PROPOSAL FOR PRELIMINARY EXPLORATION OF MALANGTOLI IRON ORE DEPOSIT IN D-SUB BLOCK OF BONAI-KENDUJHAR-IRON ORE BELTIN THE DISTRICT-SUNDARGARH & KENDUJHAR, ODISHA

SYNOPSