92
5/SKG-62	277.4	278	6.47
5/SKG-62	278	279	16.53
5/SKG-62	279	280	11.07
5/SKG-62	280	281	21.56
5/SKG-62	281	282	20.55
5/SKG-62	282	283	10.13
5/SKG-62	283	284	10.43

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-62	284	285	13.47
5/SKG-62	285	286	14.11
5/SKG-62	286	287	20.99
5/SKG-62	287	288	18.91
5/SKG-62	288	288.8	20.57
5/SKG-63	29.6	32.4	2.62
5/SKG-63	37.4	38.2	26.7
5/SKG-63	38.6	39.6	37.01
5/SKG-63	39.6	40.6	21.18
5/SKG-63	41.25	41.9	21.06
5/SKG-63	42.8	45.3	20.92
5/SKG-63	62	65	8.25
5/SKG-63	81	82.2	12.26
5/SKG-63	82.9	83.1	12.36
5/SKG-63	124	126	1.88
5/SKG-63	126	129	1.86
5/SKG-63	129	132	1.79
5/SKG-63	132	133.6	1.95
5/SKG-63	137.4	139.5	1.77
5/SKG-63	161.8	162.2	1.73
5/SKG-63	163	163.8	1.65
5/SKG-63	164.7	165.6	2.28
6/SKG-63	185.6	186.5	1.86
5/SKG-63	230	233	1.97
5/SKG-64	62	65	5.83
5/SKG-64	84.52	85.7	23.8
6/SKG-64	96.8	98.8	3.08
6/SKG-64	98.8	101.35	6.34
5/SKG-64	101.35	103.5	4.41
5/SKG-64	103.5	106	4.17
5/SKG-64	106	108.2	2.54
6/SKG-64	111.5	113.7	3.05
5/SKG-64	113.7	116.4	3.04
5/SKG-64	116.65	116.5	2.73
5/SKG-64	129	132	2.61
5/SKG-64	174	177	2.01
5/SKG-64	207	210	1.91
5/SKG-65	5.5	8.5	2.45
5/SKG-65	8.5	11.5	2.37
5/SKG-65	11.5	14.5	2.43
5/SKG-65	14.5	17.5	2.37
5/SKG-65	17.5	20.5	2.38
5/SKG-65	20.5	23.4	2.35
5/SKG-65	23.4	26.3	2.19
5/SKG-65	26.3	28.4	1.95
5/SKG-65	130	133	2.97
5/SKG-65	133	136	2.97
5/SKG-65	136	139	3.67
5/SKG-65	139.3	142.3	3.56
5/SKG-65	142.3	145.3	3.74
5/SKG-65	145.3	148.3	3.23
5/SKG-65	148.3	151.3	2.85
5/SKG-65	151.3	154.3	2.8
5/SKG-65	154.3	157.3	2.87
5/SKG-65	201.8	203.2	3.13
5/SKG-65	207	209.2	6.97
5/SKG-65	209.2	212	12.14
5/SKG-65	212	215	11.37

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-65	215	218.5	6.38
5/SKG-65	221.3	224.3	3.68
5/SKG-65	224.3	227.25	4.29
5/SKG-65	227.25	228.5	20.86
5/SKG-65	228.5	230.5	23.85
5/SKG-65	230.5	233.5	31.17
5/SKG-65	233.5	236.2	21.58
5/SKG-65	236.2	240.3	21.79
5/SKG-65	240.3	241.3	11.39
5/SKG-65	241.3	242.4	18.81
5/SKG-65	242.4	245.4	21.28
5/SKG-65	245.4	248.2	27.14
5/SKG-65	248.2	250	27.35
5/SKG-65	250	253	28.9
5/SKG-65	253	254	20.39
5/SKG-65	254	257	25.16
5/SKG-65	257	260	24.06
5/SKG-65	260	262	18.61
5/SKG-65	262	263.1	16.09
5/SKG-66	263.1	266	13.17
5/SKG-65	266	269	16.96
5/SKG-65	269	272	17.38
5/SKG-65	272	275	20.24
5/SKG-65	275	278	18.96
5/SKG-65	278	280.3	14.1
5/SKG-65	280.3	282	6.28
5/SKG-65	282	285	5.29
5/SKG-65	285	287.8	5.55
5/SKG-65	287.8	288.5	16.22
5/SKG-65	291.4	293.7	2.64
5/SKG-65	293.7	296.7	3.78
5/SKG-65	296.7	300	3.65
5/SKG-65	300	303	3.79
5/SKG-65	303	306	5.03
5/SKG-65	306	309	2.77
5/SKG-66	10.7	13.6	2.39
5/SKG-66	24.5	26	7.36
5/SKG-66	26	28.5	6.83
5/SKG-66	41.95	44.45	4.66
5/SKG-66	44.45	47.4	4.63
5/SKG-66	47.4	50.4	3.84
5/SKG-66	50.4	53.4	4.41
5/SKG-66	53.4	55.2	5.07
5/SKG-66	55.4	57.85	5.48
5/SKG-66	57.85	60.3	4.51
5/SKG-66	60.3	63.1	4.43
5/SKG-66	63.1	65.1	3.07
5/SKG-66	66.1	68.1	4.91
5/SKG-66	68.1	71.1	4.62
5/SKG-66	71.1	73.7	3.88
5/SKG-66	73.7	76.4	3.09
5/SKG-66	76.4	79.3	3.79
5/SKG-66	79.3	80.7	4.78
5/SKG-66	80.7	82.9	3.81
5/SKG-66	171	174	2.71
5/SKG-66	174	177	3.12
5/SKG-66	189	192	10.04
5/SKG-66	192	195	4.87

BOREHOLE ASSAY - BAND V

BAND/BH	DEPTH FROM	DEPTH TO	Cr_2O_3
5/SKG-66	193.4	195	3.08
5/SKG-66	195	197	3.51
5/SKG-66	197	199.05	3.46
5/SKG-66	199.05	200	23.32
5/SKG-66	200	201	28.73
5/SKG-66	201	204	31.53
5/SKG-66	204	205	25.77
5/SKG-66	205	207	23.87
5/SKG-66	207	210	22.19
5/SKG-66	210	211.55	23.54
5/SKG-66	211.55	213	23.01
5/SKG-66	213	216	21.22
5/SKG-66	216	219	22.51
5/SKG-66	219	220.25	19.66
5/SKG-66	220.25	222	26.35
5/SKG-66	222	223	20.24
5/SKG-66	223	224	2049
5/SKG-66	224	226.8	17.77
5/SKG-66	226.1	229.1	20.22
5/SKG-66	229.1	231.7	18.02
5/SKG-66	231.7	234.3	14.46
5/SKG-66	234.3	237	15.51
5/SKG-66	237	239	16.03
5/SKG-66	239.5	243.2	6.71
5/SKG-66	247.4	250	4.13
5/SKG-66	250	252	4.37
5/SKG-66	252	256	3.87
5/SKG-66	255	257.1	4.23
5/DMG-30	0	29.95	-
5/DMG-23	0	60.6	-
5/DMG-23	60.6	60.6	13.95
5/DMG-23	60.6	65.45	-
5/DMG-23	65.45	66.65	27.36
5/DMG-23	66.65	73.55	-
5/DMG-20	0	99.6	-
5/DMG-31	0	43.4	-
5/DMG-31	43.4	44.4	34.04
5/DMG-31	44.4	45.4	14.96
5/DMG-31	45.4	46.4	24.02
5/DMG-31	46.4	47.4	29.32
5/DMG-31	47.4	48.4	26.9
5/DMG-31	48.4	49.4	33.22
5/DMG-31	49.4	50.4	32.99
5/DMG-31	50.4	51.4	35.28
5/DMG-31	51.4	52.4	24.16
5/DMG-31	52.4	53.4	30.2
5/DMG-31	53.4	54.4	23.23
5/DMG-31	54.4	55.4	22.95
5/DMG-31	55.4	56	2.81
5/DMG-31	56	70	-
5/DMG-34	0	41.7	-
5/DMG-34	41.7	42.7	36.07
5/DMG-34	42.7	43.7	38.07
5/DMG-34	43.7	44.7	38.88
5/DMG-34	44.7	44.9	35.66
5/DMG-34	44.9	55	-

Orissa Mining Corporation Ltd.
Chromite Prospecting Camp
Camp Office

Annex. 28

PURCHASE ORDER
THE ODISHA MINING CORPORATION LIMITED

(A GOLD CATEGORY STATE PSU)
(A GOVT.OF ODISHA UNDERTAKING)
J.K.Road Prospecting Division,
J.K.Road Jajpur Dt. - 755020
INDIA

Phone :06726220396
Fax :
OST No.BH-II-1764/01,04.95
CST No.BHC-17/13.03.58
TIN - 21761104653

Supplier No : 100073

M/S Maheswari Mining Pvt.Ltd.
21, Chhtela Marwari Lane,P.O. Ranig
713347 Raniganj-Burdwan

PO Number / Date
4700001072 / 08.08.2011

Delivery Date: 30.06.2012

Sub: Purchase/Work/Service Order

Dear Sir,
With reference to your quotation and our RFQ as cited above we are pleased to award the suppy/work for the followings as per the details given below/list enclosed under the terms & conditions attached herein after.Please refer this P.O Number in all your correspondence.

Terms of delivery: NA
Terms of payment : AS PER THE ATTACHMENT Currency INR

Item	Material	Qty&Unit	Description & Price/Unit	Net value
00001		1 Activ.unit	**2nd yr 13000+/- 10% m core drilling in J**	
	Gross Price		63,536,825.50 INR	63,536,825.50
	Non-Deductible Tax		6,544,293.03	
	Sub Total		70,081,118.53 INR	70,081,118.53
The item covers the following services:				
10		12,969 M	Mineral/Ore in associated formations 4,317.00	55,987,173.00
20		2.750 M	Chert/BHJ Formations 5,180.40	14,246.10
30		1 EA	Wage escalation II 4,333,601.48	4,333,601.48
40		1 EA	Spares escalation II 1,195,683.82	1,195,683.82
50		1 EA	Diesel escalation II 2,006,121.10	2,006,121.10

Total net value INR

70081118.53

Annex. 2.8

PURCHASE ORDER
THE ODISHA MINING CORPORATION LIMITED

(A GOLD CATEGORY STATE PSU)
(A GOVT.OF ODISHA UNDERTAKING)
J.K.Road Prospecting Division,
J.K.Road Jajpur Dt. - 755020
INDIA

Phone :06726220396
Fax :
OST No.BH-II-1764/01.04.95
CST No.BHC-17/13.03.58
TIN - 21761104653

PO Number / Date
4700001072 / 08.08.2011

The terms and conditions indicated above / attached here with.

For The Odisha Mining Corporation Ltd

Authorized Signatory

Please acknowledge receipt of the Order.
For the Vendor

Authorized Signatory
Date:

Annex. 2.3

PURCHASE ORDER
THE ODISHA MINING CORPORATION LIMITED

(A GOLD CATEGORY STATE PSU)
(A GOVT.OF ODISHA UNDERTAKING)
J.K.Road Prospecting Division,
J.K.Road Jajpur Dt. - 755020
INDIA

Phone :06726220396
Fax :
OST No.BH-II-1764/01.04.95
CST No.BHC-17/13.03.58
TIN - 21761104653

Supplier No : 100073	PO Number / Date
M/s Maheswari Mining Pvt.Ltd. 21, Chhtela Marwari Lane,P.O. Raniganj /13347 Raniganj-Burdwan	4700001216 / 11.09.2012

Delivery Date: 30.06.2013

Sub: Purchase/Work/Service Order

Dear Sir,

With reference to your quotation and our R&Q as cited above we are pleased to award the suppy/work for the followings as per the details given below/list enclosed under the terms & conditions attached herein after.Please refer this P.O Number in all your correspondence.

Terms of delivery: NIL
Terms of payment : AS PER THE ATTACHMENT
Currency INR

Item	Material	Qty&Unit	Description & Price/unit	Net value
00001			8000+/-10% M LTCD III, JKRD	
		1 Activ.unit		
	Gross Price		46,279,665.30 INR	
46,279,665.30				
	Non-Deductible Tax		5,720,166.63	
	Sub Total		51,999,831.93 INR	
51,999,831.93				

The item covers the following services:

10	8,945 M		Mineral/ore in associated formations 4,317.00	38,617,565.00
30		1 EA	wage escalation. 4,400,076.45	4,400,076.45
40		1 EA	Diesel escalation 2,169,585.80	2,169,585.80
50		1 EA	Spares escalation 1,094,438.05	1,094,438.05

Total net value INR

51999831.93

Annex-28

PURCHASE ORDER
THE ODISHA MINING CORPORATION LIMITED

(A GOLD CATEGORY STATE PSU)
(A GOVT.OF ODISHA UNDERTAKING)
J.K.Road Prospecting Division,
J.K.Road Jajpur Dt. - 755020
INDIA

Phone :06726220396
Fax :
OST No.BH-II-1764/01.04.95
CST No.BHC-17/13.03.58
TIN - 21761104653

PO Number / Date
4700001216 / 11.09.2012

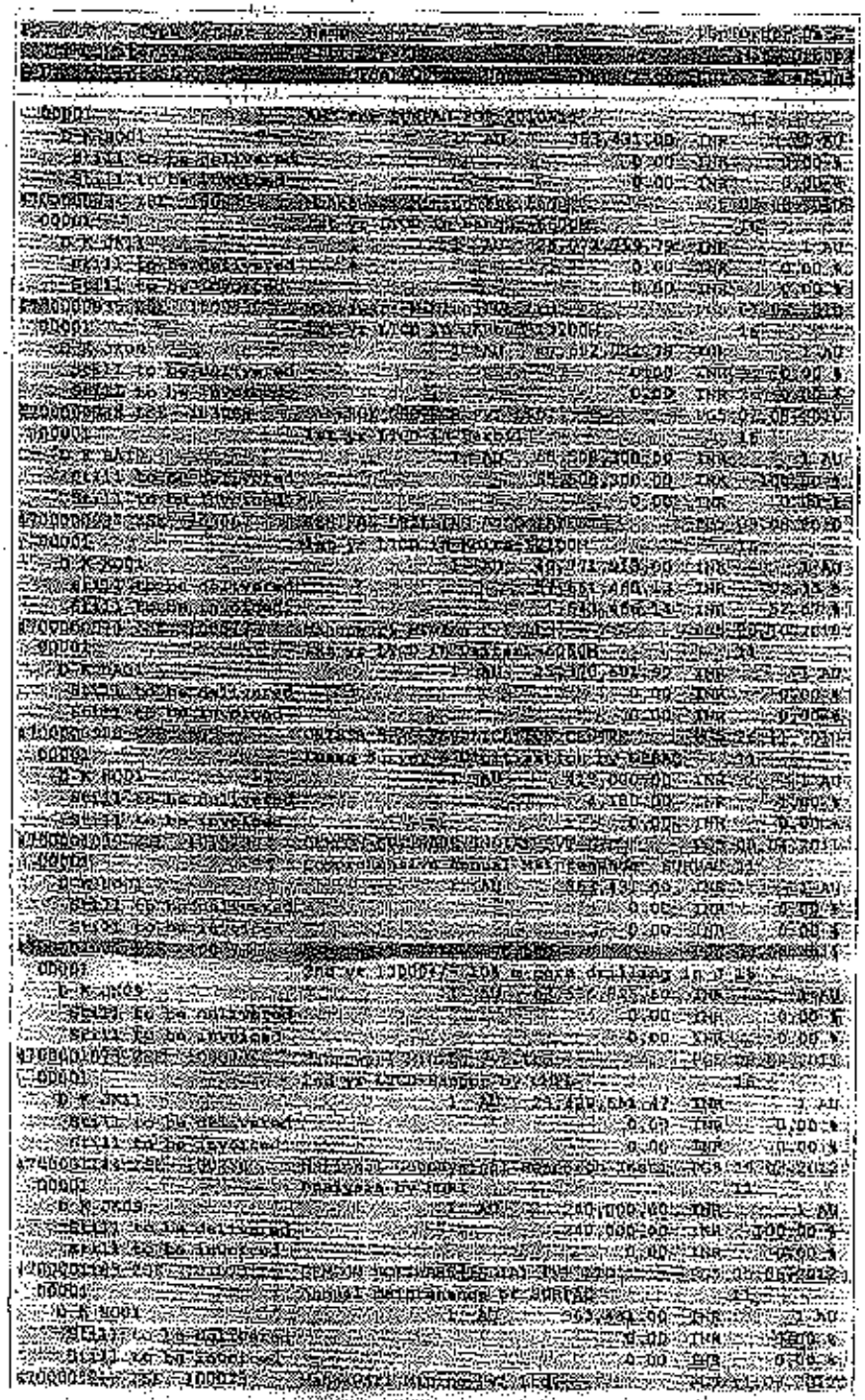
The terms and conditions indicated above / attached here with.

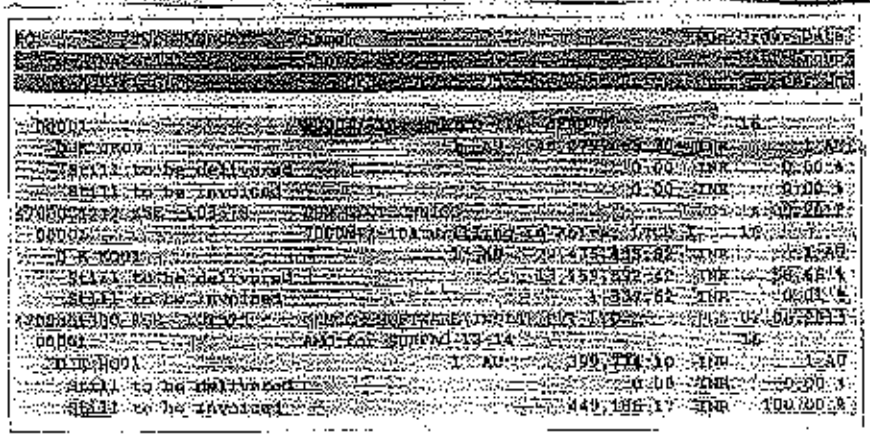
For The Odisha Mining Corporation Ltd

Authorized Signatory

Please acknowledge receipt of the Order.
For the Vendor

Authorized Signatory
Date:





The Orissa Mining Corporation Ltd.

(A Government of Orissa Undertaking)
BHUBANESWAR - 751 001
ISO 9001 & 14001 Certified

OMC

BY REGD.POST WITH A.D.

No. 10750 /OMC/2010 Dt.2.6.2010

To

M/s. Maheswari Mining Pvt.Ltd.
Maheshwari Mining Pvt.Ltd.,
21 Chhotelal Marwari Lane,Raniganj,
Burdwan, West Bengal

Sub:- Award of 12,000 ±10% Diamond Core Drilling Work in different lease holds of OMC Ltd. for package-C (J.K.Road) during first year(out of 33,000 ±10% Mtrs in 3 years) -Work order regarding.

Ref:- Tender/Technical Bid opened on 15.2.2010, price bid opened on 22.3.2010 and subsequent negotiation on 29.3.2010.

Sir,

In inviting a reference to the above cited subject and reference, the Management of OMC is pleased to award the above work in your favour i.e. 12,000 ±10% Mtrs of Diamond Core Drilling for the first year against package-C (J.K.Road) in Jajpur & Dhenkanal Districts, as per the enclosed scope of work, period, terms and conditions.

Above work order in two copies, duly signed is being forwarded to you for your reference. One copy of said work order is to be signed in each page by you as a token of acceptance of work, period, terms and conditions and return the same to us within 10 days time for our record.

Further, you are also requested to sign the contract/agreement for the above tendered work within one month from the date of issue of this work order.

Thanking you,

Yours faithfully,

DY.GENERAL MANAGER(GEO)

Encl:as above.

www.orissamining.com
Phone : 0674-2393431, 2395606, 2306421, Fax : 0674-2396889, 2391629

Annex. 28

TERMS & CONDITIONS FOR CARRYING OUT DIAMOND CORE DRILLING WORK IN DIFFERENT LEASE HOLE OMC LTD FOR PACKAGE-C OF J.K.ROAD REGION IN JAJPUR & DHENKANAL DISTRICTS, OI (TENDER/TECHNCIAL BID OPENED ON 15.02.2010) IN FAVOUR OF M/S. Maheswari Mining Pvt. Raniganj (W.B.)

1. SCOPE OF WORK

Diamond core drilling in 3 years against **Package-C** in different lease holds of **OMC** coming under J.K Road Region as per the scope of work, period, specifications, terms and conditions detailed below:

Package	Name of Region (Dist)	Name of lease hold areas to be explored	Quantum of work (Mtrs) & period			Base rate/Price per meter exclusive of service tax (In Rs.)	
			1st year	2nd year	3rd year	Mineral/Ore in associated formations	BHJ/Chert
C	J.K.ROAD	Kaliapani, Sukrangi, Kathpal, Kalarangi	12,000 ±10%	13,000 ±10%	8,000± 10%	4317/-	5180.40

I) The period of work shall ordinarily be for three years subject to annual renewal on satisfactory performance of agency at the sole discretion of OMC.

II) The period for 1st year drilling work (12 months) shall start from the date of issue of work order by OMC.

III) The quantum of drilling meterage or part indicated above may be diverted to any other lease hold area of the same region by OMC in case of need.

2. DESCRIPTION OF WORK AWARDED FOR FIRST YEAR

The target area, quantity and expected max.depth of drilling in Mtrs in respect of above package for execution by agency in first year is given below:

Package	Region	Mineral/ore in associated formations	Quantity of work for first year (Mtrs)	Expected max. depth in Mtrs	Basic rate/price per meter of core drilling exclusive of service taxes	
					Mineral/ore in associated formations	BHJ/Chert
C.	J.K.ROAD	Chromite	12,000±10%	250	Rs.4317/-	Rs.5180.40

(Signature of the agency)
(Seal)

DY.GENERAL MANAGER(GEO)
OMC

MAHESWARI MINING PVT. LTD.

The agency/firm has to undertake the following ancillary works related to core drilling in addition the core drilling work as per specification, terms and conditions indicated hereinafter.

I. Survey for location of drill hole points as per approved plan or as advised by Site Geologists/Cam Incharge/respective Regional Head of Geology.
II. Measurement of co-ordinates, RL of drill holes and drawing of profiles of each completed drill ho section.
III. Drawal and processing of drill core samples as advised by Site Geologist/Camp Incharge.

3. SPECIFICATIONS: The core drilling work shall be taken up by the agency as per following specifications:

a. Size of hole/core: The holes shall be drilled in HQ/HX, NQ/NX or BQ/BX sizes.
b. Inclination of hole: The holes shall be mostly inclined or rarely vertical in case of chrome o formations in different lease holds as per direction of site/field Geologist.
c. Depth of hole: Depth of closure of every hole shall be advised by the concerned site geologist/can Incharge or if required by respective Regional Head of the Geology.
d. Recovery of core: Recovery of core should be minimum 90% in ore zone and 70% in othe formation, with overall core recovery being minimum 80% per hole. This will be certified by th concerned site Geologist/Camp Incharge. Details to be maintained in register on daily basis by th site representatives of the agency to be countersigned by site Geologist of OMC.
e. Type of Drilling: Wet drilling using triple tube core barrel with appropriate drilling mud/polymer preferred. Wet drilling by double tube core barrel or dry drilling is also acceptable provided the cor recovery satisfies the norms as at clause 3d.
f. Preservation of Core/Sludge: Core/sludge recovered as per run shall be handed over by the agenc to the local site geologist/camp Incharge in G.I. Core boxes with proper labelling of depth/length c core. The core boxes are to be supplied by the agency. The core boxes should be of appropriate siz with suitable size partition/cabinets to accommodate different size of core recovere (HQ/HX,NQ/NX, BQ/BX) and preserved in original shape without breaking/ alteration.
g. Sampling: The agency shall draw samples from the core and process it for analysis as per standar procedure under the guidance of the Site Geologist. Each sample shall be reduced to an appropriat quantity by following the standard sampling procedures such as homogenising, coning & quarterin and pulverising into 100/200 mesh and prepared into four packets of 50gm each. The final sampl packets shall be properly labelled with BH Number, sample run and handed over to the concerne site geologist/camp Incharge.
h. Bore hole pillaring: Each completed drill holes shall be marked with a concrete pillar indicating th bore hole number, location coordinates and RL, under the guidance of the site geologist/cam Incharge.
i. Plans and Sections: Completed drill hole sections showing the ground profile and location of th holes along the section drawn in 1:500 scale on a graph tracing film (100μ) with two blue prin copies shall be submitted by the agency to the concerned site geologist/camp Incharge.

Signature of the agency)
(Seal)

j. Deviation Survey: Deviation of drill holes both in inclination and azimuth shall be measured with suitable instruments at every 30m length of each drill hole or as desired in case of inclined bore holes. Deviation survey is to be conducted by the Agency by using modern tool (say, digital bore hole camera). Acid etching method shall not be accepted. The bore hole survey results are to be certified by concerned Geologists of respective Region.

The drilling work and the ancillary work as per specification above will be executed under supervision and direction of the site geologist/camp incharge for the concerned area, as nominated by Geologist Incharge of Region/ Regional Head of Geology of respective region.

Note:

Depending upon the field conditions, OMC Limited reserves the right of changing the technical parameters and specifications on mutual agreement with the Agency.

4. TIME PERIOD:

a. The agency shall commence drilling within one month of issue of the work order.

b. The total quantity of work should be completed within schedule period from the date of issue of work order as per clause No. 1 under scope of work.

c. The agency shall make all necessary arrangements for commencement of the drilling work in strict adherence to the specifications, terms and conditions and complete the work within the stipulated time.

d. Initially this work is awarded to the agency for the first year. The work shall be extended to 2nd and 3rd year for the meterage as indicated under scope of work at clause-1.

e. The annual/yearly extension is subject to satisfactory performance of the agency in proceding years), which is at sole discretion of OMC. The period for 1st year drilling work shall start from the date of issue of work order by OMC.

f. Non completion of the work within the stipulated time shall attract the penalty clauses as at clause 9 of this work order.

5. OTHER TERMS & CONDITIONS:

a It shall be the agency's responsibility to set up the camp for providing necessary accommodation to its drilling personnel nearest to the drilling site at respective mining leases. Management of the camp affairs, providing logistic support including supply of water to the drilling personnel at camp shall be the responsibility of the agency.

Signature of the agency
(Seal)

Annex. 2.8

b. Preparation of approach road for mobilisation of men and machinery to the drill site and other required materials shall be the responsibility of the agency.

c. The agency is to take up the drilling work as per the direction of concerned Site Geologist/Camp Incharge or Regional Head of Geology and is answerable to them.

d. The site-incharge of the agency shall submit the daily, weekly and monthly progress report of the drilling work to the Regional Head of Geology, duly certified by Site Geologist/Camp Incharge. A copy of monthly progress report must be forwarded to Dy. General Manager(Geo)/Head of Geology, HO within first week of succeeding month by the agency, duly certified by Regional Head of Geology.

e. The drilling should be undertaken as per the quantum and specifications indicated at Clause No. 2 & 3 under scope of work, terms and specifications of this document and any deviation to the same without written consent of OMC Limited will lead to termination of the contract or cancellation of the particular hole. However, depending upon the field conditions, OMC Limited will reserve the right of changing the technical parameters on mutual agreement with the agency.

f. In case the agency fails to achieve the desired specification or abandons a hole before the required depth, another hole adjacent to the incomplete hole would be taken up at the cost of agency as directed by the site geologist/camp incharge and no cost for the incomplete hole shall be paid by OMC.

g. The core /sludge should be collected with utmost care at the time of drilling and shall be preserved in properly partitioned G.I. core boxes (to be supplied by Agency) with necessary labelling of the runs/depth under the direction of the site geologist/camp incharge. Details of the hole, box number, length of core etc. are to be written on the outer and inner side of the core boxes. The core boxes are to be delivered to the respective site geologist/camp incharge at the respective Prospecting Camp.

h. Necessary survey work required for locating the bore holes on the ground as per the supplied approved plan, measurement of the co-ordinates, RL of the completed holes and profile of each drill section etc. shall be done by the agency as per the advice of the site geologist/ camp incharge.

i. A register is to be maintained at drilling site (rigwise) by agency to record bore hole wise/runwise drilling logs, indicating size of core barrel/casing used, percentage of core recovered, process of core drilling (dry/wet in DT or TF method etc.) for convenience of supervision and preparation of summarized log with above data (bore hole wise). Summarized logs in respect of completed bore holes with abstract of above data duly submitted to Camp Incharge and Regional Head of Geology alongwith the monthly bill of agency.

6. RESPONSIBILITY OF THE AGENCY.

a. The agency will submit necessary statutory returns as applicable under Mines Act, 1952, EPF Act, 1952, C. L. (R&A) Act, 1971, MC Rules, 1961, MCDR, 1988 etc. to the site geologist/ Mines Manager/ Labour Welfare in charge of respective Mines, as the case may be.

b. The agency will provide all safety equipments to the workers and take necessary measures for safety.

c. The agency will provide necessary medical facilities to its workers and provide drinking water at its own cost.

Signature of the agency
(Seal)



d. The agency shall report immediately to the site geologist/camp incharge/ Mines Manager in case of any major or minor accident to his worker or staff.

e. The agency shall be liable for payment of compensation to workers under Workmen's Compensation Act, 1923. Any payment, if made by OMC, shall be reimbursed if not deducted by OMC from the agency's dues.

f. The agency shall liaise with concerned authorities, if required, for uninterrupted drilling operation.

g. The agency will make all necessary arrangements for commencement and carrying out of the drilling work by its own resources in accordance to the specifications, terms and conditions indicated herein.

h. Utmost care will be taken by the agency to preserve the recovered cores and sludge in G.I. Core Boxes as per clause 3(f&g)) and deliver the same at the place as specified by the Site Geologist/Camp Incharge. The core boxes are to be provided by the agency.

i. The agency shall achieve a minimum of 30% of the work within initial 50% of the time period allowed in the tender/work order and minimum 90% of the work within the stipulated time period.

j. Concrete pillars are to be constructed on the completed holes and details will be written on the concrete pillar indicating the drill hole number, location coordinates and RL under the guidance of the Site Geologist/Camp Incharge.

k. The agency shall undertake necessary survey work required for locating the bore holes on the ground as per the supplied approved plan, measurement of the co-ordinates, RL of the completed holes and profile of each drill section etc. as per the advice of the site geologist/ camp incharge.

7. RESPONSIBILITY OF OMC.

a. The OMC site representative (Site Geologist/Camp Incharge) will show the area and drill hole locations broadly as per the approved plan or as advised by Site Geologist/Camp incharge/respective Regional Head of Geology.

b. OMC Limited will provide the principal employer certificate to the agency if necessary for obtaining labour licence.

c. The site geologist and the Labour Welfare in charge of the respective mines (as in the case may be) will verify all the statutory records/ returns of the agency.

d. The format for daily as well as weekly progress report of the drilling work along with the logging of the report shall be provided by the Site Geologist/Camp Incharge.

8. REPRESENTATIVES:

a. An authorized person/Geological Executive, to be nominated by respective Regional Head of Geology, who will act as the OMC's site Geologist for respective areas for the purpose of execution of the drilling work by the agency. Besides, respective Regional Head of Geology may authorize more than one Geological Executive under his control to supervise the work as per requirement.

Signature of the agency
(Seal)

b. The agency will declare the name and designation of its site representative who shall be responsible for execution of the work and will act according to the instruction of the OMC Limited representative and authorities.

9. PENALTY:

Penalty shall be imposed as below.

a. In case the agency fails to start the work within two months of issue of the work order, the contract may be terminated along with forfeiture of the EMD/ISD at OMC option.

b. In case the agency fails to achieve a minimum of 30% of the yearly awarded work within 6 months from the date of issue of the work order, the contract/work order may be terminated along with forfeiture of EMD/ISD and balance 10% amount (SD) available with OMC. *In such case, OMC will have right and shall be free to award the balance quantity of work* to eligible participated *bidders* willing to work *at approved rate.*

c. In case the agency fails to achieve a minimum of 90% of the work within the stipulated contract period, penalty @10% for the balance work value shall be recovered. The amount will be recovered from the S.D. and/or EMD/ISD deposited with OMC.

d. In case of delay and/or shortfall in achievement of target caused due to reasons beyond control of agency, penalty may be waived subject to approval of Chairman/CMD/M.D., OMC Ltd.

10. TERMS OF PAYMENT:

a. Monthly running bills in triplicate in respect of completed drill holes will be submitted by the agency to the Camp Incharge/Regional head of geology of respective region duly forwarded through the site geologist/camp incharge with his certification in respect of quantity of work completed, compliance to the specifications, terms & conditions. The respective regional head of Geology will recommend for release of payment to agency by Manager/Dy.Manager (Accounts) of the Region.

b. The monthly running bill amount in respect of completed drill holes would be released by the concerned Regional Manager / Manager/Dy.Manager (Accounts), OMC Limited after deduction of 10% of the bill value towards S.D. as per the recommendation of the site geologist/camp incharge and Regional Head of Geology of the respective Region, OMC Limited, subject to all kinds of permissible recovery.

c. On completion of the total work, 10% S.D. so deducted from R.A. Bill shall be released at HO on recommendation of the Dy.Genral Manager(Geo)/Head of Geology Division, HO, Bhubaneswar subject to clearance of all dues, liabilities or any other outstanding against the agency on account of the allotted work and on certification of the site geologist/camp incharge and the regional head of Geology for respective Region.

d. Applicable Income Tax and ED Cess etc. on R.A. bill value shall be deducted from the bills.

e. For payment, minimum 90% core recovery in the ore zone and 70% in other formation, with overall core recovery of 80% per hole will be considered. Payment on prorate upto 70% will be allowed. However, for overall core recovery of below 70%, no payment shall be made.

Signature of the agency
(Seal)



Annex. 2-B

11. GENERAL:

a) OMC Limited reserves all the right to terminate the Agreement/Contract/work order at any point of time in case progress of the work and the precision/quality of the work are found not satisfactory during the periodical assessment and in case of stoppage of drilling work due to reasons beyond the control of OMC.

b) Decision of the Chairman/CMD/M.D., OMC Limited shall be final and binding in case of any dispute that may arise during the period of this work or in connection with this agreement/ contract. If, however, the Agency is not satisfied with the decision of the Management, a sole Arbitrator shall be appointed by the Agency from out of a panel of 8 Arbitrators selected by the management of OMC Ltd. The panel of arbitrators to be selected by the Management shall comprise of retired High Court Judges of Orissa High Court or retired State Government Officers of Chief Secretary cadre/level. The arbitration proceeding shall be conducted in accordance with the procedures laid down under the Act, 1996.

c) Any other provision applicable as per Tender Norms.

12. ESCALATION/DE-ESCALATION (over the base rate)

Escalation/de-escalation will be given on account of change in price/rate of wages, diesel and machinery spares as per formula given below:

i) For Diesel

$$RED = \frac{0.15 \times (Pr - Pb) \times R}{Pb}$$

Where, RED= Rate of escalation/de-escalation on account of change in price of diesel.

0.15=Weightage for diesel component

Pr= Revised rate of diesel

Pb= Rate of diesel as on the date of opening of tender

R= Awarded rate/mtr.

II) For Wages

$$REW = \frac{0.30 \times (Wr - Wb) \times R}{Wb}$$

Where, REW=Rate of escalation/de-escalation on account of change in minimum wages of semi-skilled worker working above ground for mines as declared by Central Govt.

0.30=Weightage for wages component.

Wr=Revised minimum wages including special allowance of semi-skilled workers working above ground workers of iron/manganese/chrome ore mines as per Central Govt..

Wb= minimum wages including special allowance of semi-skilled workers working above ground of iron/manganese/ chrome ore mines as per Central Govt. prevailing on the date of opening of tender.

R= Award rate/mtr.

Signature of the agency

(Seal)

Annex. 2B

iii) For Spares

$$RES = \frac{0.30 \times (WPIsr - WPIsb) \times R}{WPIsb}$$

Where, RES= Rate of escalation/de-escalation on account of change in price of machinery spares

0.30= Weightage for spares in awarded rate

WPIsr= Whole-sale Price Index (WPI) series of heavy machinery & parts as per R.B.I. bulletin for the last month of immediately preceding quarter.

WPIsb= Whole-sale Price Index (WPI) series of heavy machinery & parts as per R.B.I. bulletin for the month of opening of tender.

R= Awarded rate/Mtr

13 (1) Effective Date=

a) Wages/Diesel: If the wage/diesel rate is revised on first day of a month, escalation/de-escalation effect shall be given from the month of revision itself, otherwise effect will be given from the next month of revision.

b) Spares: Escalation/de-escalation on account of change in price of heavy machinery & parts will be given quarterly on the basis of Index for heavy machinery & parts as per R.B.I. bulletin prevailing for the last month of the immediately preceding quarter. For example:

Bill for the month of	Index for the month of
January'10,Feb.'10,March'10	December,2009
April'10,May'10,June'10	March,2010
July'10,Aug.'10,Sept.'10	June,2010
Oct.'10,Nov'10,Dec'10	September,2010

14. EARNEST MONEY DEPOSIT (EMD):

a. The EMD deposited by the agency shall be retained and shall be converted to ISD and returned after successful completion of the work in accordance with the terms and conditions and after 60 days from release of the final bill.

b. In case the agency quits the work in the middle of any year then the ISD shall be forfeited besides imposing penalty for under achievement, if any, as per clause-9.

c. In case the agency does not take up the work in next year, for which tender was made, then the ISD shall be forfeited alongwith S.D.deducted from the agency in the previous year from R.A.Bill.

15. *INSPECTION* OF WORK

Competent officials of OMC will have the authority to inspect the work anytime, anywhere including the premises of the firm/agency executing the work. The agency shall extend every facility and assistance to carry out such inspection.

16. DISPUTE RESOLUTION:

Bhubaneswar shall be treated as having jurisdiction for all sorts of dispute including arbitration, if any.

16.1. In case of dispute arising out of or in connection with this contract, the disputant shall nominate/ select one of the arbitrators out of the panel of three retired Judges of the High Court of Orissa to be selected by the Chairman/CMD/M.D., OMC Ltd. The arbitration shall be conducted in accordance with the Arbitration & Conciliation Act, 1996.

(Signature of the agency)
(Seal)

DY.GENERAL MANAGER(GEO)
OMC

dmmex. 23

Date: 05/03/2010 Page: 2 / 4

Column: 1 / 3

Cost Center/Group: 38 [illegible]
Person responsible:
Reporting period: 1 to 12 2008

Cost Element	Act Costs	Plan Costs	Var (Abs)	Var (%)
601200	1,379,[illegible]	1,329,[illegible]	350,206.67	20.69
601400	16,280.11		16,286.14	
601660	5,900.11	4,681.45	1,018.66	20.67
605000	12,427,122.00		12,427,122.00	
605050	41,352,[illegible]		41,352,[illegible]	
605100	29,150.84	31,231.24	2,081.00-	6.66
605150	244,698.05	160,960.55	84,111.50	52.30
605200	50,580.67	35,794.16	14,786.51	12.90
605250	15,295.33		15,296.33	
605260	71,762.50	65,755.50	6,924.99	9.16
605300	33,372.96	106,496.33	75,122.37-	69.24-
605450	130,915.68	673,914.91	111,002.87	12.76
606400	36,258.78		36,258.78	
606500	2,931,[illegible]	2,947,[illegible]	15,861.76-	0.54-
606600	4,000.00		3,000.00	
607001	2,064,643.00	1,916,746.00	147,[illegible]	7.71
607002	17,387.60	61,963.96	15,325.84	24.73
607003	314,240.32	85,714.00	28,526.32	33.29
608001	1,600.00	1,600.00		
608005	9,910.00	12,930.00	2,960.00-	22.89-
608006				
608009	74,913.20	66,[illegible]	8,912.29	5.97
608010	987,688.60		787,698.60	
608013	226,955.46		220,860.06	
608042	16,160.00	11,842.00	2,133.00-	11.59-
608810	154,[illegible]		152,193.14	
608820	92.09	116.09	24.00-	20.09-
608824	321,690.00-	4,750.00	306,890.00	6,465.93
608826	70,600.00	61,[illegible]	24,009.00	46.61
608827	229,900.00	20,[illegible]	199,864.30	739.15
608830	[illegible]	[illegible]	2,865.[illegible]	[illegible]
608832	[illegible]	[illegible]	[illegible]	[illegible]
609002	56,[illegible]	[illegible]	51,691.00	
609003	74,691.00	[illegible]	3,[illegible]	3.53
609004	153,[illegible]	[illegible]	64,891.33	67.[illegible]
609007	345,[illegible]	[illegible]	10,349.00-	10.[illegible]
609009	5,440.00	[illegible]	15,600.00-	100.[illegible]
609010	[illegible]	[illegible]	0.00	0.00
609012	[illegible]	[illegible]	231,900.00-	99.[illegible]
609013	[illegible]	[illegible]	1,463.50	11.[illegible]
609015	3,520.00	[illegible]	60,[illegible]	47.[illegible]
609020	42,[illegible]	[illegible]	386,[illegible]	
610012	106,[illegible]	66,[illegible]	60,[illegible]	100.00-
610016	[illegible]	[illegible]	18,230.00	
611000	49,[illegible]	[illegible]	29,[illegible]	42.[illegible]
611001	19,091.62	[illegible]	[illegible]	[illegible]
611002	15,[illegible]	[illegible]	431,165.31	[illegible]
611003	619,[illegible]	[illegible]		

Annex. 28

Cost Centers: Actual/Plan/Variance Date: 07.03.2011 Page: 1 / 1

Columns: 1 / 2

Cost Center/Group: JK_RD_GRO JK Road Prospecting

Person responsible:

Reporting period: 1 to 12 2009

Cost Element			
601200	2,660,026.01		2,660,026.01
603000	60,811,669.25		60,811,669.25
603060	39,569,200.00		39,569,200.00
605100	29,150.86		29,150.86
605150	351,382.69		351,382.69
605210	56,101.92		56,101.92
605220	18,533.49		18,533.49
605230	59,727.00		59,727.00
605250	13,498.30		13,498.30
605400	640,697.31		640,697.31
605410	36,364.00		36,364.00
605500	6,395.00		6,395.00
605810	19,023,570.50		19,023,570.50
606000	15,000.00		15,000.00
606002	2,406,527.00-		2,406,527.00
606003	105,849.31		105,849.31
606004	115,500.00		115,500.00
606005	3,859.22		3,859.22
606006	9,100.00		9,100.00
606009	392.00		392.00
606010	77,928.07		77,928.07
606012	1,717,525.13		1,717,525.13
606014	339,917.54		339,917.54
606016	8,050.00		8,050.00
606017	1,285,830.00		1,285,830.00
606020	232,079.71		232,079.71
606024	73.00		73.00
606025	294,000.00		294,000.00
606026	1,018,090.00		1,018,090.00
606027	94,351.41		94,351.41
606030	126,043.94		126,043.94
606040	4,360,749.20-		4,360,749.20
606060	38,952.00		38,952.00
606065	198,508.36		198,508.36
606081	284,727.59		284,727.59
606082	20,000.00		20,000.00
606084	27,600.00		27,600.00
606087	2,760.00		2,760.00
606088	362,950.00		362,950.00
606089	6,106.00		6,106.00
606090	134,330.00		134,330.00
610012	787,670.00		787,670.00
610013	626,995.00		626,995.00
610014	14,370.00		14,370.00
610021	9,916.00		9,916.00
610022	507,515.47		507,515.47
610023	12,145.00		12,145.00

47

Annex. 28

Cost Center Actual/Plan/Variance Date: 07.09.2011 Page: 1 / 4

Column: 1 / 2

Cost Center/Group JR_RD_UPO JR Road Transportation

Person responsible:

Reporting period: 1 to 12 2011

Cost Element	Act Costs	Plan Costs	Variance	Var(%)
601200 Miscellaneous	2,837,391.09	2,709,489.10	127,901.99	4.70
601250 Energy Costs	42,281.15-		42,281.15-	
601260 Water Costs	50,537,152.49	38,991,224.74	11,545,927.75	29.60
601300 Rent	7,103.00		7,103.00	
601500 Repairs		2,674.00-	2,674.00	100.00-
601600 Maintenance	51,992.47	47,701.41	4,291.06	9.00
601610 Maintenance	213,266.17	574,627.83	361,361.66-	62.89-
601620 Maintenance	31,984.51	40,024.11	8,039.60-	20.15-
601630 Maintenance	65,132.82	11,339.63	53,793.19	474.42
601650 Maintenance	40,887.00	83,583.00	42,696.00-	51.08-
601654 Maintenance	15,390.96	27,406.53	12,014.54-	58.65-
601660 Maintenance	981,986.51	932,692.04	49,294.47	5.60
601680 Maintenance	47,496.66	21,592.30	25,904.36	119.98
601690 Maintenance	1,185.00	9,085.00-	7,900.00	87.04-
601700 Maintenance	5,969,626.15	6,952,979.61	1,057,352.46-	15.64-
601800 Maintenance	14,596.77	9,000.00	5,596.77	62.19
601801 Maintenance	3,391,741.00	3,318,446.00	73,295.00	2.21
601802 Maintenance	108,230.60	142,214.21	33,983.61-	23.83
601803 Maintenance	13,500.00	17,743.-	4,243.-	23.91
601804 Maint. Kitch	4,816.49	2,100.00	2,716.49	129.45
601805 Maint. AC/V	4,760.00	8,505.00	3,745.00-	44.03-
601806 Maint. Fire	95,060.00	92,511.13	13,549.87	14.71
601810 Maint. Vehicles	18,051.00	26,564.87	8,513.87-	32.05-
601814 Maint. Boats	166.00	216.00	50.00-	23.15-
601824 Maint. Other		250,000.00	250,000.00-	100.00-
601826 Maint. Roads		146,811.00	146,811.00-	100.00-
601827 Maint. Bridges	159,190.60	115,060.84	27,131.76	23.59
601830 Contract Labour	131,400.00	131,477.00		
601832 Maint. Machin	11,700.00	33,961.00	22,261.00-	65.57-
601834 Maint. Office	523,029.27	263,589.30	259,439.97	98.42
601837 Consumables	214,466.61	370,035.49	155,568.88-	42.03-
601838 Maint. Equip		1,236.00	1,236.00-	100.00
601845 Maint. Buil	14,400.00	25,200.00	10,800.00-	42.86-
601847 Maint. Plant	4,200.00	4,439.00	239.00-	5.39
601848 Maint.		50,306.00	200,306.00-	130.00-
601849 Maint.	6,651.00	3,779.50	2,869.00	75.91
601850 Maint. Roads	42,113.00	50,193.00	7,920.00-	39.33
601852 Diverses	1,064,377.00	407,702.00	656,675.00	161.05
601853 Heavy Machinery		8,404.17	8,404.17-	100.00-
611000 HQ Space Costs	28,497.00	45,346.00	16,849.00-	37.15-
611001 R & M Vehicles	596.00	6,063.00	5,467.00-	90.17-
611002 M.V. Fuel	505,912.39	491,546.00	14,366.39	2.92
611003 Office Cleaning	2,200.00	5,059.00	2,859.00-	56.53-
611004 M.V. Insurance	58,391.25		58,391.25	
612000 Fire Stock/Equ	1,001.00	1,968.00	967.00-	49.14-
612001 Civil Contempts	10,497.00	26,961.00	16,464.00-	61.07-
612002 R.M for Building				

Annexure 2.2

Cost Centres: Actual/Plan/Variance Date: 01.03.2011 Page: 2 / 3

Column: 1 / 2

Cost Center/Group JK RD_GEO JK Road Prospecting
Person responsible:
Reporting period: 1 to 12 2010

Cost Element	Actual Costs	Plan Costs	Deviation	Var. (%)
600100 Salary Wages	3,345,218.56	3,827,393.09	482,174.53-	12.61-
600150 Monthly Incomes				
600600 [illegible]		12,403.15-	42,261.15	100.00-
600650 [illegible]	63,268,754.62	58,037,152.49	5,737,601.86	9.89
600700 [illegible]	56,319.00	7,103.00	49,216.00	692.22
600800 [illegible]	23,901.54	51,992.67	28,091.13-	54.03-
600900 [illegible]	194,361.86	221,366.12	27,104.16-	12.55-
600910 [illegible]	66,217.82	97,954.51	31,363.31	32.00
600950 [illegible]		65,137.82	65,137.82-	100.00-
600960 [illegible]	31,061.00	40,987.95	9,926.95-	24.03
600980 [illegible]	63,070.99	35,390.99	27,680.00	309.79
600990 [illegible]	699,839.90	735,788.51	35,948.73-	12.31
601000 [illegible]	17,732.69	47,496.66	29,763.81-	62.67-
601010 [illegible]	3,705.00	1,185.00	2,520.00	212.66
601020 [illegible]	4,171,611.36	5,865,626.13	245,985.03	4.19
601030 [illegible]	12,000.00	14,596.77	2,596.77-	17.79-
601040 [illegible]	4,401,761.00	3,391,741.00	1,010,020.00	29.78
601050 [illegible]	88,797.39	108,820.60	20,023.21-	18.40-
601060 [illegible]	141,457.99	141,000.00	10,457.99	1.07
601070 [illegible]	1,800.00	4,818.43	3,018.43	62.64-
601080 [illegible]	4,510.00	4,760.00	250.00-	5.25
601090 [illegible]	80,960.00	85,060.00	4,099.11	4.82
601100 [illegible]	20,705.50	19,650.00	1,055.50	5.37
601110 [illegible]	605,000.00		605,000.00	
601120 [illegible]	91.00	144.55	53.55-	37.04-
601130 [illegible]	234,190.00		234,190.00	
601140 [illegible]	162,475.90	142,182.00	19,293.90	13.57
601150 [illegible]	8,702.00		8,702.00	
601160 [illegible]	71,900.00	131,400.00	59,500.00	45.28
601170 [illegible]	86,550.00	19,750.00	67,800.00	343.29
601180 [illegible]	216,599.99	529,029.37	312,379.38	59.06
601190 [illegible]	193,864.30	224,666.61	30,802.31-	13.71-
601200 [illegible]	30,000.00		30,000.00	
601210 [illegible]	58,600.00	14,406.00	44,000.00	411.47
601215 [illegible]	3,165.00	5,200.00	2,035.00-	39.13-
601217 [illegible]	5,423.00	6,659.00	1,236.00	18.56-
601219 [illegible]	47,462.00	91,112.00	43,650.00-	47.91-
601220 [illegible]		1,066,477.00	1,066,277.00-	100.00-
611001 [illegible]	43,195.00	28,492.00	14,703.00	51.61
611002 [illegible]		546.00	546.00	100.00-
611003 [illegible]	276,123.80	306,532.31	30,408.51	9.92-
611004 [illegible]	8,527.00	7,100.00	1,427.00	20.10
612000 [illegible]		20,191.25	95,151.25	100.00
612001 [illegible]	2,103.91	1,007.94	996.07	98.81
612003 [illegible]	17,700.00	14,407.00	3,293.00	22.86
613000 [illegible]		1,940.00	1,940.00	100.00-
614001 [illegible]	16,958.00	40,514.00	23,556.00	58.14-

Annex. 28

Cost Control Actual/Plan/Variance Date: 01.07.2014 Page 2 / 3

Column 1 / 2

Cost center/Group GR_RD_080 GR Road Prespunding

Person responsible:

Reporting period 1 to 12 2013

Cost element	Act. Costs	Plan Costs	Var. (Abs.)	Var. (%)
		2,545,218.50	2,545,218.50-	100.00-
601000 Mining Rents	39,390,621.71	68,264,454.02	40,873,832.31-	64.07-
601350 Energy Charges (D		56,312.00	56,312.00-	100.00-
603050 Drill Bit	2,294.51	23,901.34	21,607.21-	90.40-
603560 Water Tank Rent	79,859.80	174,261.99	94,402.11-	54.17-
603700 Mining Tools Consu	30,210.59	68,277.82	38,089.23-	55.76-
603720 Drilling Costs Cha	65,638.25	31,061.00	34,564.25	111.29
603730 General Expenses M	1,664.00	63,070.99	61,406.99-	97.36-
603800 Work Place Control	566,692.09	685,939.80	119,237.71-	17.43-
603830 PPE Personnel Cost		17,725.65	17,725.65-	100.00-
603840 Training Costs	1,710.00	3,793.00	2,083.00-	54.92-
603850 Legal Charges	1,223,329.43	1,111,618.14	111,708.29	10.10
603860 Audit Fee - Statu	8,016.57	14,000.00	5,983.32-	42.74-
603865 Special Fee - Sec	2,448,997.00	4,401,161.00	2,047,236.50-	46.51
603882 Technical Assista	108,960.62	88,297.39	20,663.63	23.40
603884 Local Taxes Divers	190,401.20	143,454.39	46,946.81	32.72
603885 Fines Other Govt	1,650.00	1,800.00	150.00-	8.33-
603886 Other Other Govt	90.00	4,510.00	4,420.00-	98.00-
603895 Bonds Govt Fee Ex	1,174.72	1,174.72	0.00	0.00
603910 Washing Allowance		20,785.00	20,785.00-	100.00-
603916 PF Administration		605,900.00	605,900.00-	100.00-
603917 Pay Grid		97.00	97.00-	100.00-
603924 Employee Life Ins		254,150.00	254,150.00-	100.00-
603925 Insurance	138,673.79	165,175.80	26,502.01-	16.05-
603927 Work Injury Be		8,748.00	8,748.00-	100.00-
603929 Miscellaneous Expe		21,960.00	21,960.00-	100.00-
603930 Consultancy Fee		90,950.00	51,550.00-	56.68-
603932 Other Salaries Exp	35,000.00	210,600.00	175,600.00-	83.38-
603934 Medical Reimbursem	77,000.00	193,464.39	116,464.39-	60.20
603937 Conveyance Allow	347,500.00	30,000.00	317,500.00	1058.33
603938 Telephone Expense		70,560.00	70,560.00-	100.00-
603946 Scholarship				
603947 Water & Sanitat	1,000.00	2,500.00	1,500.00-	60.00-
603949 Periodicals & Subs	6,136.00	4,700.00	1,436.00	30.55
603950 Liveries		47,562.00	47,562.00-	100.00
610013 Leave Surrender	1,056,142.90		1,056,142.90	
611001 N.S.S.F. Contribu	24,936.00	43,195.00	18,259.00-	42.27-
611002 N.H.I.F.	936.00		936.00	
611005 Key Customer (KC)	933,981.72	875,423.86	61,447.14	7.02-
611006 N.S.S.F. Contribu	6,189.00	5,577.00	612.00	10.97
612000 Elec. Store Consum	8,949.00		8,949.00	
612001 Civil Consumables	1,864.40	6,470.00	4,605.60-	71.18-
612003 R.M.To Building	18,014.50	37,706.00	19,691.50-	52.23-
614001 Printing & Station	21,291.50	14,396.00	6,895.50	47.89
614005 Fees & Fines		1,000.00	1,000.00-	100.00-
614012 Telephone Charges	3,148.00	9,501.00	6,353.00-	67.87-
614014 Postage Exp	579.00	901.00	322.00-	35.73-

Page 368

Annex. 29

FORM IV
[See rule 11]

FORM OF NOTICE

No. 253 /DE [illegible]

From

Shri Akil Kumar [illegible] IAS
Collector & District Magistrate
Jaipur

To

The Mines Manager
[illegible] Chromite Mines, Sakhawas [illegible]
[illegible] M/s [illegible]

Notice under section 19(b) of Environment (Protection) Act, 1986

Whereas an offence under the Environment (Protection) Act, 1986 has been committed by you. I hereby give notice of the same under section 19(b) of the Environment (Protection) Act, 1986 of my intention to file a complaint in the Court of [illegible] Judicial Magistrate under the Environment (Protection) Act, 1986.

In support of my above said intention I am to enclose the following documents (Annexure No. 1) as evidence of proof of the Environment (Protection) Act, 1986.

Place: [illegible]
Dated: [illegible]

[illegible] 19.1.14
Collector & District Magistrate
Jaipur

Annex.29

STATEMENT SHOWING THE ACTUAL PRODUCTION OF CHROME ORE BY THE LESSEE AGAINST THE APPROVED ENVIRONMENTAL CLEARANCE (EC) QUANTITY IN RESPECT OF SUKINGHI CHROMITE MINES OVER 382.209 HECTARES OF M/S OMCETO DURING THE PERIOD FROM 2005-06 TO 2009-10

Year	APPROVED PRODUCTION QUANTITY AS PER EC (in MT)	ACTUAL QUANTITY PRODUCED BY LESSEE (in MT)	EXCESS QUANTITY PRODUCED THAN APPROVED QUANTITY OF EC IN MT	REMARKS
2005-06	NOT OBTAINED	205154 504	205154 504	The lessee has produced/extracted excess quantity of 111133.353 MT of chrome ore during period 2005-06 to 2009-10, without obtaining requisite EC from MOEF Govt of India which violates provisions of EP Act 1986
2006-07	NOT OBTAINED	350400 000	350400 000	
2007-08	NOT OBTAINED	0 000	0 000	
2008-09	NOT OBTAINED	165966 700	165966 700	
2009-10	NOT OBTAINED	100009 490	100009 490	
	NOT OBTAINED	50010 000	50010 000	
	NOT OBTAINED	120070 000	120070 000	
2007-08	NOT OBTAINED	109180 503	109180 503	
2008-09	NOT OBTAINED	163772 556	163772 556	
2009-10	NOT OBTAINED	45776 600	45776 600	
TOTAL			1111133.353	

Proposal and checked by Concerned

19/12/09

Page 370

Annexure-29

OMC Odisha Mining Corporation Limited

(A GOLD CATEGORY STATE PSU)

No. 91 /OMC/SKG/2014 Dated. 7/2/14

To

The Collector & District Magistrate
Jajpur

Sub : Notice under section 18(b) of Environment (Protection) Act,1986.

Ref : Notice No. 79, Dt.10.01.2014.

Sir,

In inviting a reference to the notice, the following are placed herewith for kind consideration pertaining to mining operation in Sukrangi Chromite Mines of Odisha Mining Corporation Ltd.

Office Memorandum of MOEF, Govt. of India bearing No.J-11013/41/2006-IA,II (i) dtd. 16.11.2010 may kindly be referred to, a copy of which is enclosed here with. This Office Memorandum delineates the revised procedure for consideration of proposals involving violation of the Environment (Protection) Act-1986 or Environment Impact Assessment Notification-2006. The letter indicates that formal EC will be issued to the project only after the matter relating to violations have been put up to the Board of Directors of the Company for consideration of its environment related policy/plan of action as also a written commitment in the form of a formal resolution to be submitted to the MOEF to ensure that violations of the Environment (Protection) Act, etc. will not be repeated. For this purpose, a time limit of 90 days will be given to the project proponent. Further, it is stated in the same letter that respective State Governments will be informed of the violation cases for initiating legal action only when the said commitment is not received from the concerned Board of Directors of the Company within the prescribed 90 days period.

The District Collector, Jajpur on 10.01.2014 issued notice to OMC after passage of more than three years, without considering the revised procedure of the MOEF issued vide Office Memorandum dtd.16.11.2010 (Annexure-I).

(Page ..1/3)

Sukrangi Chromite Mines, PO- Kaliapani, Dist- Jajpur PIN-755047 Ph.No.06726 268748, Fax- 06726-268770

Annex. 29

It is extremely pertinent to mention here that during the period, in which mining activity in Sukrangi Chromite Mines was going on before obtaining the Environment Clearance (EC), all other statutory clearances were in place and the mining activity had been undertaken during this period complying to all conditions imposed under these various statutory clearances. Competent authorities of Govt. of Odisha as well as Govt. of India had visited/inspected the mines during that period; but had not pointed out violation on account of EC. Sale and despatch of Chrome Ore from the mines during the period had been made with due permission/license of the competent Govt. authorities. Royalty on the Chrome Ore raised had also been paid to the State Govt. in full.

Therefore, considering the following:-

1) that, the EC was granted in favour of OMC for its Sukrangi Chromite Mines by MOEF on 18.02.2010;

2. that, the EIA/EMP study was carried out during 2005-06 and due to procedural delay the project details could be appraised to EAC in its meeting held on 22.12.2009. Since then the production limit was confined to 0.13 million tons per annum.

3. that, the mining prior to grant of EC was undergoing in compliance of terms & conditions of all other statutory clearances such as MP/MS, Consent to Operate etc. Royalty had been paid to the State Government for the entire quantity of chrome ore raised during that period and sale & despatch of chrome ore had been made during the period with permit/license of the competent Govt. authorities;

4. that, Environmental Clearance pertaining to Sukrangi Chromite Ore Mines was granted in favour of OMC vide letter No.J-11015/409/2007-IA.II(M) dt. 18.02.2010 for enhancement of production of chrome ore to 0.13 million tons per annum. The proposal was considered by MOEF during its 1st renewal period of 2000-2020. Hence the grant order is with effect from the date of renewal;

5. that, the earlier procedure for dealing with all such case of violation has already been revised by the MOEF vide its Office Memorandum dtd. 16.11.2010;

Sukrangi Chromite Mines, PO- Kaliapani, Dist- Jajpur PIN- 755047 Ph.No.06726-268748, Fax- 06726-268770

Annexure-29

OMC Odisha Mining Corporation Limited

(A GOLD CATEGORY STATE PSU)

6. that, OMC has taken adequate environmental protection measures in the ML area incurring a total amount of Rs.97,64,533/- within a period of 6 to 7 years. Monitoring environmental parameters, uploading data every month in the website of OMC and submission of six monthly compliance report to MOEF & SPCB is regularly done;

7. that, as compared to pre-94 maximum production of 63226.14 MT, the production has never been exceeded;

8. that, in order to compensate the environmental load, OMC has scaled down the production upto a minimum level of 4579.60 MT achieved during the year 2009-10. Different environmental parameters are maintained to be within the prescribed standard;

9. that, OMC is a 100% Govt. of Odisha Public Sector Undertaking which supplies chrome ore from Sukrangi Chromite Ore Mines to the State based Chrome alloy industries of Odisha, especially MoU-signed industries.

It is sincerely prayed that the case initiated against OMC may kindly be dropped.

Yours faithfully,

Encl : As above

Sr. Manager (Mining),
Sukrangi Chromite Mines

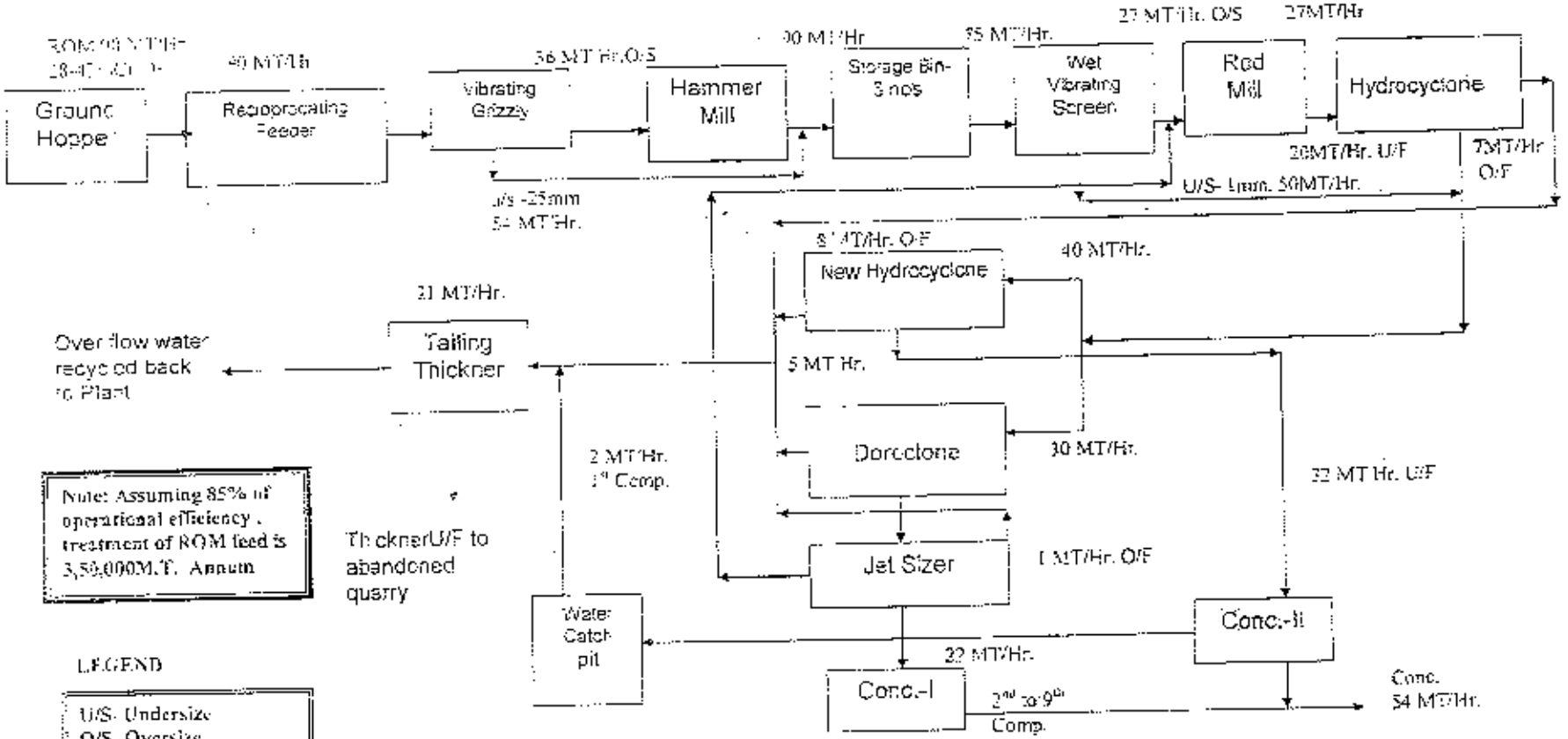
Memo No. 92 /OMC/SKG/2014 Dated. 7 /02/2014

Copy along with enclosure forwarded to RM, OMC Ltd; JK Road/ Sr. Manager (PE)/ Addl. General Manager (Mining) , OMC Ltd; Bhubaneswar for favour of kind perusal and necessary action.

Sr.Manager (Mining),
Sukrangi Chromite Mines

Sukrangi Chromite Mines, PO- Kaliapani, Dist- Jajpur PIN-755047 Ph.No.06726-268748, Fax - 06726-268750

PROCESS FLOW SHEET OF C.O.B. PLANT, O.M.C. LTD., SOUTH KALIAPANI



ANNEXURE -33

Level wise resources established at 10% Cr_2O_3 Inside Sukrangi Lease

Level mRL	Volume	Tons	Grade
-106.0 -> -100.0	888	1595	14.9
-100.0 -> -94.0	3480	6242	14.85
-94.0 -> -88.0	6442	11895	16.15
-88.0 -> -82.0	9384	17399	16.32
-82.0 -> -76.0	12226	22880	16.66
-76.0 -> -70.0	16718	30866	16.13
-70.0 -> -64.0	21622	39661	15.85
-64.0 -> -58.0	25898	49439	17.8
-58.0 -> -52.0	30016	57973	18.34
-52.0 -> -46.0	34230	63141	16.13
-46.0 -> -40.0	40958	74286	15.35
-40.0 -> -34.0	48076	90329	17.78
-34.0 -> -28.0	53330	101125	18.31
-28.0 -> -22.0	57892	114742	20.58
-22.0 -> -16.0	60286	120164	20.95
-16.0 -> -10.0	62884	121612	19.64
-10.0 -> -4.0	65316	127444	20.23
-4.0 -> 2.0	67756	133442	20.93
2.0 -> 8.0	70416	144780	23.45
8.0 -> 14.0	72702	150980	24.2
14.0 -> 20.0	74832	158006	25.35
20.0 -> 26.0	78094	167027	26.39
26.0 -> 32.0	81620	178137	27.83
32.0 -> 38.0	85782	190848	29.06
38.0 -> 44.0	94596	218358	31.35
44.0 -> 50.0	104182	243690	32.51
50.0 -> 56.0	113118	266499	33.21
56.0 -> 62.0	122336	292415	34.3
62.0 -> 68.0	138554	342045	36.15
68.0 -> 74.0	152228	383713	37.22
74.0 -> 80.0	164216	425911	38.73
80.0 -> 86.0	177854	467180	39.47
86.0 -> 92.0	191684	511954	40.21
92.0 -> 98.0	204234	556536	40.8
98.0 -> 104.0	219248	606020	41.24
104.0 -> 110.0	233038	654614	41.68
110.0 -> 116.0	247056	696791	41.78
116.0 -> 122.0	262556	733457	41.15
122.0 -> 128.0	274312	758079	40.76
128.0 -> 134.0	279194	764477	40.33

Annex. 33

Level mRL	Volume	Tons	Grade
134.0 -> 140.0	278564	756875	39.65
140.0 -> 146.0	269558	725547	39.04
146.0 -> 152.0	257060	680359	37.88
152.0 -> 158.0	238314	623000	37.08
158.0 -> 164.0	211080	548952	36.64
164.0 -> 170.0	173690	442452	35.36
170.0 -> 176.0	136508	339235	33.47
176.0 -> 182.0	112474	271803	32.09
182.0 -> 188.0	90750	215322	31
188.0 -> 194.0	55474	126278	28.59
194.0 -> 200.0	28698	62006	25.14
200.0 -> 206.0	8038	17231	25.44
206.0 -> 212.0	716	1642	28.35
212.0 -> 218.0	78	160	21.09
218.0 -> 224.0	2	4	20.14
224.0 -> 230.0	0	0	0
230.0 -> 236.0	0	0	0
236.0 -> 242.0	0	0	0
242.0 -> 248.0	0	0	0
Grand Total	**5920258**	**14906618**	**35.92**

Annex-33

Level wise reserves established at 30% Cr_2O_3 inside Sukrangi Lease & within the UPL

Level mRL	Volume	Tons	Grade
98.0 -> 104.0	87924	284271	49.48
104.0 -> 110.0	117376	371928	48.07
110.0 -> 116.0	138960	436577	47.46
116.0 -> 122.0	149774	468793	47.08
122.0 -> 128.0	161376	504602	47.11
128.0 -> 134.0	159552	499963	47.25
134.0 -> 140.0	156168	487797	46.96
140.0 -> 146.0	152532	472687	46.43
146.0 -> 152.0	135216	417307	46.05
152.0 -> 158.0	123230	378054	45.59
158.0 -> 164.0	111340	337792	44.79
164.0 -> 170.0	92146	273005	43.26
170.0 -> 176.0	64082	186207	41.87
176.0 -> 182.0	49452	142950	41.56
182.0 -> 188.0	29952	89706	43.71
188.0 -> 194.0	13082	39308	44.21
194.0 -> 200.0	3836	11526	44.07
200.0 -> 206.0	1534	4594	43.95
206.0 -> 212.0	49	154	47.38
Grand Total	**1747581**	**5407221**	**46.32**

9-3

Annex. 33

Level wise production of Direct Ore/ Beneficiable ore/ Sub grade ore & Waste at the end of 1st Year

Level	Direct Ore, t		Beneficiable ore, t		Sub grade ore, t		Waste, cu.m
	Tons	Grade	Tons	Grade	Tons	Grade	
164-170	105	50.13	0	0	0	0	70
170-176	38333	46.61	2609	34.27	2936	26.29	39734
176-182	27172	46.4	7261	34.58	10726	23.39	108450
182-188	19289	45.77	4126	32.38	19126	20.34	137244
188-194	15278	45.37	1456	32.39	14847	18.15	135870
194-200	9753	46.17	366	31.03	13111	18.32	122996
200-206	3892	46.37	675	30.54	7552	20.05	97420
206-212	354	47.38	0	0	442	24.48	59924
212-218	0	0	0	0	0	0	18804
218-224	0	0	0	0	0	0	1442
Total	114176	46.21	16493	33.54	68740	20.21	721954

41

Annexure-23

Level wise production of Direct Ore/ Beneficiable ore/ Sub grade ore & Waste at the end of 2nd Year

Level	Direct Ore, t		Beneficiable ore, t		Sub grade ore, t		Waste, cu.m
	Tons	Grade	Tons	Grade	Tons	Grade	
158-164	12560	45.27	352	31.79	1111	24.72	3130
164-170	88826	47.58	9162	33.76	32733	23.79	81186
170-176	2319	45.35	13182	34.92	31268	23.04	146696
176-182	0	0	3204	31.78	17780	21.21	132524
182-188	0	0	20	30.49	12	24.57	79722
188-194	0	0	0	0	0	0	49924
194-200	0	0	0	0	0	0	28184
200-206	0	0	0	0	0	0	18328
206-212	0	0	0	0	0	0	14932
212-218	0	0	0	0	0	0	9504
218-224	0	0	0	0	0	0	784
Total	103705	47.25	25919	34.08	82904	22.97	561784

Annexure - 33

Level wise production of Direct Ore/ Beneficiable ore/ Sub grade ore & Waste at the end of 3rd Year

Level	Direct Ore, t		Beneficiable ore, t		Sub grade ore, t		Waste, cu.m
	Tons	Grade	Tons	Grade	Tons	Grade	
152-158	0	0	0	0	0	0	8
158-164	120104	48.03	7626	35.57	7210	23.61	73166
164-170	0	0	2018	34.27	8943	24.45	163318
170-176	0	0	51	36.65	4942	18	139374
176-182	0	0	0	0	863	25.95	130894
182-188	0	0	0	0	0	0	66617
Total	**120104**	**48.03**	**9695**	**35.31**	**21958**	**22.78**	**500203**

4-2

Annex. 33

Level wise production of Direct Ore/ Beneficiable ore/ Sub grade ore & Waste at the end of 4th Year

Level	Direct Ore, t		Beneficiable ore, t		Sub grade ore, t		Waste, cu.m
	Tons	Grade	Tons	Grade	Tons	Grade	
152-158	109798	48.28	987	31.93	7960	20.06	69034
158-164	11354	48.31	7042	33.54	53515	22.06	184684
164-170	0	0	745	34.46	12737	17.43	139260
170-176	0	0	28	31.21	1474	25.27	143224
176-182	0	0	0	0	0	0	112944
182-188	0	0	0	0	0	0	46676
188-194	0	0	0	0	0	0	19668
194-200	0	0	0	0	0	0	7036
200-206	0	0	0	0	0	0	9524
206-212	0	0	0	0	0	0	7186
212-218	0	0	0	0	0	0	324
Total	121152	48.28	8801	33.43	75686	21.13	670526

Annex. 33

Level wise production of Direct Ore/ Beneficiable ore/ Sub grade ore & Waste at the end of 5th Year

Level	Direct Ore, t		Beneficiable ore, t		Sub grade ore, t		Waste, cu.m
	Tons	Grade	Tons	Grade	Tons	Grade	
146-152	15835	49.27	8122	33.32	15371	25.07	9806
152-158	81521	48.64	21511	33.75	53760	22.75	143444
158-164	47	53.64	1426	33.99	4133	17.17	141630
164-170	0	0	525	31.76	2930	26.64	180742
170-176	0	0	138	32.32	3475	27.21	154824
176-182	0	0	0	0	112	27.61	81652
182-188	0	0	0	0	0	0	24022
188-194	0	0	0	0	0	0	19618
194-200	0	0	0	0	0	0	1628
200-206	0	0	0	0	0	0	84
206-212	0	0	0	0	0	0	70
Total	97403	48.74	31722	33.61	79781	23.25	747714

1.0 General Mine Description

Sukrangi chromite lease of M/s OMC Ltd. is located in Jajpur Dist. of Odisha. The Sukrangi lease was executed on 20.9.1980 for a period of 20 years. A copy of the lease deed is enclosed as Annexure -8. Application for renewal of the lease has been done on 19.9.1999 and currently the lease is under deemed renewal stage. A copy of the renewal application (Form-J) & receipt of the application (Form-D) is enclosed as Annexure-10 & 9. The last scheme of mining was approved by IBM for the period from 1.4.2009 to 31.3.2014 vide letter No. MS/OTF.MECH/33-ORI/BHU/2009-10 dated 18.12.2009. The mine has been accorded environment clearance vide letter No. J-11015/409/2008-IA.II(M) dated 18.2.2010 for a production capacity of 1.30 lakh tonnes per annum. A copy of the same is enclosed as Annexure -11. Consent to operate have also been granted by the state pollution control board, Odisha under the Air & Water (Prevent & Control of Pollution) Act, which is valid upto 31.3.2016. A copy of the same is also enclosed as Annexure -13. The mine has also been accorded permission for diversion of 104.79 Ha. of forest land vide letter No F.NO-8-104/2000-FC dated 21.7.2011.

Permission has also been accorded for dumping of waste from the adjoining & contiguous S/Kaliapani lease to Sukrangi lease by the state government. A copy of the same is enclosed as Annexure -22.

The current submission is therefore a scheme of mining for the period from 1.4.2014 to 31.3.2019, which also incorporates the provision of dumping of waste from South Kaliapani lease to Sukrangi lease.

2.0 Exploration work carried out

A summary of the exploration carried out for G1/G2 areas indicating mapping, drilling (No./ spacing), sample drawn/ analyzed etc is given in the table below:-

Sukrangi lease area	Borehole data				
	No. & spacing	Max. depth	Grade From/ to	Samples drawn and analyzed	Level of exploration
Band-IV-S	74 Nos (50m × 25m)	290m	2.87/62.9% Cr_2O_3	1868	G1
Band-IV-N	6 Nos	94m	7.29/51.07% Cr_2O_3	53	G1
Band-III-S	20 Nos (100m)	180m	5.56/53.12% Cr_2O_3	161	G1
Band-III-N	9 Nos. (25m × 25m)	72m	4.03/52.77% Cr_2O_3	50	G1
Band-V	35 Nos. (100m × 50m)	330m	0.26/56.2% Cr_2O_3	636	G1

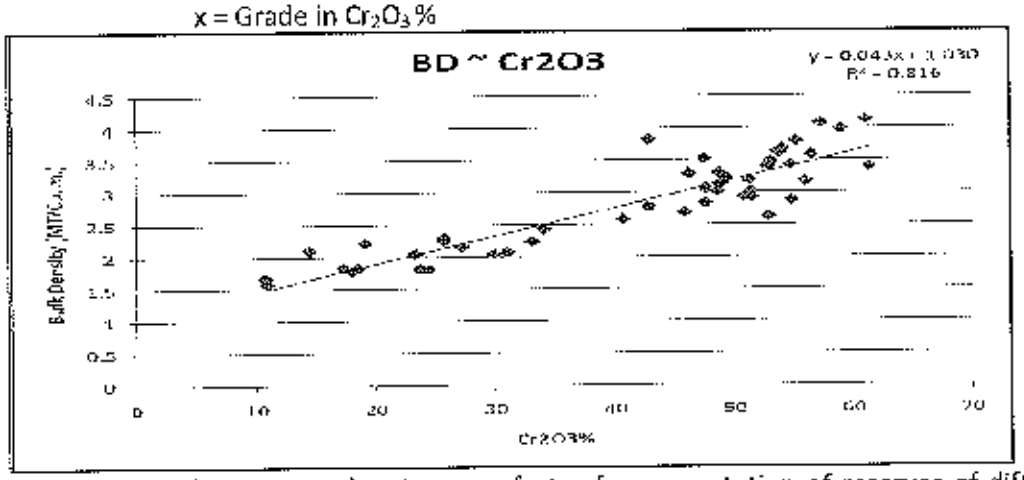
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Sixty (60) experiments were conducted for determination of bulk densities of different bands in ore & waste. The copies of test results are enclosed at Annexure- 15 .The samples were drawn from different ore bands in Sukrangi as well as in the adjoining South Kaliapani lease. 53 sample values were subjected to regression analysis by plotting bulk density values against the Cr_2O_3% grade of each sample. The following linear regression equation was established from the X-Y scatter plot of bulk density (BD) & Cr_2O_3% value of samples.

y = 0.043 x +1.030 at a correlation coefficient of 0.903

where, y = Bulk density

x = Grade in Cr_2O_3 %



The regression equation was used as tonnage factor for computation of reserves of different chromite band. On basis of the above geological works carried out, the area covered under Band-IV-S & N, Band-III-S&N and Band-V can be considered under G1 category of the geological axis as per the UNFC classification of reserves.

3.0 Reserves

For estimation resources the following parameters have been considered:-

Measured resources: -

- The entire exploratory drill holes with grid spacing of 100m X 100m & below has been considered as G1 category and has been categorized under 331 as per UNFC code.

The details of the reserves/ resources established at 10% Cr_2O_3 cut off for Sukrangi deposit as on 31.1.2014 is given in table below. The detailed calculation of the quarry-wise reserves/ resources established at 10% Cr_2O_3, cut off for Sukrangi deposit as on 31.1.2014 is given in Annexure 33.

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Resource type	Total tonnage at cut-off (+10% Cr_2O_3), million tons	Remarks
Measured mineral resources (331)	14.91/ 35.92% Cr_2O_3	All bands

Resource type	Total tonnage at cut-off (+30% Cr_2O_3), million tons	Remarks
Measured mineral resources (331)	8.63/ 47.81% Cr2O3	All bands

The Measured resources under different classes of land are given below:

Block	Total tonnage	Non Forest land	Forest land	
			Already Diverted	Remaining forest land
	(in Million Tons)			
All bands	14.91/ 35.92% Cr_2O_3	7.05/ 35.89% Cr_2O_3	7.69/ 35.84% Cr_2O_3	0.16/ 40.66 % Cr_2O_3

The Measured resources under mineable and non-mineable portions are (in Million Tons):-

Total tonnage	Mineable	Non Mineable					
		Stat. barriers	Below economic opencast UPL		Non forest land	Others (10-30% Cr_2O_3 mined but stacked)	Total
			Already diverted forest land	All remaining forest land			
14.91/ 35.92% Cr_2O_3	5.41/ 46.33% Cr_2O_3	0.04/ 27.84% Cr_2O_3	3.04/ 29.44% Cr_2O_3	0.10	4.12/ 22.14% Cr_2O_3	2.20/ 21.16% Cr_2O_3	9.50/ 30.02% Cr_2O_3

Feasibility Study was then carried out as enclosed in Annexure – 34 and the reserves/ resources classified thereafter (in Million Tons) for the G1 areas comprising of Band-IV-S&N, Band-III-S&N & part of Band-V are given below:-

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RESERVES				REMAINING RESOURCES				
Category	Quantity (Mineable)	Break-up land wise		Potentially Economic (Non-mineable)	Quantity	Constraints wise quantities		Remaining Measured Resources
Proved (111)	5.41/ 46.33% Cr_2O_3	3.55/ 45.57% Cr_2O_3	Diverted forest land	Feasibility Mineral Resources (211)	9.50/ 30.00% Cr_2O_3	7.26/ 32.67% Cr_2O_3	Below economic o/c Ultimate pit limit	Nil
		1.84/ 47.8% Cr_2O_3	Non-forest land)			0.04/ 27.84% Cr_2O_3	Lease barrier	
		0.02/ 46.64% Cr_2O_3	Un-diverted forest land			2.20/ 21.16% Cr_2O_3	Mined Sub grade	

4.0 Production schedule

The year-wise quantum of ore & waste proposed to be excavated during the scheme period is shown in Table 4.1.

(Table 4.1) Overall Targets for ROM and Waste removal

Year	Chrome Ore						Sub-grade in tons/ Cr_2O_3%	Inter-cala-ted waste in tons	ROM in tons/ Cr_2O_3%	Waste in cubic meters	Stripping ratio in cubic meters per tonne
	Direct ore, tons	Cr_2O_3%	Beneficiable ore, tons	Cr_2O_3%	Total Chrome Ore	Cr_2O_3%					
1	2	3	4	5	6=2+4	7	8	9	10=6+8+9	11	12=11/10
2014-15	114176	46.21	16493	33.54	130669	44.56	68740/ 20.21%	657	200066/ 36.19%	721954	3.61
2015-16	103705	47.25	25919	34.07	129624	44.56	82904/ 22.97	651	213179/ 36.16%	561784	2.64
2016-17	120104	48.03	9695	35.3	129799	47.02	21958/ 22.78	652	152409/ 43.52	500203	3.28
2017-18	121152	48.28	8801	33.43	129953	47.21	75686/ 21.13	653	206292/ 37.64	670526	3.25
2018-19	97403	48.74	31722	33.61	129125	44.97	79781/ 23.25	649	209555/ 36.70	747714	3.57

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5.0 Mining method

The Sukrangi Chromite mines comes under Category-A (Fully Mechanized category) as per the IBM guideline. The deposit is worked by opencast mining method with formation of benches. Working benches are kept 6 m high and minimum 11 m wide. The conventional mining method deploys use of 115 mm diameter drills and blasting with low density (LD) cartridge explosives, 15-25 t capacity dumper/ tipper with matching capacity hydraulic excavators/ loaders for loading and transportation of ore to sale plots and transportation of waste/ sub grade materials to their respective dumps/ stock yards have been envisaged in this scheme of mining.

In general the stratum is very soft however, occasional drilling & blasting is being carried out in the hard strata only for improved fragmentation and as per the requirement of the customers. For the purpose of carrying out drilling, 115 mm diameter down the hole (DTH) blast-hole drills are deployed. The drilling pattern for 115 mm diameter holes is at a burden of 2m and spacing of 3m. The bench height has been kept at 6 m. Therefore keeping into account the factor for sub grade drilling & extra drilling to take care of hole collapse, the depth of the hole is around 6.5 m.

Around 2.5-4 cubic meters bucket capacity hydraulic excavators (diesel powered) is being used in conjunction with 15-25t dumpers. The ROM is being segregated at the mining face itself as ore/ beneficiable ore/ sub-grade ore depending into the content of Cr_2O_3 in it. If the Cr_2O_3 content in the ore is more than 40% it is being considered into direct ore, if the Cr_2O_3 content in the ore is between 30-40% it has been considered into beneficiable ore and if the Cr_2O_3 content in the ore is in between 10-30% it is being considered as sub grade ore. Accordingly the ore is being stacked into their respective stacking plots. Waste & sub grade materials generated is being transported to their respective dumping/ stacking locations. Front end loader of around 1.5-3.0 cubic meters bucket capacity is being deployed to load the ore/ beneficiable grade ore from the respective stacking plots.

Regular sampling of the ore at mine face itself is being carried out for on-face segregation of ore/ beneficiable grade ore & sub grade ore. As per the permission granted by DGMS under regulation 106(2)(b), the bench configurations adopted at Sukrangi chromite mine is given below:-

Height	: 6 meters
Min. working width	: 11 meters
Bank slope angle	: 60 deg.
Ultimate pit slope angle	: Below 25 deg.

6.0 Beneficiation

The direct ore having more than 40% of Cr_2O_3 is being directly dispatched to the consumers. However the beneficiable grade generated between 30-40% Cr_2O_3 is being

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sent to the beneficiation plant located in the adjacent leasehold area of the OMC i.e inside the South Kaliapani lease.

7.0 Marketing

No change is proposed in the use of mineral. The mine is supposed to produce high grade ore for Metallurgical purpose, medium grade ore for charge chrome/ ferro-chrome manufacturing and sub grade ore which is being upgraded by beneficiating it in a plant located within the adjoining S/ Kaliapani lease of M/s OMC itself.

8.0 Infrastructure

Basic infrastructure is available in the mine to facilitate the workings. They are mine offices, workshop, garage, rest shelter, first aid station, site store, , Time office, Canteen, laboratory, etc. The Explosives magazine & V.T. centre of Kalarangi chromite mines are in common use.

Electric Supply

The actual power consumption during the year 2012-13 is 309920 kWh.

Magazine

The magazine is located within Kalarangi lease and is valid upto 31.3.2016 and is licensed to store the following quantities:-

(i) Explosives : 3 t
(ii) Detonating fuse : 10000 m
(iii) Safety fuse: 40000 m
(iv) Detonator : 44000 Nos.

9.0 Environmental requirements

9.1 Mine out land:

The land use pattern at the end of conceptual period for the total lease area of 382.709 Ha. is given below in Table 9.1. The conceptual plan is shown in drawing No. MEC/10G9/11/16/11 and the conceptual section is shown in drawing No. MEC/10G9/11/16/10.

(Table 9.1) Land use in stages upto conceptual stage

S.No	Heads	Area, (Ha.)		
		Existing land use	Land use at the end of 5 year	Conceptual land use
1	Excavated area (Ultimate Pit)	21.25	26.82	142.81
2	Waste Dump	12.57	65.08	95.29
3	Mineral storage/ Sub grade	126.68	124.425	19.61
4	Infrastructure	41.80	6.99	8.36

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5	Roads	4.56	5.52	1.54
6	Safety Zone	(26.25) *	(26.25) *	26.25
7	Untouched land & Nala	-	-	88.849
8	Total	206.86	228.835	382.709

Note: Excluding * as shown in the above table.

9.2 Water Quality Management:

Depending upon the drainage pattern of the area where the dump is located, retaining walls, garland drain with settling tanks will be provided in all the dumps. The quantum of work envisaged for construction of drains, retaining walls and settling tanks are given in table 9.4.

(Table 9.3) Steps for water quality management

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits
2014-15	WD1	92 m	92 m	-
	WD1'	900 m	609 m	1 No.
2015-16	WD1	-	-	-
2016-17	WD2	900 m (common with WD1')	609 m (common with WD1')	1 No. (common with WD1')
2017-18	WD2	-	-	-
2018-19	WD2	-	-	-
	WD3	-	243 m	-

The measures as envisaged above will be strictly implemented alongwith continued monitoring of environmental parameter as per the statutes.

9.3 Air quality management:

Following measures were proposed for management of air quality:-

- Water sprinkling on haul roads.
- Dense plantation along the safety zone.
- No overloading of tippers/ Dumpers.
- Provision of wet drilling in the drill machine.
- Provisions of dust masks to the persons exposed to dust.

Apart from the above, regular monitoring of the ambient air quality as per the statutes will be strictly followed. . The results of the ambient air quality / noise quality monitoring reports as enclosed in Annexure – 17 indicates that the quality parameters are within the acceptable levels.

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9.4 Waste Management:

Year wise total quantity of wastes proposed to be generated with their location of disposal is given below:-

Year	Waste generated, in cubic meters	Lease		Location where the waste will be disposed, along with its name
		From where it is generated	To where it is disposed	
2014-15	721954	Sukrangi	Sukrangi	WD1 – 721954
	2731963	South kaliapani	Sukrangi	WD1' - 2731963
2015-16	561784	Sukrangi	Sukrangi	WD1-561784
2016-17	733888	Sukrangi	Sukrangi	WD2-733888
2017-18	670526	Sukrangi	Sukrangi	WD2-670526
2018-19	747714	Sukrangi	Sukrangi	WD2-453955 WD3-293759

The details of the protective measures envisaged for the dump with year wise proposed reclamation/ rehabilitation measures are given below:-

Year	Waste Dump No.	Length of garland drain, m	Length of retaining wall, m	No. of settling pits	Proposed reclamation measures
2014-15	WD1	92 m	92 m	-	-
	WD1'	609 m	900 m	1 No.	-
2015-16	WD1	-	-	-	WD1 will be completely afforestated by the end of 2015-16.
2016-17	WD2	609 m (common with WD1')	900 m (common with WD1')	1 No. (common with WD1')	-
2017-18	WD2	-	-	-	-
2018-19	WD2	-	-	-	WD2 will be completely afforestated by the end of 2018-19.
	WD3	-	243 m	-	-

9.5 Top soil management:

5155 cubic meters of top soil will be generated during the next five years of mining operation. The same will be used for plantation purpose, due to its low shelf life.

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10 Others like legal factors like tribal issues, national parks etc.

Sukrangi chromite lease of M/s OMC Ltd. is located in Jajpur Dist. of Odisha. The Sukrangi lease was executed on 20.9.1980 for a period of 20 years. A copy of the lease deed is enclosed as Annexure -8. Application for renewal of the lease has been done on 19.9.1999 and currently the lease is under deemed renewal stage. A copy of the renewal application (Form-J) & receipt of the application (Form-D) is enclosed as Annexure-10 & 9. The last scheme of mining was approved by IBM for the period from 1.4.2009 to 31.3.2014 vide letter No. MS/OTF.MECH/33-ORI/BHU/2009-10 dated 18.12.2009. The mine has been accorded environment clearance vide letter No. J-11015/409/2008-IA.II(M) dated 18.2.2010 for a production capacity of 1.30 lakh tonnes per annum. A copy of the same is enclosed as Annexure -11. Consent to operate have also been granted by the state pollution control board, Odisha under the Air & Water (Prevent & Control of Pollution) Act, which is valid upto 31.3.2016. A copy of the same is also enclosed as Annexure -13. The mine has also been accorded permission for diversion of 104.79 Ha. of forest land vide letter No F.NO-8-104/2000-FC dated 21.7.2011.

Permission has also been accorded for dumping of waste from the adjoining & contiguous S/Kaliapani lease to Sukrangi lease by the state government. A copy of the same is enclosed as Annexure -22.

The current submission is therefore a scheme of mining for the period from 1.4.2014 to 31.3.2019, which also incorporates the provision of dumping of waste from South Kaliapani lease to Sukrangi lease.

11 Economic evaluation

The mine will be operated through a mine developer cum operator (MDO). The total capex involved is in general borne by the MDO. However, the cost as specified in the abandonment cost including the NPV for forest diversion i.e. 8.9 crores will be borne by OMC. . The details of the CAPEX to be made by OMC are given below:-

Sl.No	Parameters with qty.	Cost, in Rs.
1	Parapet wall, 1235 m	300000
2	Garland drain, 701 m	160000
3	Settling tank, 1 No.	30000
4	Afforestation over dumps, 2500 Nos.	20000
6	Environmental monitoring	6250000
7	NPV (approx.)	82054500
8	Total	88814500

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The total production cost per tonne of chrome ore comes to around Rs. 2834.13 per tonne and the average sales realization per tonne of chrome ore is Rs. 6967.60/- per tonne. The details of the OPEX are given below:-

Sl.No.	Parameters	Rs./ tonne
1	Exploration	475.45
2	Mining	621.38
3	Overhead	852.93
4	Depreciation	15.64
5	Interest	0
6	Royalty	612.8
7	Taxes	255.93
	Total	2834.13

The openpit is having a mineable reserves of 5.41 million tonnes. Accordingly the total cost projected till the mine life will be around 1533 crores against a sales realization of 3750 crores.

However, during the scheme period, a sales realization of 452 crores will be achieved against an operative expense of 184 crores. Therefore, a profit of 268 crores is anticipated against a capex of 8.9 crores. Therefore, the return on investment will be significant (34%).

12 Conclusions

On the basis of the above analysis, UNFC categorization of reserves for Sukrangi lease of M/s OMC Limited is given in table 12.1

(Table 12.1) Reserves as per UNFC classification (in tonnes and as on 1.3.2014)

Sl. No	Reserve Category (UNFC Classification)	Qty. (in Million Tons)	Grade (Cr_2O_3,%)
1	Proved Mineral Reserves (111)	5.41	46.33%
2	Probable Mineral Reserves (112)	NIL	NA
3	Feasibility Mineral Resource (211)	9.50	30.00%
	Feasibility Mineral Resource (212)	NIL	NA
4	Remaining measured resource (331)	NIL	NA
5	Indicated Resource (332)	NIL	NA
6	Inferred Resource (333)	NIL	NA
7	Reconnaissance Resource (334)	NIL	NA

[PK Bhattacharjee, Key Person]
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Technical Assistance for Remediation of Hexavalent Chromium from Mine Effluent and Surface Runoff in South Kaliapani Mines of OMC Ltd

Final Report
November, 2013

Department of Civil Engineering
IIT Kharagpur

CONTENTS

1. Introduction 1
1.1 Objective and Scope of Study 2
2. Existing Treatment System: Review 4
2.1 Study Area 4
2.2 Wastewater Sources and Quantity 4
2.3 Basic Process Methodology 7
2.4 Treatment Scheme 7
3. Existing Treatment System: Critical Evaluation 10
3.1 Reconnaissance Survey 10
3.2 Process Performance Study 10
3.2.1 *Process Efficiency* 10
3.2.2 *Hydraulic Efficiency* 11
3.3 Issues with Existing ETP 12
3.3.1 *Quality Management* 12
3.3.2 *Flow Management* 12
3.4 Review/Remarks 13
3.4.1 *Process Improvisations* 13
4. Experimental Analysis for Process Evaluation 15
4.1 Background 15
4.2 Parameter Selection 15
4.3 Process Performance 16
4.4 Other Remarks 16
5. Proposed Treatment Scheme 17
5.1 Unit Wise Description 17
5.2 Key Improvements Compared with Existing Treatment Plant 19
6. Plant Design and Upgradation 22
6.1 ETP at Quarry D 22
6.2 ETP for Quarry F 34
7. Broad Cost Estimate 45
7.1 Broad Capital Cost 45
7.2 Operational Cost 48
8. Recommendations 51
Annexure I 53

LIST OF TABLES

Table No.	Topic	Page No.
1	Existing ETP Unit for quarry D	8
2	Existing ETP Unit for quarry F	9
3	Characteristics of Quarry D ETP mine drainage water	11
4	Characteristics of Quarry F ETP mine drainage water	11
5	Dimensions of the sump at ore stack yard	21
6	List of new units in proposed ETP at quarry D	26
7	Pipe details for ETP at quarry D	30
8	Valve details for ETP at quarry D	31
9	List of Pumps for ETP at Quarry D	33
10	List of units in proposed ETP at quarry F	37
11	Pipe details for ETP at Quarry F	40
12	Valve details for ETP at Quarry F	40
13	List of Pumps for ETP at Quarry F	43
14	Broad Capital cost For ETP at Quarry D	45
15	Broad Capital cost For ETP at Quarry F	46
16	Total Broad Capital cost	47
17	Operational Cost for ETP at Quarry D	48
18	Operational Cost for ETP at Quarry F	49

LIST OF FIGURES

Figure No.	Title	Page No
1	Location map of OMC South Kaliapani chromite mine	5
2	OMC South Kaliapani mine	6
3	Schematic diagram of sump at ore Stack-yard	20

Drawing No.	Title
Drwg M1	Existing ETP System of quarry D Flow Diagram
Drwg M2	Existing ETP System of quarry F Flow Diagram
Drwg D1	ETP and Pipe Layout for quarry D
Drwg D2	Process Flow Diagram for quarry D
Drwg D3	Hydraulic Flow Diagram for quarry D
Drwg D4	GA of Baffle Chamber for quarry D
Drwg D5	GA of Clariflocculator for quarry D
Drwg D6	GA of Rapid Gravity Filter for quarry D
Drwg D7	GA of Chemical House for quarry D
Drwg F1	ETP and Pipe Layout for quarry F
Drwg F2	Process Flow Diagram for quarry F
Drwg F3	Hydraulic Flow Diagram for quarry F
Drwg F4	GA of Baffle Chamber for quarry F
Drwg F5	GA of Clariflocculator for quarry F
Drwg F6	GA of Rapid Gravity Filter for quarry F
Drwg F7	GA of Chemical House for quarry F

Chapter 1

Introduction

Chromium, one among the most abundant element in the earth's crust, has wide industrial application ranging from producing steel and other alloys, tanning leather, chrome plating, manufacture of pigments and dyes, mordant in textile industry etc. India is one of the largest producers of chromium with about 203 million ton of chromite deposit. More than 93% of India's chromium reserves are concentrated in Odisha, mostly in Sukinda (IBM, 2012[1]). At present, there are seventeen mines in Sukinda, leased out to nine companies.

The entire mine discharge in Sukinda area is disposed of to the natural drainage channel named 'Dhamsala Nalla'. Compared to surface water quality standards (IS 2296-1982), concentration of hexavalent chromium was reported higher in Dhamsala Nalla. Hexavalent chromium, a known carcinogen, is reported to have detrimental effect on the flora, fauna and aquatic life. The health effects of hexavalent chromium are well documented.

Adverse effects of hexavalent chromium on the environment make it necessary to adopt a technically effective treatment for chrome mine discharge. Since the existing treatment plant in South Kaliapani Mines of Odisha Mining Corporation (OMC) Ltd. was installed more than a decade ago and needs upgradation, OMC entrusted the project "Technical Assistance for Remediation of Hexavalent Chromium from Mine Effluent & Surface Runoff in South Kaliapani Mines of OMC Ltd." to IIT Kharagpur.

[1] Indian Minerals Yearbook 2011 (Part II), 50th edition, Govt. of India, Ministry of Mines, Indian Bureau of Mines, October 2012.

1.1 Objective and Scope of Study

The objective of the project was to evaluate the existing Effluent Treatment Plant (ETP) and propose upgradation/augmentation to achieve the desired discharge standards set by CPCB/Odisha SPCB. The scope of work as defined in work order:

1. Study the existing system in detail.
2. Assessment of quantity of wastewater generation from different activities in mining and non-mining area of South Kaliapani OMC Mines based on data provided.
3. Water balance diagram preparation.
4. Characterization of wastewater with respect to various parameters like pH, TSS, TDS, COD, iron, hexavalent chromium, turbidity.
5. Study of existing treatment methods and its adequacy and efficacy.
6. Delineation of suitable measures for improvement in performance of existing treatment plant.
7. Submission of interim report
8. Remedial measures/treatment of surface runoff generated within the mining lease area.
9. Delineation of treatment system with respect to discharge norms of statutory bodies like SPCB/CPCB.
10. Quantification of sludge generated and its handling for disposal.
11. Study of process chemistry and preparation of chemical dosing/utilities specifications.
12. Preparation of design of the ETP components including wastewater conveyance mains (Existing process and units will be considered in the design as far as possible).
13. Sizing and listing of units and equipment required.
14. Preparation of ETP layout, piping layout, hydraulic profile and process flow diagram.

15. Preparation of GA drawings for all units & equipment.
16. Preparation of broad cost estimate of civil, mechanical, electrical works and operational cost.
17. Preparation of Detailed Project Report for proposed effluent treatment system.
18. Submission of Draft Detailed Project Report.
19. Submission of Final Detailed Project Report.

Chapter 2

Existing Treatment System: Review

2.1 Study Area

South Kaliapani Mines located in the Sukinda Valley covers a lease area of 552.457 hectares (**Figure 1**). Two quarries, Quarry D and Quarry F operate through open cast mode. Two ETPs located near the quarries are treating the mine drainage water. The mine area map showing the location of various units is given in **Figure 2.**

Sukinda area has an average yearly precipitation of 1400 mm with an average relative humidity of 60%. It has a maximum wind velocity of 162 km/h predominantly from the western side. The temperature ranges from around 48°C during summer to 10°C during winter.

2.2 Wastewater Sources and Quantity

The sources of mine drainage water are ground water from the subsoil passing through the ore layer and the rain water accumulated in the quarry. Both are collected in the sump of the quarry, from where it is pumped to ETPs. The quantity of total water generated varies from season to season. During rainy seasons, limited mining operations lead to less subsoil drainage compared to surface runoff. In dry seasons the subsoil percolation is the main source of mine drainage water. The flow rates of mine drainage water are 1248 m^3/h and 144 m^3/h for Quarry D and F respectively as provided by OMC.

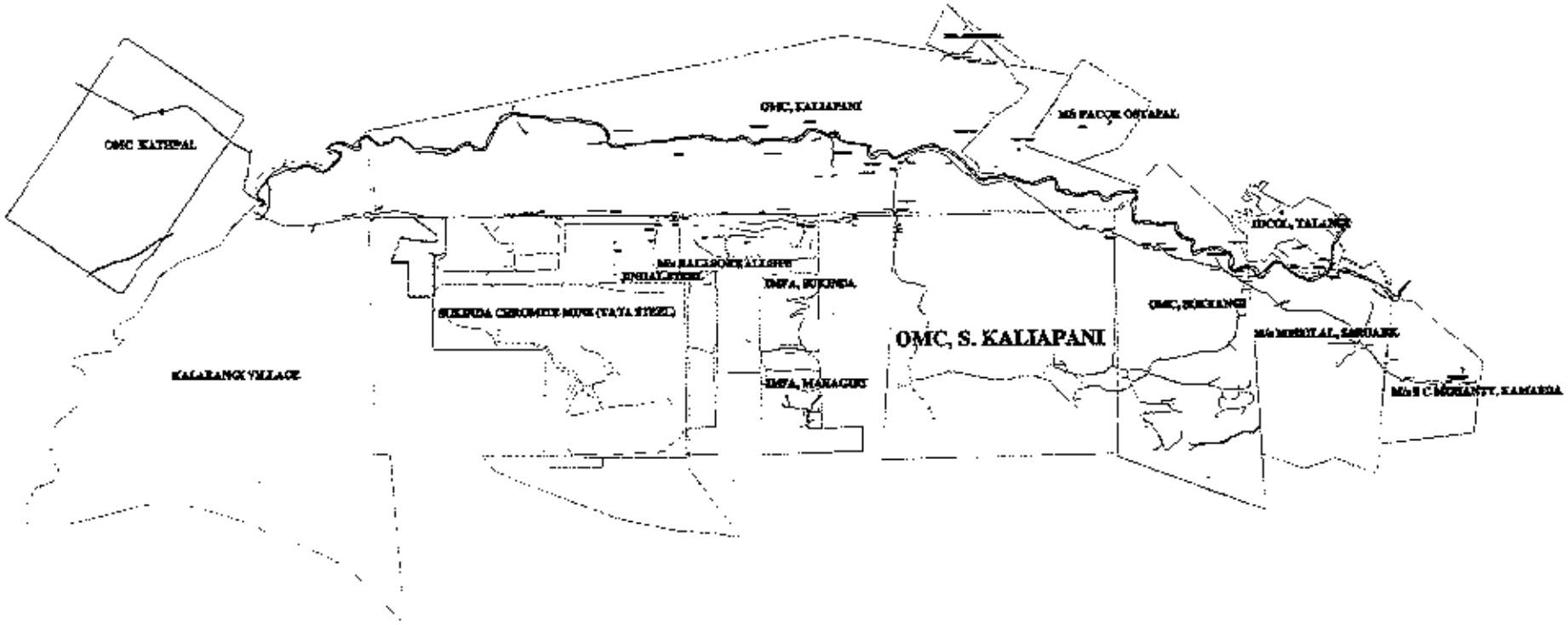


Figure 1: Location Map of OMC South Kaliapani Chromite mine

Page 5

Figure 2. DMC South Kalapani Mine

2.3 Basic Process Methodology

The existing treatment technology adopted for hexavalent chromium rich mine drainage water in South Kaliapani Mines is reduction of hexavalent chromium to trivalent chromium using ferrous ion in the form of ferrous sulphate. The reduced chromium is precipitated as chromium hydroxide ($Cr(OH)_3$). Ferrous ion added for reduction of hexavalent chromium is oxidized to ferric ion and subsequently precipitated as ferric hydroxide ($Fe(OH)_3$). Alum is added along with ferrous sulphate to enhance the settling. The whole process is carried out at natural pH condition (pH 7.5 – 8.5).

Ferrous sulphate solution (8%) is added to the effluent for reduction of hexavalent chromium. Potash alum dosing was done with 0.5% solution. The solutions are fed by gravity (as provided by OMC).

2.4 Treatment Scheme

The process comprises of the following:

For ETP at quarry D

The flow diagram of exiting ETP at Quarry D is provided in Drawing **M1**. List of existing units & equipment are given in **Table 1**. The ETP consists of the following units.

i) The inlet pump lifts the mine drainage water from the sump in the quarry to inlet tank. This pump is the only equipment used in the system. From the inlet tank the water flows partially through a channel and a pipe to Tank 1 located at a distance of 66.6m from inlet tank.

ii) Chemical dosing (ferrous sulphate and alum) is carried out in Tank 1. A small channel of length 4.7m, connects tank 1 to baffle chamber, with 31 baffles provided for mixing of chemicals with the influent mine drainage water. The chemical dosing is carried out from tanks containing ferrous sulphate and alum solutions.

These tanks are kept at a higher elevation and solution is fed by gravity.

iii) The water from the baffle chamber enters the settling tank. The effluent is discharged from the outlet of settling tank through drain.

iv) The flow of effluent from inlet tank to the outlet drain is by gravity.

Table 1: Existing ETP Unit for quarry D*

Sl. No.	Unit/ Equipment	MOC	Dimensions (L x W x D)
1	Inlet Channel	RCC	30m (L) x1m (D)
2	Inlet tank	RCC	4.9m x 4m x 1.4m
3	Channel 1	RCC	66.6m x 0.6m x 1.0m
4	Tank 1	RCC	4m x 4m x 2.4m
5	Channel 2	RCC	4.7m x 1.0m x 1.8m
6	Baffle chamber	RCC	21.0m x 4m x 1.7m with 31 nos. baffle
7	Settling Tank	RCC	10m x 4m x 1.9m

*data provided by OMC

For ETP at quarry F

The flow diagram of exiting ETP at Quarry F is provided in **Drawing M2.** List of existing units & equipment are given in **Table 2.** The ETP consists of the following units.

i) The inlet pump lifts the mine drainage water from the sump to inlet tank. This is the only equipment used in the system.

ii) From the inlet tank the water flows through a channel of length 2.55m to the baffle chambers. Chemical dosing is carried out in this channel.

iii) Chemical dosing is carried out from tanks containing ferrous sulphate and alum, kept at a higher elevation. The chemicals are

added to the mine drainage water through pipes. The plan area of chemical dosing room is 2.2m x 5.3m.

iv) The baffle chamber with 25 nos. baffles is provided for mixing of chemicals with the mine drainage water.

v) The water coming out of the baffle chamber reaches to settling tank 1 though a channel of length 1.72m.

vi) The water flows to settling tank 2 through a 5.1m long channel. The effluent discharge from the outlet of settling tank is through a drain.

vii) The flow of effluent from inlet tank to the outlet drain is by gravity.

Table 2: Existing ETP Unit for quarry F*

Sl. No.	Unit/ Equipment	MOC	Dimensions (L x W x D)
1	Inlet Channel	RCC	30m x 0.6m x 0.75m
2	Inlet tank	RCC	3.95m x 3.95m x 1.55m
3	Channel 1	RCC	2.55m x 0.56m x 1.10m
4	Baffle chamber	RCC	19.45m x 3.43m x 1.12m with 25 nos. baffle
5	Channel 2	RCC	1.72m x 0.60m x 0.90m
6	Settling Tank 1	RCC	9.80m x 3.95m x 2.10m
7	Channel 3	RCC	5.10m x 0.60m x 0.54m
8	Settling Tank 2	RCC	9.40m x 3.90m x 2.10m

*data provided by OMC

Chapter 3

Existing Treatment System: Critical Evaluation

3.1 Reconnaissance Survey

A reconnaissance survey was conducted to collect the background information of the South Kaliapani Mines area and the existing treatment facilities for mine discharge. The main aim of the survey was to evaluate the existing condition of the ETPs and their operation and maintenance status. During the reconnaissance survey, the team visited the mine area and had detailed discussions with the mine authorities regarding various aspects of wastewater generation and treatment. The following points were noted as informed by OMC.

i) The maximum operation time for Quarry D ETP is 20h and that for Quarry F ETP is 10h.

ii) The mine water of entire quarry is stored in a sump. A part of it is used for dust sprinkling operation and the remaining is being pumped to the ETP.

iii) No treatment facility is provided for surface runoff from ore stack yard.

iv) Surface runoff is mostly carried by natural drains. Quarry D receives a part of the surface runoff from OBD area.

v) There is no segregation of runoff from contaminated and non-contaminated area.

3.2 Process Performance Study

3.2.1 Process Efficiency

Raw and treated effluent samples were collected during reconnaissance survey. Analysis of the samples collected was carried

out to evaluate the effectiveness of existing treatment. The results are presented in Table 3 and 4.

Table 3: Characteristics of Quarry D ETP mine drainage water

Parameter	Unit	Sampling date 21/06/2013		Sampling date 17/08/2013	
		Inlet	Outlet	Inlet	Outlet
pH	-	8.20	8.14	8.19	7.52
Turbidity	NTU	8.0	65.6	1.1	58.8
Hexavalent chromium	mg/L	1.746	0.166	1.277	0.007
Total dissolved solids	mg/L	136	135	106	171
Total suspended solids	mg/L	26	13	26	57
Total iron	mg/L	0.01	3.60	0.20	7.20

Table 4: Characteristics of Quarry F ETP mine drainage water

Parameter	Unit	Sampling date 21/06/2013		Sampling date 17/08/2013	
		Inlet	Outlet	Inlet	Outlet
pH	-	7.93	7.54	8.22	7.96
Turbidity	NTU	13.2	45.4	0.9	14.8
Hexavalent chromium	mg/L	0.5	0.203	0.517	BDL
Total dissolved solids	mg/L	150	147	147	162
Total suspended solids	mg/L	87	22	49	54
Total iron	mg/L	0.10	3.27	0.12	7.00

3.2.2 Hydraulic *Efficiency*

The existing ETP is analyzed for the existing hydraulic load adequacy. The details are given in **Annexure I.**

The major findings are as given below:

Quarry D ETP for flow rate 1248m³/h:

1. Detention time in inlet tank is 1.04min, which is inadequate.
2. Detention time in tank 1(1.62 min), is also inadequate.
3. The detention in baffle is 4.29 min, which is inadequate.
4. The settling tank has detention time of 3.08 min, is not sufficient for proper settling.

Quarry F ETP for flow rate 144m³/h:

1. The detention time of 8.13 min in inlet tank is inadequate.
2. Baffle chamber also is of inadequate capacity with a detention time of 10.68 min.
3. The detention time for settling tank 1 is 29.03 min and for settling tank 2 is 27.50 min, which are inadequate for sedimentation.

3.3 Issues with Existing ETP

3.3.1 *Quality Management*

Performance analysis of existing treatment system reflects:

i. Removal of hexavalent chromium was not consistent for ETP effluent samples as per lab analysis as well as observed from the reports given by OMC.
ii. There is an increase of iron concentration in the final effluent.
iii. The turbidity of treated effluent water was found higher compared to raw wastewater.

3.3.2 *Flow Management*

The main drawbacks in the existing units are:

1. Inadequate capacity of the existing units.
2. The process design parameters are not within the stipulated values.

3. The dosing of chemicals is not proper.
4. Solid-liquid separation is not effective.
5. Sludge accumulation was observed in the baffle chamber.
6. Sludge removal is manual.

3.4 Review/Remarks

The existing system is not having sufficient retention time to accommodate the present flow in many units. This, along with improper dosing of chemicals, is the major challenge in consistent removal of hexavalent chromium from the mine drainage water. New units with sufficient retention time and proper chemical dosing system need to be installed in order to meet the standards.

The increase in iron and turbidity in the treated water indicated that proper settling of suspended flocs of $Fe(OH)_3$ is not achieved. Therefore sludge settlement and removal mechanism needs to be improved in order to achieve proper solid liquid separation.

The analysis of the above shows that there is requirement for augmentation of the existing system to cater for the proposed flow and desired treated wastewater characteristics. This requires modification of the existing treatment system or complete new system depending on the parameters.

3.4.1 Process Improvisations

This section details the proposals for overcoming the drawbacks noted in performance.

1. The major drawback of existing ETPs is its incapability to meet effluent discharge quality standards set by CPCB/Odisha SPCB. To overcome this problem, the following upgradation is proposed.
    a. Flash Mixer along with baffle unit to ensure proper mixing of ferrous sulphate with influent water.

b. Proper reaction time of ferrous sulphate with influent water to ensure hexavalent chromium removal.

c. Provision of caustic soda addition for better precipitation of hydroxides.

d. Addition of settling aids to enhance settling.

e. Clariflocculator for sludge separation.

f. Rapid Gravity Filter to eliminate fine solids passing through the clariflocculator.

II. The existing system does not have sludge dewatering system. The proposed system incorporates the following.

a. Continuous sludge removal with sludge handling pumps.

b. The proposed system provides centrifuge for sludge dewatering.

III. Present system has ferrous sulphate and alum dosing, which is gravity fed and the rate of dosing is not controlled.
Proposed system eliminates the gravity dosing and incorporates dosing pump so that metered amount of chemicals is added on continuous basis.

IV. In the present system, the chemical dosing is not based on the reaction requirement.
The chemical dosing in the proposed system is worked out based on lab scale batch experiments.

Chapter 4

Experimental Analysis for Process Evaluation

4.1 Background

The proposed treatment system is based on process chemistry implemented in existing treatment plant.

Lab scale batch experiment was carried out to assess the performance of existing process for reduction of hexavalent chromium to trivalent form and precipitation of the same as hydroxides. The chromium hydroxide is separated by settling, which is enhanced by addition of flocculant.

4.2 Parameters selection

Batch experiments were conducted in lab to optimize the dose and retention time. The optimum dose of ferrous sulphate (0.2%) at natural pH required at different initial concentration of hexavalent chromium is recorded. The study shows a dose of 50 mg/L of commercial ferrous sulphate is efficiently removing 1mg/L of hexavalent chromium from mine water.

The plant scale dosing will be based on the actual wastewater characteristics and the strength of commercial dosing chemicals and need to be decided at the time of commissioning of the plant.

The process chemistry indicates the reduction of hexavalent chromium with ferrous sulphate to be instantaneous. However in actual field conditions, hydraulic and environmental parameters restrict the selection of very short retention time. Therefore, based on the flow hydraulics and process chemistry, 1min retention time in ferrous sulphate mixing tank (flash mixer) was chosen to ensure homogeneous

distribution of ferrous sulphate in the dissolved phase. Further, 15min retention time is provided in baffle chamber with mixing to complete the reaction process.

The enhanced precipitation of chromium and iron hydroxides was observed at alkaline pH (above 8).

4.3 Process Performance

The samples of raw water to quarry D and F collected on 17.08.13 **(Table No. - 3 and 4)** were treated for reduction and flocculation followed by settling in lab scale batch reactors. Hexavalent chromium concentrations in treated water of both the quarries were below detectable limit while total iron (less than 0.3mg/L) were in an order of magnitude below the discharge standard. The water had turbidity less than 3 NTU for both the quarries. The pH of water did not change significantly during the course of treatment. It may be noted that the results from lab scale batch experiments discussed above may vary in actual field conditions.

4.4 Other Remarks

It is necessary that the ferrous sulphate is freshly prepared before application. Caustic soda solution is added to maintain the pH in the range 8 to 9 for precipitation of hydroxide. Polyelectrolyte/other equivalent setting aid is found to enhance settling. This dosing is to be arrived at by daily jar test at site.

Chapter 5

Proposed Treatment Scheme

5.1 Unit Wise Description

Considering the improvements mentioned in **section 3.4** to account, a process flow diagram of the proposed treatment system for Quarry D and Quarry F are provided in **Drawing D2 and F2**.

The system basically consists of:

1. **Inlet Tank:** Inlet tank is provided to dampen the high velocity of water coming through pumps. Variation of flow can also be adjusted to some extent.

2. **Ferrous sulphate mixing tank (Flash mixer):** After the inlet chamber a flash mixing unit is provided for mixing of ferrous sulphate with mine drainage water.

3. **Baffle Chamber:** Subsequent to ferrous sulphate mixing tank a baffle chamber is provided for mixing during the hexavalent chromium reduction.

4. **Balancing tank:** The chemically treated water is collected in a storage tank with 1 h retention time and pumped to elevated distribution chamber.

5. **Distribution Chamber cum Caustic soda mixing tank:** This is provided prior to flocculant mixing tank. This unit is used to mix caustic soda with chemically treated water to correct the pH to 8 to 9 for favoring hydroxide formation of iron and chromium.

6. **Flocculant mixing tank (Flash mixer):** This unit facilitates flash mixing of flocculant with chemically treated water.

Polyelectrolyte/other equivalent settling aids is mixed to enhance the floc formation.

7. **Clariflocculator:** Clariflocculator comprises of central flocculator zone and peripheral clarifier zone. Flocculator is used for enhancing the settleable floc formation through slow mixing. The clarified water comes through top of weir to lounder. The sludge is discharged from bottom of sludge cone.

   The amount of sludge generated in the clariflocculator is estimated based on the initial TSS concentration and calculated amount of chromium and iron floc generated. The amount of floc generated is calculated stochiometrically. The sludge quantity may vary depending on the influent wastewater characteristics and corresponding chemical dosing.

8. **Rapid Gravity Filter (RGF):** The clarified water is passed through rapid gravity filter to entrap the remaining suspended solids including unsettled hydroxide particulates.

9. **Filter water tank:** For the storage of backwash water from rapid gravity filter, a storage tank along with pump house is provided from where backwash water is lifted to overhead reservoir.

10. **Over Head Reservoir (OHR):** Back wash is done from OHR by gravity.

11. **Air scouring blower:** It is proposed for loosening the filter sand during backwashing.

12. **Backwash collection tank:** The water after backwashing is collected in a tank, from where it is recirculated to distribution chamber/ caustic soda mixing tank through pumping.

13. **Sludge Tank:** The sludge from clarifier bottom is taken out by gravity to the sludge tank from where it is pumped to centrifuge.

14. **Centrifuge:** The sludge is processed in centrifuge for solid liquid separation. The dewatered sludge need to be disposed of in hazardous waste management facility.

15. **Chemical House and MCC room:** Chemical dosing, electrical work and chemical storing will be carried out in a two storied building.

Apart from these units, a settling tank with 30 min detention time and a sump with 15 min detention time is proposed at the ore stack yard. This arrangement is made to separate the settleable solids in the surface runoff from ore stack yard before pumping the same to the ETP. A schematic diagram of the same is provided in **Figure 3** and the dimensions are provided in **Table 5**. The sludge settled in the settling tank could be removed periodically.

5.2 Key improvements compared with existing treatment plant

I. Flash mixer is proposed for better mixing of the chemicals with the mine drainage water.
II. Proper dosing is assured by use of dosing pumps.
III. Hydraulically adequate units ensure the process reactions to complete in a smooth manner.
IV. Recommends optimized and uniform chemical dosing
V. Recommends use of flocculant aid to enhance flocculation.
VI. Clariflocculator ensures effective flocculation and sludge separation.
VII. RGF is introduced to trap remaining suspended solids.
VIII. Sludge withdrawal and dewatering system is introduced for proper handling and disposal of the sludge generated.

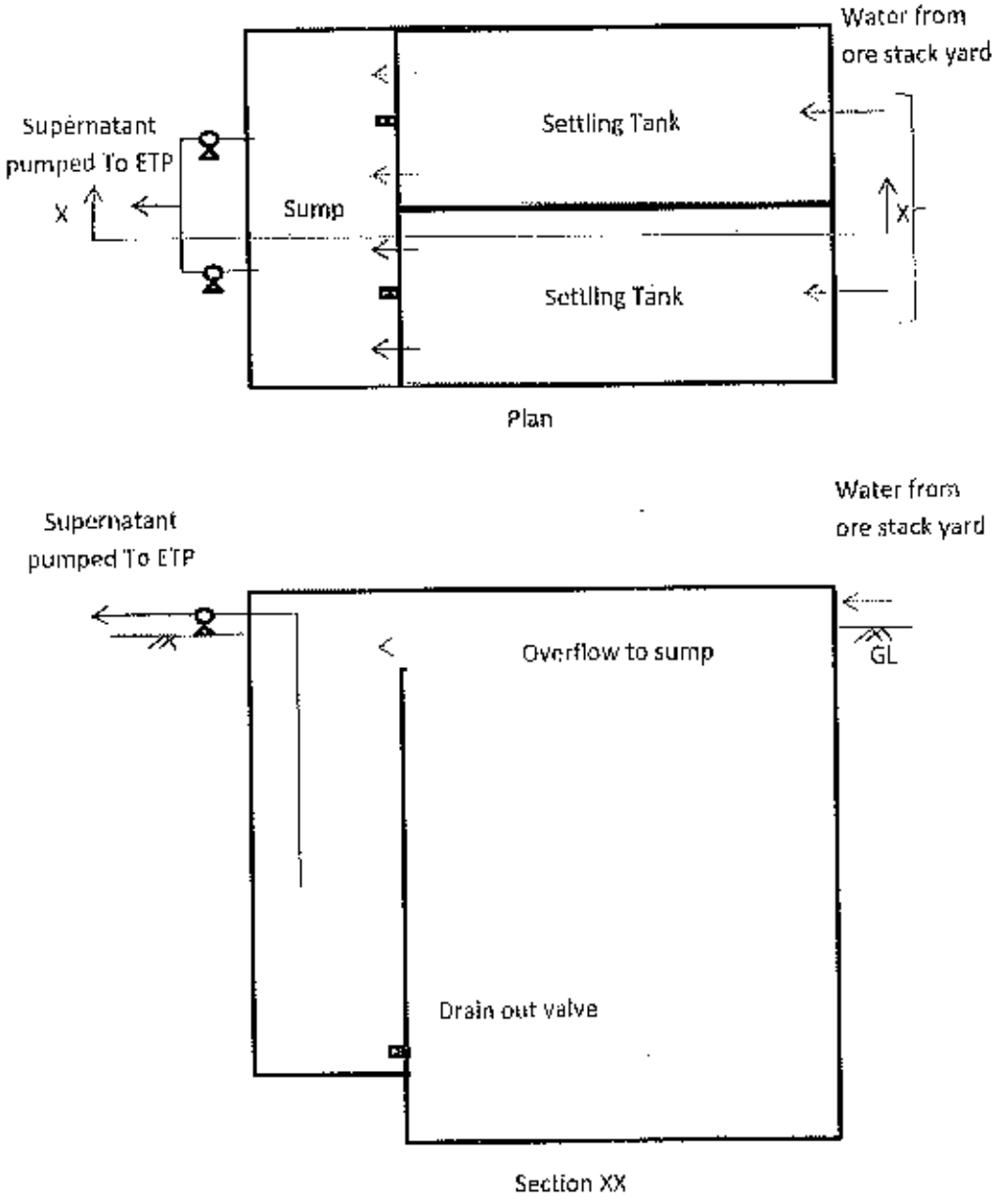


Figure 3: Schematic diagram of sump at ore Stack-yard

Notes:
Pump 1W + 1S
Settling Tank 1W + 1S

Table 5: Dimensions of the sump at ore stack yard

Quarry D (250 m³/h)*	L x B x SWD (m x m x m)	Detention time (min)	Sludge Zone(m)	Freeboard (m)
Settling tank (2 nos)	20 x 6.25 x 1	30	0.5	0.5
Sump	4.9 x 12.8 x 1	15	0.25	0.5
Quarry F (162 m³/h)*				
Settling tank (2 nos)	15 x 5.4 x 1	30	0.5	0.5
Sump	3.65 x 11.1 x 1	15	0.25	0.5

*data provided by OMC

Chapter 6

Plant Design and Upgradation

The proposed ETPs are designed according to the flow diagram discussed in chapter 5. The design flow rates of mine drainage are 1248 m^3/h and 144 m^3/h for Quarry D and F respectively (data provided by OMC). Surface runoff from ore stack area is contaminated and needs to be treated in ETP. The quantity of surface runoff from ore stack yard adjacent to quarry D and F are 250 m^3/h and 162 m^3/h respectively (data provided by OMC). The mine drainage water and ore stack surface runoff will be treated collectively in the proposed ETPs of design capacities 1500 m^3/h and 310 m^3/h.

6.1 ETP at Quarry D

The maximum discharge at the inlet of this ETP is 1500 m^3/h which is considered as the design flow rate of the system. In this, 250 m^3/h is surface runoff from ore stack yard and 1250 m^3/h is mine discharge. During non-monsoon period the mine discharge has to be pumped at the rate of 1500 m^3/h to maintain the constant flow rate at the ETP.

Inlet chamber, channel and baffle chamber of the existing ETP will be used for the flow rate of 250 m^3/h. Proper repair, renovation and cleaning of each unit is essential before it is used in proposed treatment. The following modifications are to be incorporated in the existing system.

1. Rectangular weir will be provided in the channel to increase the water depth upto desired level (indicated in drawing no. D 3).
2. The second storage tank will be abolished. The flow will be bifurcated to a ferrous sulphate mixing tank (flash mixer). (indicated in drawing no. D1)

3. Adequate wash out drains should be provided in the baffle system to clear the sludge, if deposited.

Structural adequacy of existing units integrating with the proposed units shall be checked as per site condition before utilizing/modifying the same.

The list of new units with dimensions for the proposed ETPs of quarry D is provided in **Table 6**. The details of the treatment process are as provided:

1. **Channel:** The channel in the existing system is oversize for the proposed part of design flow (i.e. 250 m^3/h). A weir is proposed before inlet tank to raise the water level at upstream side. The existing Tank 1 is not matching the design criteria as ferrous sulphate mixing tank. Hence, a new channel is proposed to carry the water to proposed ferrous sulphate mixing tank (flash mixer) and from there to the existing baffle unit. The water is diverted to the ferrous sulphate mixing tank by obstructing the channel connecting the existing inlet tank with Tank 1 at entry of Tank 1. The height of weir and obstruction are as per hydraulic flow diagram given in **Drawing no. D3** and length is as per layout diagram in **Drawing no. D1**. For the balance part of flow i.e. 1250 m^3/h a new channel is proposed.
2. **Inlet Tank:** The existing influent pit is used for flow rate of 250 m^3/h. Detention time in inlet tank is 5.17 min. A new inlet chamber is proposed for 1250 m^3/h of flow with detention time 5.4 min.
3. **Ferrous sulphate mixing Tank (flash mixer):** Flash mixing unit is provided to mix ferrous sulphate with influent water. The units proposed are of capacities 250 m^3/h and 1250 m^3/h. Detention time of 60 sec is provided with velocity gradient of 600 s^{-1}.
4. **Baffle Chamber:** The baffle chamber is used for enhancing the mixing of ferrous sulphate. The existing baffle chamber is used for

250 m^3/h flow and a new baffle chamber is proposed for the remaining flow of 1250 m^3/h. Detention time in baffle units is 15 min.

5. **Balancing Tank:** The chemically treated water will be stored in balancing tank for 1 h detention time. Pumping arrangement is to be installed at the sump to deliver wastewater along with solids, if any, to distribution chamber cum caustic soda mixing tank.
6. **Distribution Chamber cum Caustic soda mixing Tank:** The total flow of 1500 m^3/h is distributed equally to two clariflocculation unit for which a distribution chamber of 2 min detention time is proposed. Addition of caustic soda will be carried out in this unit (to maintain pH 8-9).
7. **Flocculant mixing Tank (flash mixer):** The wastewater mixed with caustic soda is taken to a flash mixing unit through a channel. Polyelectrolyte/other equivalent settling aid is proposed to be added in this channel which will be mixed in the flash mixing unit. The detention time is taken as 60 sec and velocity gradient was taken as 600 s^{-1}. Two flocculant mixing tanks catering for the flow of 750 m^3/h are provided.
8. **Clariflocculator:** The flocculator well is designed for a detention time of 20 min and velocity gradient of 40 s^{-1}. The clarifier unit is designed for surface overflow rate of approximately 26 $m^3/m^2/d$. The diameter of clarifier is arrived at as 32 m and side water depth is 2.5 m with additional 0.5 m as freeboard. Detention time and weir loading rate are 2.31 h and 179 $m^3/m/d$ respectively. Two clariflocculatior unit each one catering for the flow of 750 m^3/h is provided.
9. **Rapid Gravity Filter:** The rapid gravity filter unit is proposed after clarifier to remove the remaining suspended solids. RGF operates at a rate of filtration 5 $m^3/m^2/h$. Eight Twin filter bed (with two

standby) are provided. The effluent of RGF is disposed to Inland surface water. RGF is designed for a flow of 1500m³/h.

10. **Air Scouring Blower:** For performing backwash in filter bed air scouring blower will be provided. The total capacity of the blower is chosen as 60 m³/min (1W + 1S).
11. **Filter water Tank:** A part of filtered water is stored for back washing. The detention time in this tank is taken as 20 min.
12. **Over Head Reservoir (OHR):** Rectangular OHR with staging height 8 m from top level of sand is proposed for back washing at the rate 600 Lpm/m² for 10 min time. Water head varies from 8 m to 9.5 m.
13. **Backwash Collection Tank:** The backwash water will be collected in a backwash collection tank from where it is recirculated by pumping to distribution tank.
14. **Sludge Tank:** The sludge collected from bottom of both the clarifier is drawn to common sludge tank by gravity. Rate of flow of sludge from each clarifier is estimated as 7.5 m³/h. The sludge is pumped to centrifuge unit for dewatering at the rate 15 m³/h.
15. **Centrifuge:** The centrifuge (1 working and 1 standby) size is chosen for a flow rate of 15 m³/h with input sludge consistency of 2 %.
16. **Chemical house cum MCC room:** All dosing work, i.e. ferrous sulphate, caustic soda and polyelectrolyte/other equivalent settling aid dosing, will be made through dosing pumps. Chemical dosing, electrical work and chemical storing will be carried out in a two storied building. The first floor will have dosing solution preparation facility and dosing pumps while ground floor will have MCC and area for storage of chemicals.
17. **Pipe network:** The pipeline and valve schedule are given in the Table 7-8.

Table 6: List of new units in proposed ETP at quarry D

Sl. No	Unit/Equipment	Dimensions (L X W X D)	MOC
1.	Channel (Ch-1) (for 250 m^3/h flow)	Cross section: 0.35m(W) X 1m(D) (including 0.65m F.B.) Bed slope: 1 in 700 Length: As per Layout	RCC
2.	Ferrous sulphate mixing tank (flash mixer) (for 250 m^3/h flow)	1.5m X 1.5m X 2.4m (including 0.5m F.B.)	RCC, propeller type blade-MS
3.	Channel (Ch-2) (for 1250 m^3/h flow)	Cross section: 0.75m (W) x 1m (D) (including 0.425m F.B.) Bed Slope 1 in 900 Length: As per Layout	RCC
4.	Inlet tank (for 1250 m^3/h flow)	7.5m x 7.5m x 2.5m (including 0.5m F.B.)	RCC
5.	Ferrous sulphate mixing tank (flash mixer) (for 1250 m^3/h flow)	2.75m x 2.75m x 3.25m (including 0.5m F.B.)	RCC, propeller type blade - MS

6.	Baffle Chamber (for 1250 m^3/h flow)	41.65m X 6m X 2m (including 0.5m F.B.) Width of Channel = 0.8m Width of throat = 0.5m No of Baffles = 43	RCC
7.	Balancing tank (for 1500 m^3/h flow)	25m X 25m X 3m (including 0.5m F.B.) Along with pump house size 18.0m x 8.0m	RCC
8.	Distribution Chamber cum Caustic soda mixing tank (for 1500 m^3/h flow)	5.8m x 5.8m x 2m (including 0.5m F.B.)	RCC
9.	Channel (Ch-3) (for 750 m^3/h flow)	Cross section: 0.6m (W) x 1m (D) (including 0.5m F.B.) Bed Slope 1 in 900 Length: As per Layout	RCC
10.	Flocculant mixing tank **(2 nos)** (flash mixer) (for 750 m^3/h flow)	2.4m X 2.4m X 2.9m (including 0.5m F.B.)	RCC, propellier type blade-MS

11.	Clariflocculator **(2 nos)** (for 750 m^3/h flow)	32m Dia. X 2.5m SWD (excluding 0.5m freeboard and sludge zone depth as per vendor requirement) including flocculation well 11.4m Dia. x 2.5m (D) (additional 0.5m freeboard)	RCC Scrapper-MS Painting For Underwater-Epoxy water resistance
12.	Rapid Gravity Filter (for 1500 m^3/h flow)with annex building cum blower room	8m (L) X 6.4m (W) Bed size; 8 nos Bed (6W+2S) Total size 32.85m x 22.4m area (with annex building 19.5m x 4m)	RCC
13.	Filter water Tank (for 923 m^3/h flow)	15m x 7.5m x 1.5m (excluding 0.5m F.B. from bottom of pure water channel) Along with pump house size 15.0m x 8m	RCC
14.	OHR (for 1845 m^3/h flow)	14.5m x 14.5m x 2m (including 0.5m F.B.)	RCC

15.	Backwash collection Tank (for 1845 m^3/h flow)	14.5m x 14.5m x 1.5m (excluding 0.5m F.B. from bottom of backwash channel) Along with pump house size 14.5m x 8m	RCC
16.	Sludge tank (for 15 m^3/h flow)with mixer	6.75m x 6.75m x 2m (including 1m F.B.)	RCC
17.	Centrifuge (2nos: 1W + 1S) with shed	Flow rate 15m^3/h With 10m X 8m shed including platform	SS
18.	Chemical House cum MCC room	26m x 8m two storied building 3 dosing tanks, 3 mixing unit. (3W +3S) dosing pump	RCC, brick work
19.	Air Scouring Blower	60 m^3/min total capacity (1W +1S)	–

Table 7: Pipe details for ETP at quarry D*

Sl. No.	Purpose	Flow (m^3/h)	Dia. Provided (mm)	MOC
1	To carry water from Balancing tank to distribution chamber cum caustic Soda mixing tank	1500	750	DI
2	To carry water from flocculant mixing tank to flocculator	750	550	DI
3	To carry water from clarifier to Distribution box	750	550	DI
4	To carry water from distribution box to RGF(each Channel)	750	550	DI
5	To carry water from filter water tank to OHR	923	600	DI
6	To carry water from OHR to RGF	1845	800	DI
7	To Carry water from RGF to backwash collection tank	1845	800	DI
8	To carry sludge slurry from Clariflocculator bottom to Sludge sump	7.5	150	CI
9	To carry sludge slurry from Sludge sump to centrifuge	15	150	HDPE
10	To carry filtrate from centrifuge to Backwash collection tank	15	150	HDPE
11	To carry water from Backwash collection tank to Distribution tank cum Caustic soda mixing tank	923	600	DI
12	To carry chemicals	0-40Lpm	60, 30 (for $FeSO_4$ mixing tank with $250m^3/h$ flow)	HDPE

Annex 35

Table 8: Valve details for ETP at quarry D*

Sl. No.	Position	Type	Size(mm)	No	MOC
1 A	In pipe line from Balancing tank to distribution tank (before pump)	Butterfly Valve	400	5	CI
1 B	In pipe line from Balancing tank to distribution tank (after pump)	Non-return Valve	400	5	CI
1 C	In pipe line from Balancing tank to distribution tank (after pump)	Butterfly Valve	400	5	CI
2 A	In pipe line from Flocculant mixing tank to flocculator	Butterfly Valve	550	2	CI
3 A	In pipe line from Clarifier to Distribution box	Butterfly Valve	550	2	CI
3 B	To pipe line from Distribution box to Rapid gravity filter	Butterfly Valve	550	2	CI
4 A	In pipe line from filter water tank to OHR (Before pump)	Butterfly Valve	350	4	CI
4 B	In pipe line from filter water tank to OHR (after pump)	Non-return Valve	350	4	CI
4 C	In pipe line from filter water tank to OHR (after pump)	Butterfly Valve	350	4	CI
5 A	In pipe line from OHR to RGF	Butterfly Valve	800	1	CI
5 B	In pipe line from OHR to RGF (8nos for each filter bed)	Butterfly Valve	800	8	CI
6 A	In pipe line from RGF to backwash collection tank	Gate Valve	800	1	CI
7 A	In pipe line from Clariflocculator bottom to Sludge sump	Gate Valve	150	2	CI

8 A	To carry sludge slurry from Sludge sump to centrifuge (before pump)	Butterfly Valve	150	2	CI
8 B	To carry sludge slurry from Sludge sump to centrifuge (after pump)	Non-Return Valve	150	2	CI
8 C	To carry sludge slurry from Sludge sump to centrifuge (after pump)	Butterfly Valve	150	2	CI
9 A	To carry sludge slurry from centrifuge to Backwash collection tank	Butterfly Valve	150	1	CI
10A	In pipe line from Back wash collection tank to caustic soda mixing tank (Before pump)	Butterfly Valve	350	4	CI
10 B	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Non-return Valve	350	4	CI
10 C	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	4	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering.

ETP and Pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- D 1-7** respectively.

The pumping machinery details are given in **Table 9.**

Table 9: List of Pumps for ETP at Quarry D

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	5(4W+1S)	To feed water from Balancing tank to Distribution chamber cum Caustic Soda mixing tank	104.17 Lps	15m	Wastewater with TSS
2	Horizontal Centrifugal	4(3W+1S)	To feed water from filter water tank to OHR	86.11Lps	20m	Filtered water
3	Horizontal Centrifugal	4(3W+1S)	To feed water from Back wash collection tank to distribution chamber cum Caustic Soda mixing tank	86.11Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	4.17 Lps	25m	Sludge
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-40 Lpm	-	Ferrous sulphate, Caustic soda and poly-electrolyte or other equivalent settling aid

Table 9: List of Pumps for ETP at Quarry D

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	5(4W+1S)	To feed water from Balancing tank to Distribution chamber cum Caustic Soda mixing tank	104.17 Lps	15m	Wastewater with TSS
2	Horizontal Centrifugal	4(3W+1S)	To feed water from filter water tank to OHR	86.11Lps	20m	Filtered water
3	Horizontal Centrifugal	4(3W+1S)	To feed water from Back wash collection tank to distribution chamber cum Caustic Soda mixing tank	86.11Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	4.17 Lps	25m	Sludge
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-40 Lpm	-	Ferrous sulphate. Caustic soda and poly-electrolyte or other equivalent settling aid

Table 9: List of Pumps for ETP at Quarry D

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	5(4W+1S)	To feed water from Balancing tank to Distribution chamber cum Caustic Soda mixing tank	104.17 Lps	15m	Wastewater with TSS
2	Horizontal Centrifugal	4(3W+1S)	To feed water from filter water tank to OHR	86.11Lps	20m	Filtered water
3	Horizontal Centrifugal	4(3W+1S)	To feed water from Back wash collection tank to distribution chamber cum Caustic Soda mixing tank	86.11Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	4.17 Lps	25m	Sluage
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-40 Lpm	-	Ferrous sulphate, Caustic soda and poly-electrolyte or other equivalent settling aid

Table 9: List of Pumps for ETP at Quarry D

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	5(4W+1S)	To feed water from Balancing tank to Distribution chamber cum Caustic Soda mixing tank	104.17 Lps	15m	Wastewater with TSS
2	Horizontal Centrifugal	4(3W+1S)	To feed water from filter water tank to OHR	86.11Lps	20m	Filtered water
3	Horizontal Centrifugal	4(3W+1S)	To feed water from Back wash collection tank to distribution chamber cum Caustic Soda mixing tank	86.11Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	4.17 Lps	25m	Sludge
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-40 Lpm	-	Ferrous sulphate, Caustic soda and poly-electrolyte or other equivalent settling aid

Table 9: List of Pumps for ETP at Quarry D

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	5(4W+1S)	To feed water from Balancing tank to Distribution chamber cum Caustic Soda mixing tank	104.17 Lps	15m	Wastewater with TSS
2	Horizontal Centrifugal	4(3W+1S)	To feed water from filter water tank to OHR	86.11Lps	20m	Filtered water
3	Horizontal Centrifugal	4(3W+1S)	To feed water from Back wash collection tank to distribution chamber cum Caustic Soda mixing tank	86.11Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	4.17 Lps	25m	Sludge
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-40 Lpm	-	Ferrous sulphate. Caustic soda and poly-electrolyte or other equivalent settling aid

6.2 ETP for Quarry F

The existing units of ETP at quarry F cannot be used due to inadequate capacity. New units are proposed for entire mine discharge and surface runoff.

The maximum discharge at the inlet of this ETP is 310 m^3/h, which is considered as the design flow rate of the system. Out of this 162 m^3/h is surface runoff from ore stack yard and 144 m^3/h is mine discharge. During non-monsoon period the mine discharge has to be pumped to maintain the constant flow rate of 310 m^3/h to ETP. The list of units with dimensions in the proposed ETP for Quarry F is given in **Table 10**.

The treatment process is mainly based on the following units:

1. **Channel:** A new channel is proposed to carry water to proposed units. Length and height are as per **Table 10** and **Drawing No. F 1**.
2. **Inlet Tank:** A new inlet tank for 310 m^3/h of flow is proposed keeping detention time 5 min.
3. **Ferrous sulphate mixing Tank (flash mixer):** Flash mixing unit is provided to mix ferrous sulphate with the influent water. Detention time of 60 sec is provided with velocity gradient of $600s^{-1}$.
4. **Baffle chamber:** The baffle chamber is used for enhancing the mixing of ferrous sulphate. New baffle chamber is proposed for 310 m^3/h. Detention time in baffle units are taken as 15 min.
5. **Balancing Tank:** The chemically treated water will be stored in balancing tank for 1 h detention time. A pump is to be installed at the sump, which will be a part of the tank, to deliver wastewater along with solids deposited, if any, to caustic soda mixing tank.
6. **Caustic soda mixing tank:** A tank of 2 min detention time is proposed for addition of caustic soda.

7. **Flocculant mixing Tank (flash mixer):** The wastewater mixed with caustic soda (applied to maintain pH 8-9) is taken to a flash mixing unit through a channel. In the channel Polyelectrolyte/other equivalent settling aids is added before entering in the flash mixing unit prior to clariflocculation. The detention time is taken as 60 sec and velocity gradient 600 s^{-1}.
8. **Clariflocculator:** The flocculator well is designed for a detention time of 20 min and velocity gradient of 40 s^{-1}. The clarifier unit is designed for surface overflow rate around 28$m^3/m^2/d$. The designed diameter of clarifier is 20 m and side water depth is 2.5 m with additional 0.5 m for freeboard. Detention time and weir loading rate are 2.14 h and 118 $m^3/m/d$.
9. **Rapid Gravity Filter unit:** The rapid gravity filter unit is provided after clarifier to remove the remaining suspended solids/fine particles. RGF operates at a rate of filtration 5 $m^3/m^2/h$. Five number filter beds (including 1 standby) are provided with design dimension 4.5 m X 3.5 m each. The effluent of RGF is disposed to inland surface water.
10. **Air Scouring Blower:** For performing backwash in filter bed air scouring blower will be provided. The capacity of the blower is chosen as 20 m^3/min (1W + 1S).
11. **Filter water tank:** A part of filtered water is stored for back washing. Detention time required in this tank is 20 min. Flowrate of backwashing 600 Lpm/m^2, which is kept constant for backwashing from overhead tank.
12. **Over Head Reservoir:** Rectangular OHR with staging height 8 m from top level of sand is proposed for back washing at the rate 600 Lpm/m^2. Water head varies from 8 m to 9.5 m.
13. **Backwash Collection Tank:** The backwash water will be collected in a backwash collection tank from where it is recirculated to caustic soda mixing tank by pumping.

14. **Sludge Tank:** The sludge collected from bottom of the clarifier is coming to sludge tank by gravity. The sludge is then pumped to centrifuge unit for dewatering. Rate of flow of sludge from clarifier is 3.1 m^3/h and goes to centrifuge.
15. **Centrifuge:** The centrifuge (1 working and 1 standby) is chosen for a flow rate of 3.1 m^3/h with sludge consistency 2 %.
16. **Chemical dosing cum electrical panel room:** All chemical dosing work will be made through dosing pumps. Chemical dosing, electrical work and chemical storing will be done in a two storied building. The first floor will have dosing solution preparation facility and dosing pumps while ground floor will have MCC and area for chemical storage.
17. **Pipe network:** The pipeline and valve schedule are given in the **Table 11-12.**

Table 10: List of units in proposed ETP at quarry F

Sl. No	Unit/Equipment	Dimensions (L X W X H)	MOC
1.	Channel (310 m^3/h)	Cross section: 0.3m (W) x 1m (D) (with 0.54m F.B.) Bed Slope: 1 in 600 Length: As per Layout	RCC
2.	Inlet Tank (310 m^3/h)	3.75m x3.75m x 2.5m (including 0.5m F.B.)	RCC
3.	Ferrous sulphate mixing Tank (flash mixer) (310 m^3/h)	1.75m x 1.75m x 2.25m (including 0.5m F.B.)	RCC propeller type blade-MS
4.	Baffle Chamber (310 m^3/h)	23.35m x 4m x 1.7m (D) (including 0.5m F.B.) Width of Channel= 0.35m Width of throat= 0.2m No of Baffle= 46	RCC
5.	Balancing tank (310 m^3/h)	12.5mx 12.5m x 2.5m (including 0.5m F.B.) Along with pump house size 9.0m x 7.0m	RCC

6.	Caustic soda mixing tank (310 m^3/h)	2.65m x 2.65m x 2m (including 0.5m F.B.)	RCC
7.	Flocculant mixing tank (flash mixer) (310 m^3/h)	1.75m x 1.75m x 2.25m (including 0.5m F.B.)	RCC, propeller type blade-MS
8.	Clariflocculator (310 m^3/h)	20m Dia. X 2.5m SWD (additional 0.5m freeboard and sludge zone depth as per vendor requirement) including flocculation well 7.4m Dia. x 2.5m (D) (additional 0.5m freeboard)	RCC Scrapper-MS Shaft -MS Tubular Painting For Underwater-Epoxy water Resistance
9.	Rapid Gravity Filter with annex building cum blower room (310 m^3/h)	4.5m (L) X 3.5m (W) Bed size; 5 nos. Bed(4W+1S) Total size 26m x 11m area (with annex building 8m x 3.5m)	RCC
10.	Filter water Tank (264 m^3/h)	8m x 4.5m x 1.5m (excluding 0.5m F.B. from bottom of pure water channel) Along with pump house size 8.0m x 7.0m	RCC

11.	OHR (567 m^3/h)	8m x 8m x 2m (including 0.5m F.B.)	RCC
12.	Backwash collection Tank (567 m^3/h)	8m x 8m x 1.5m (excluding 0.5m F.B. from bottom of backwash channel) Along with pump house size 8.0m x 7.0m	RCC
13.	Sludge tank (3.1m^3/h)	3.1m x 3.1m x 2m (including 1.0m F.B.)	RCC
14.	Centrifuge (2nos: 1W+1S) with shed	Flow rate 3.1m^3/h With 10m X 8m shed including platform	SS
15.	Chemical house cum MCC room	15m x 6m; 2 storied building 3 dosing tank; 3 mixing unit; (3W + 3S) dosing pump	RCC; brickwork
16.	Air scouring Blower	20 m^3/min total capacity (1W+1S)	-

Table 11: Pipe details for ETP at quarry F*

Sl. No.	Purpose	Flow (m^3/h)	Dia. Provided (mm)	MOC
1	To carry water from Balancing tank to Caustic soda mixing tank	310	350	DI
2	To carry water from Flocculant mixing tank to flocculator	310	350	DI
3	To carry water from filter water tank to OHR	284	350	DI
4	To carry water from OHR to RGF	567	450	DI
5	To carry sludge slurry from Clariflocculator bottom to Sludge tank	3.1	150	CI
6	To carry sludge slurry from Sludge tank to centrifuge	3.1	75	HDPE
7	To carry filtrate from centrifuge to Back wash collection tank	3.1	90	HDPE
8	To carry water from Backwash collection tank to Caustic soda mixing tank	284	350	DI
9	To carry chemicals	0-10Lpm	40	HDPE

Table 12: Valve details for ETP at quarry F*

Sl. No.	Position	Type	Size(mm)	No	MOC
1A	In pipe line from Balancing tank to distribution tank (before pump)	Butterfly Valve	350	2	CI
1B	In pipe line from Balancing tank to distribution tank (after pump)	Non-return valve	350	2	CI
1C	In pipe line from Balancing tank to distribution tank (after pump)	Butterfly Valve	350	2	CI

2 A	In pipe line from Flocculant mixing tank to flocculator	Butterfly Valve	350	1	CI
3 A	In pipe line from filter water tank to OHR (Before pump)	Butterfly Valve	350	2	CI
3 B	In pipe line from filter water tank to OHR (after pump)	Non-return Valve	350	2	CI
3 C	In pipe line from filter water tank to OHR (after pump)	Butterfly Valve	350	2	CI
4 A	In pipe line from OHR to RGF	Butterfly Valve	450	1	CI
4 B	In pipe line from OHR to RGF (5nos in each filter bed)	Butterfly Valve	450	5	CI
5 A	In channel from Rapid Gravity Filter to backwash collection tank	Gate Valve	450	1	CI
6 A	In pipe line from Clariflocculator bottom to Sludge sump	Gate Valve	150	1	CI
7 A	To carry sludge slurry from Sludge sump to centrifuge (before pump)	Butterfly Valve	100	2	CI
7 B	To carry sludge slurry from Sludge sump to centrifuge (after pump)	Non-return Valve	100	2	CI
7 C	To carry sludge slurry from Sludge sump to centrifuge (after pump)	Butterfly Valve	100	2	CI
8 A	To carry sludge slurry from centrifuge to inlet tank	Butterfly Valve	100	1	CI
9 A	In pipe line from Back wash collection tank to caustic soda mixing tank (Before pump)	Butterfly Valve	350	2	CI
9 B	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Non-return Valve	350	2	CI

9 C	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13.**

9C	In pipe line from Back wash collection tank to cousltic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in Drawing **No- F 1-7** respectively.

The pumping machinery details are given in **Table 13.**

P-C	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13.**

9C	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13**.

9 C	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13.**

	in pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13**.

	In pipe line from Back wash collection tank to caustic soda mixing tank (after pump)	Butterfly Valve	350	2	CI

*The quantity given is indicative and this is to be worked out based on the layout/hydraulic finalized during detailed engineering

ETP and pipe Layout, Process flow diagram, hydraulic profile, G.A. drawing of Baffle chamber, Clariflocculator, Rapid gravity filter, and chemical House cum MCC room of the proposed ETP are given in **Drawing No- F 1-7** respectively.

The pumping machinery details are given in **Table 13.**

Table 13: List of Pumps for ETP at Quarry F

Sl. No	Type	Nos.	Purpose	Capacity	Head	Liquid Handled
1	Horizontal Centrifugal	2(1W+1S)	To feed water from Balancing tank to caustic soda mixing tank	86.11Lps	15m	Wastewater with some TSS
2	Horizontal Centrifugal	2(1W+1S)	To feed water from filter water tank to OHR	78.89Lps	20m	Filtered water
3	Horizontal Centrifugal	2(1W+1S)	To feed water from Back wash collection tank to Caustic soda mixing tank	78.89Lps	15m	Backwash water
4	Horizontal Centrifugal	2(1W+1S)	To feed sludge from Sludge pump to centrifuge	0.87Lps	25m	Sludge
5	Dosing Pump	6 (3W+3S)	To feed chemicals to waste water.	0-10Lpm	-	Ferrous sulphate, Caustic soda and polyelectrolyte

Hydraulic flow diagram has been provided based on the above units tentatively along with this report in **drawing no. D3 and F3**. Vendor has to finalize the hydraulic flow diagram as per there layout and detailed field survey.

Chapter 7

Broad Cost Estimate

7.1 Broad Capital Cost

The capital cost for Quarry D and Quarry F installation is provided in **Table 14 and 15** respectively. Total capital cost is provided in **Table 16.**

Table 14: Broad Capital cost for ETP at Quarry D*

Category	Cost (₹)
Mechanical Components (including Erection)	
Flow meter	3,60,000/ -
Ferrous sulphate mixing tank mechanism(1nos for 250m³/h)	1,10,000/ -
Ferrous sulphate Mixing tank mechanism (1nos for 1250m³/h)	2,80,000/ -
Flocculant mixing tank mechanism (2nos)	5,50,000/ -
Chemical dosing system including dosing tank, agitator, dosing pump and all other related electromechanical equipment	41,90,000/ -
Clariflocculator Mechanism (2 no.)	93,60,000/-
Rapid Gravity filter mechanism including blower, pipes, specials and related equipment	80,30,000/ -
Sludge sump mixing arrangement	2,30,000/-
Centrifuge (2 no.)	50,00,000/-
Pipes and fittings	80,00,000/-

Chapter 7

Broad Cost Estimate

7.1 Broad Capital Cost

The capital cost for Quarry D and Quarry F installation is provided in Table 14 and 15 respectively. Total capital cost is provided in Table 16.

Table 14: Broad Capital cost for ETP at Quarry D*

Category	Cost (₹)
Mechanical Components (including Erection)	
Flow meter	3,60,000/ -
Ferrous sulphate mixing tank mechanism (1nos for 250m³/h)	1,10,000/ -
Ferrous sulphate Mixing tank mechanism (1nos for 1250m³/h)	2,80,000/ -
Flocculant mixing tank mechanism (2nos)	5,50,000/ -
Chemical dosing system including dosing tank, agitator, dosing pump and all other related electromechanical equipment	41,90,000/ -
Clariflocculator Mechanism (2 no.)	93,60,000/-
Rapid Gravity filter mechanism including blower, pipes, specials and related equipment	80,30,000/ -
Sludge sump mixing arrangement	2,30,000/-
Centrifuge (2 no.)	50,00,000/-
Pipes and fittings	80,00,000/-

Valves	44,40,000/ -
Pumps and other related accessories	1,25,00,000/ -
Equipment installation and piping works	83,50,000/ -
Subtotal of Mechanical Components	**6,14,00,000/-**
Electrical Components (Including Erection)	
MCC panel, cables & electrical equipment, Electrical installation works, cablings, earthing, transportation, unloading, trials	1,42,00,000/-
Civil Components	
Civil works	10,00,00,000/ -
Total Cost of the Project	**17,56,00,000/-**

*Cost is approximate only.

Table 15: Broad Capital cost for ETP at Quarry F*

Category	Cost (₹)
Mechanical Components (including Erection)	
Flow meter	3,10,000/ -
Ferrous sulphate mixing tank mechanism(1nos)	1,20,000/ -
Flocculant mixing tank mechanism (1nos)	1,20,000/ -
Chemical dosing system including dosing tank, agitator, dosing pump and all other related electramechanical equipment	17,10,000/ -
Clariflocculator Mechanism (1no.)	33,20,000/-
Rapid Gravity filter mechanism including blower, pipes, specials and	29,30,000/ -

related equipment	
Sludge sump mixing arrangement	2,00,000/-
Centrifuge (2 no.)	30,00,000/-
Pipes and fittings	23,30,000/-
Valves	10,00,000/-
Pumps and other related accessories	68,20,000/-
Equipment installation and piping works	25,00,000/-
Subtotal of Mechanical Components	**2,43,60,000/-**
Electrical Components (Including Erection)	
MCC panel, cables & electrical equipment, Electrical installation works, cablings, earthing, transportation, unloading, trials	35,24,000/-
Civil Components	
Civil works	2,80,00,000/-
Total Cost of the Project	**5,58,84,000/-**

*Cost is approximate only

Table 16: Total Broad Capital cost*

Category	Cost (₹)
Mechanical Components	
Quarry D	6,14,00,000/-
Quarry F	2,43,60,000/-
Subtotal of Mechanical Components	**8,57,60,000/-**
Electrical Components	
Quarry D	1,42,00,000/-
Quarry F	35,24,000/-
Subtotal of Electrical Components	**1,77,24,000/-**

related equipment	
Sludge sump mixing arrangement	2,00,000/-
Centrifuge (2 no.)	30,00,000/-
Pipes and fittings	23,30,000/-
Valves	10,00,000/ -
Pumps and other related accessories	68,20,000/ -
Equipment installation and piping works	25,00,000/ -
Subtotal of Mechanical Components	**2,43,60,000/-**
Electrical Components (including Erection)	
MCC panel, cables & electrical equipment, Electrical installation works, cablings, earthing, transportation, unloading, trials	35,24,000/ -
Civil Components	
Civil works	2,80,00,000/ -
Total Cost of the Project	**5,58,84,000/-**

*Cost is approximate only

Table 16: Total Broad Capital cost*

Category	Cost (₹)
Mechanical Components	
Quarry D	6,14,00,000/-
Quarry F	2,43,60,000/-
Subtotal of Mechanical Components	**8,57,60,000/-**
Electrical Components	
Quarry D	1,42,00,000/-
Quarry F	35,24,000/ -
Subtotal of Electrical Components	**1,77,24,000/-**

Civil Components	
Quarry D	10,00,00,000/-
Quarry F	2,80,00,000/-
Subtotal of Civil Components	**12,80,00,000/-**
Miscellaneous	
Internal roads, boundary wall, landscaping and Commissioning	80,00,000/-
Design and detail drawings	25,00,000/-
Total Cost	**24,19,84,000/-**
Add 3% contingency	**72,59,520/-**
Total Estimated Project Cost	**24,92,43,520/-**

* Cost is approximate only

Notes

i. The cost of settling tank, sump and associated pumps, pipes and fittings for ore stack yard are not covered in the cost estimate.

ii. Outlet pipe and the associated accessories are not considered in the cost estimate.

7.2 Operational Cost

The capital cost for Quarry D and Quarry F installation is provided in **Table 17 and 18** respectively.

Table 17: Operational cost for ETP at Quarry D*

Item	Rate	Amount (₹)
Labour Cost		
Operators 3nos/ shift	500	4500
Supervisor cum Chemist 2no	1000	2000
Helpers 4no/ shift	250	3000
Sub total		**9500/day**

Electrical Cost		
265 KW x 20 hours /day	₹ 6/KWH	31800/day
Chemical Cost		
Total Chemical Cost		88250/day
Total Cost		129550/day

*cost is tentative

Table 18: Operational cost for ETP at Quarry F*

Item	Rate	Amount (₹)
Labour Cost		
Operators 3nos/ shift	500	3000
Supervisor cum Chemist 2no	1000	2000
Helpers 3no/ shift	250	1500
Sub total		6500/day
Electrical Cost		
Electrical Cost 75 KW x 10 hours /day	₹ 6/KWH	4500/day
Chemical Cost		
Total Chemical Cost		10100/day
Total Cost		21100/day

*cost is tentative

Notes

i. The cost is calculated for 20 hour operation for quarry D and 10h operation for quarry F. The cost of chemical is based on dosing arrived at from lab scale study of field wastewater. The exact dosing is to be checked as per field condition.

ii. The total power cost may vary with equipment specification.

iii. Change of sand media for RGF is not considered in the cost calculation.

iv. Cost of chemical usage and sludge handling in centrifuge is not considered in the cost.

v. 3 shifts of operation are considered for operators and helpers in Quarry D and 2 shifts of operation were considered for operators and helpers in Quarry F.

Total project cost is 25 crores approximately. Total operational cost is approx. 1.51 Lakhs per day.

Chapter 8

Recommendations

This report recommends the installation of a new ETP to treat wastewater of Quarry F. For Quarry D, part of existing ETP is recommended to be used with suitable improvisations and integrating it with new proposed units. Following recommendation may be considered for installation and operation of ETPs:

1. Water quality in terms of concerned parameters of influent and treated water should be monitored on regular basis.
2. Adequacy of existing structure shall be checked as per site condition before utilizing/modifying the same.
3. Polyelectrolyte/ other equivalent settling aid used as flocculant should confirm to WHO or other statutory Government organization certification.
4. Material Safety Data Sheet (MSDS) of all chemical used should be checked and the dose shall be fixed based on the purity of chemicals used.
5. The dose of ferrous sulphate should be worked out based on influent hexavalent chromium concentration. Similarly the flocculant dose should be chosen based on daily jar test with balancing tank water.
6. Volume of dosing tank, flow rate of chemical dosing pump and diameter of pipe carrying chemicals has to be reconfirmed based on the strength of chemicals used in field.
7. Please note the hydraulic flow diagram is indicative and was developed considering ground level for Quarry F and D as 169m and 129m respectively. However, during detailed engineering vendor has to finalize/optimize based on their layout, equipment

details, topographical survey and invert level of the outfall drainage system.

8. The invert level of the treated water pipe coming out of the filter unit should be finalized to ensure free fall into the outfall drain considering maximum water level.
9. During detailed engineering vendor shall provide inspection pits in the outlet pipe as per specifications.
10. All RCC work shall be carried out with epoxy lining.
11. All the channels and pipes need to be cleaned periodically to remove silts and debris, in order to maintain adequate depths of flow.

Annexure I

Performance Analysis of Existing ETP

The schematic dimensional drawing of existing ETPs of Quarry D and Quarry F are given in Drawing M1 and M2 respectively. The process design with the existing unit is checked with the present flow (1248 m^3/h for quarry D and 144 m^3/h for quarry F, as provided by OMC) for performance analysis of present system.

Table A1: Performance analysis of ETP at Quarry D

Sl. No.	Description	Design parameter Analyzed	Remarks
1	Channel 1 – Length – 30m x 1.0m depth (Including 0.3 m free board)	Preferable velocity range is 0.6 to 1.0 m/sec	Longitudinal slope to be updated with screed concrete, if required.
2	Inlet tank 4.9mx4.0m x1.4m (including 0.3m freeboard)	Detention time = 1.04 min	Inadequate
3	Channel 2 – Length – 66m , 0.6m widthx1.0m depth (Including 0.3m free board)	Preferable velocity range is 0.6 to 1.0 m/sec	Longitudinal slope to be updated with screed concrete, if required.
4	Tank1 - 4.0mx4.0m x2.4m (Including 0.3m free board)	Detention time = 1.62 min	Inadequate
5	Channel 3 – Length – 4.7m , 1.0m widthx1.8m depth (Including 0.3m free board)	Preferable velocity range is 0.6 to 1.0 m/s	Longitudinal slope to be updated with screed concrete, if required.
6	Baffle Chamber – Length – 21.0m , 4m widthx1.7m depth (Including 0.3m free board)	Detention time = 4.29 min	Inadequate
7	Settling tank	Detention time =	Inadequate

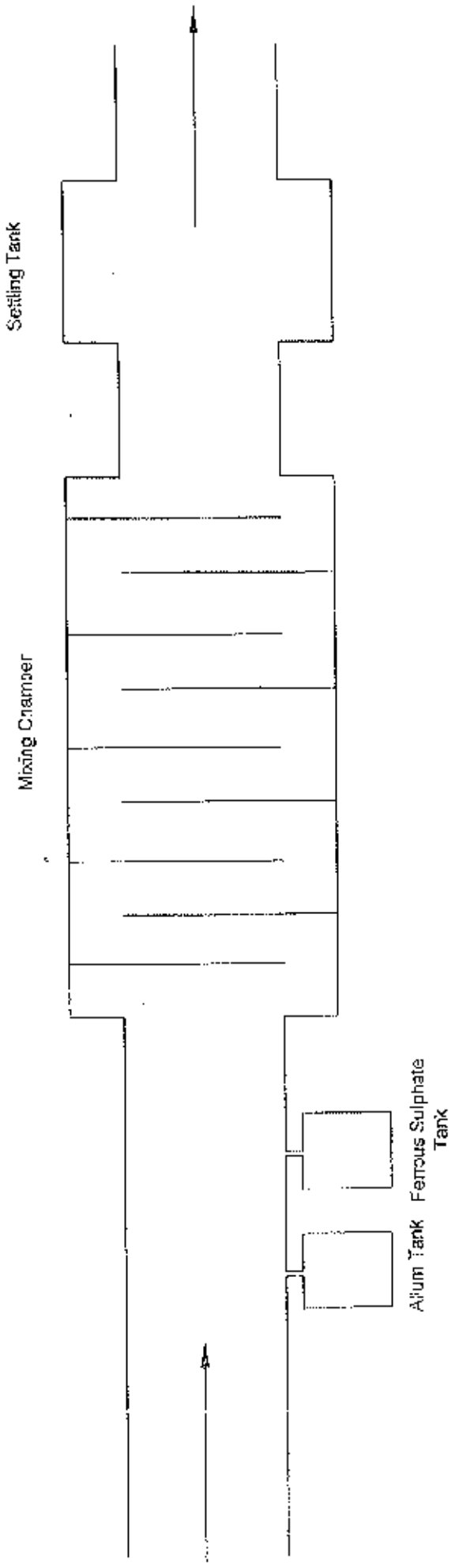
	Length – 10.m , 4m width x1.9m depth (Including 0.3m free board)	3.08min

Table A2: Performance analysis of ETP at Quarry F

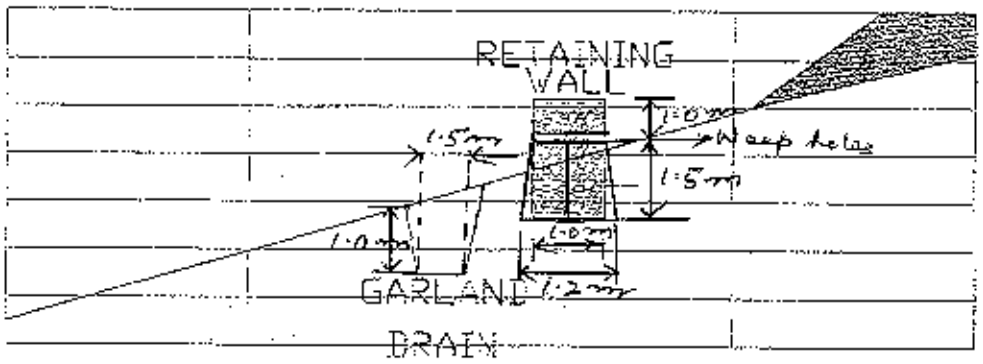
Sl. No	Description	Design Criteria Analyzed	Remarks
1	Inlet tank - 3.95mx3.95m x1.55m (Including 0.3m free board)	Detention time = 8.13 min	Adequate
2	Channel 1 – 2.55mx 0.56m widthx1.0m depth (Including 0.3m free board)	Preferable velocity range is 0.6 to 1.0 m/sec	Longitudinal slope to be updated with screed concrete, if required.
3	Baffle Chamber – Length – 19.45m , 3.48m width x 0.6m effective water depth	Detention time = 10.68 min,	Inadequate
4	Settling tank 1 Length – 9.8m , 3.95m widthx2.1m depth (Including 0.3m free board)	Detention time = 29.03 min	Inadequate
5	Settling tank 2 Length – 9.4m, 3.9m width x 2.1m depth (Including 0.3m free board)	Detention time = 27.50 min	Inadequate

Annex. 36

EFFLUENT TREATMENT PLANT



TYPICAL DESIGN OF RETAINING WALL/ SETTLING TANK



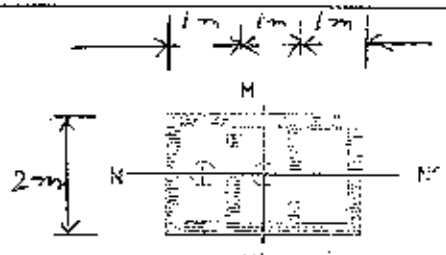
SECTION LINE

WEEP HOLES

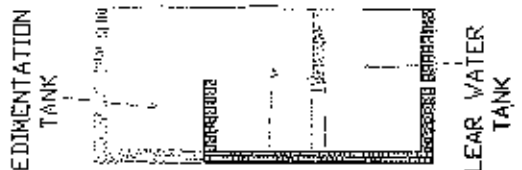
MORTAR STONE WORK

REINFORCEMENT (RCC)

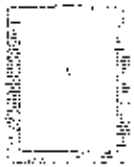
SCALE – NTS



PLAN VIEW OF SETTLING TANK



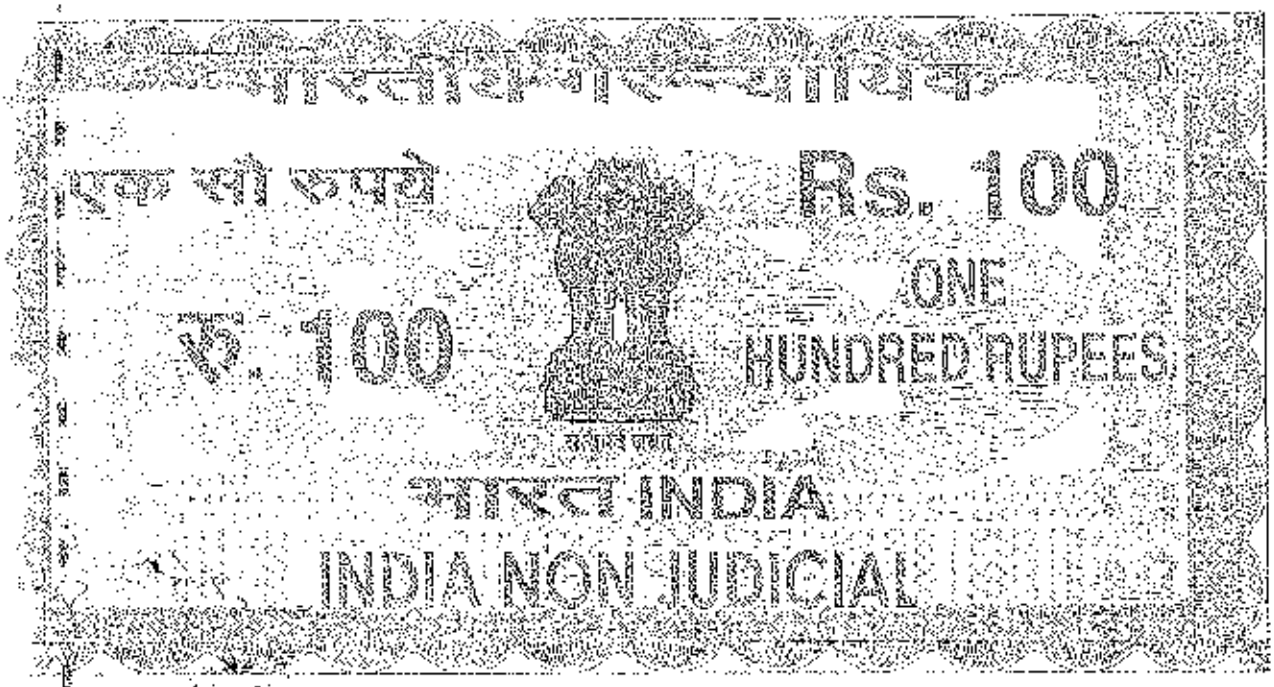
SECTION ALONG N–N''



SECTION ALONG M–M'

SCALE – NTS

Annex-38



Bank Guarantee No-14108BG000038

The Regional Controller of Mines,
Indian Bureau of Mines,
Bhubaneswar.

Guarantee NO:14108BG000038
Amount of Guarantee Rs.5720875/-
Guarantee Period: from 14/08/2014 to 31/03/2019

This Deed of guarantee executed on 14th Day of August, 2014 by Karnataka Bank Ltd., having its central office at Mangalore and amongst other places, a branch at B63, Savitri Towers, Janpath Road, Bhubaneswar (hereinafter referred to as the bank) in favor of The Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar (hereinafter referred to as the Beneficiary) for an amount not exceeding Rs 57,20,875/- (Fifty Seven lakh Twenty thousand Eight hundred and seventy Five) only at the request of M/S Odisha Mining Corporation Ltd. Bhubaneswar (hereinafter referred to as the Contractor/s)

This guarantee is issued subject to the condition that the liability of the bank under this guarantee is limited to maximum of Rs 57,20,875/- (Fifty Seven lakh Twenty thousand Eight hundred and seventy Five) only & guarantee shall remain in full force upto 31/03/2019 and cannot be revoked on or before 31/03/2019 (last date of claim) by The Regional Controller of Mines, Indian Bureau of Mines Bhubaneswar in writing.

(Contd in page 2)

For KARNATAKA BANK LTD.

Manager/Officer
Bhubaneswar-751 007 (Orissa State)

SUMESH. K
OFFICER
ST. No-8025, PA No-3[illegible]

For KARNATAKA BANK LTD.

Snilpa. P
Asst. Branch Manager
PA No-3689, ST. No-6838

(47)

Annex-33

Bank Guarantee No-I4188BG000038

1. Agreement on production of a bank guarantee for Rs 5720875/- (Fifty Seven lakh Twenty thousand Eight hundred and Seventy Five) only under rule 23F of MCDR, 1988.
2. We Karnataka Bank Ltd, Bhubaneswar, at the request of M/s Odisha Mining Corporation Ltd, Bhubaneswar (Lessee) do hereby undertake to pay to The Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other officer, authority, nominated by the controller general, Indian Bureau of Mines an amount not exceeding Rs 5720875/- (Fifty Seven lacs Twenty thousand Eight hundred and Seventy Five) only against any loss or damage caused to or suffered or would be caused to or suffered by the Govt. or towards non compliance of provision of Rule 23A, B & 23E of MCDR, 1988, i-e. Mine Closure Plan, progressive mine closure plan approved in respect of the Mining Lease for Sukarangi (Chromite) M.L.No.7288 over an area of 382.709 Hects (S.L.C. No. 73 G/16 granted by the Steel & Mines Dept. Government of Odisha, letter no. DI (G) MG.10/78-7924, dated the 5th august, 1978, to M/s Odisha Mining Corporation Ltd. (lessee) situated in KaliaPani & Forest Block- 27, Village- Sukinda, Taluka, Jajpur District, Odisha State, by reason of any breach of the said lessee or any of the terms and conditions contained in the Mine closure plan / progressive Mine closure plan.
3. We Karnataka Bank Ltd., Bhubaneswar, do hereby undertake to pay the amount due and payable under this guarantee without any demure, to the authority merely on a demand or authorized by The Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other authorized by the controller general Indian Bureau of Mines stating that the amount claimed is due by way of loss or loss of damage caused to or would be cause to or suffer by the Govt. by reason of breach by the said lessee or any of the terms or conditions contain in the Mining Plan/Mining scheme or by reason of lesse's failure to perform the said mine closure plan/ progressive mine closure plan. Any such demand made on the bank under this guarantee. However, our liability under this guarantee shall be restricted to the amount not exceeding Rs.57,20,875/- (Fifty Seven Lac Twenty Thousands Eight Hundred and Seventy five) only.
4. We, Karnataka Bank Ltd., Bhubaneswar undertake to pay to the authority on a demand from The Regional Controller of Mines, Indian Bureau Of Mines, Bhubaneswar or any other officer authorized by the notwithstanding any dispute or disputes raised by the lessee in any suite or proceedings pending before any court or tribunal relating thereto our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be valid discharge of our liability for payment thereunder and lessee shall have no claim against us for making such payments.
5. We Karnataka Bank Ltd, Bhubaneswar further agree that the guarantee herein contain shall remain in full force and effect during the period of to the end of the Mining Plan/ Scheme of Mining period of five years that would be taken for performance of the said agreement and that shall

(Contd in page 3)

For KARNATAKA BANK LTD.

Manager/Officer
Bhubaneswar-751 007 (Orissa State)

SUMESH. K
OFFICER
ST. No-8025, PA. No-[illegible]

For KARNATAKA BANK LTD.

Asst. Branch Manager
Bhubaneswar-751 007 (Orissa State)

Asst. Branch Manager
PA No-3689, ST. No-8439

(17)

Annex-32

(3)

Bank Guarantee No-1410BG000038

continue to be enforceable till all the dues of the Govt. Under or by virtue of the said agreement have been fully paid and its claim satisfied our discharge till Regional Controller of Mines, Indian Bureau of Bhubaneswar or any other officer authorized by the Controller General, Indian Bureau of Mines certify that the terms and conditions of the said progressive mine closure plan/ final mine closure plan have been fully and properly carried out by the said lessee and accordingly discharge this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before date 31/03/2019, we shall be discharged from all liability under this guarantee thereafter.

We Karnataka Bank Ltd., Bhubaneswar further agree that, The Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any other officer authorized by the controller general, Indian Bureau of Mines shall have fullest liberty without our consent and without effecting in any manner our obligations hereunder to vary any of the terms and conditions of the said agreement or the extent time of performance by the said lessee from time to time or to postpone for any time or from time to time any power exercisable by Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar against the agreement, we, Karnataka Bank Ltd., Bhubaneswar shall not relived from our liability by reason of any such variation part of Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar or any indulgence by Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar to the said lessee or any manner or thing whatsoever, which under the law relating to sureties would, but this provision have effect of so relieving us.

rantee will not be discharged due to change in constitution of the bank or lessee.

nataka Bank Ltd, lastly undertake not to revoke this guarantee during its currency except e previous consent with the Regional Controller of Mines, Indian Bureau of Mines, eswar in writing.

standing anything contained herein.

Our liability under this bank guarantee shall not exceed Rs57,20,875/- (Fifty Seven Lac Twenty Thousands Eight Hundred and Seventy five) only.

The bank guarantee shall be valid upto 31/03/2019.

The period of bank guarantee submitted is valid for the period of the proposal given in the mining plan/Scheme of mining/ PMCP etc. We are liable to pay the guarantee amount or ny part thereof under this bank guarantee and only if served upon us a written claim or demand on or before 31.03.2019

KARNATAKA BANK LTD.
Manager/Officer
Bhubaneswar-751 007 (Orissa State)

SUMESH. K
OFFICER
ST. No-8026, PA. No-3969

For KARNATAKA BANK LTD.
Asst. Branch Manager
Bhubaneswar-751 007 (Orissa State)

Shrihari. P
Asst. Branch Manager
CA No-3009, ST. No-8839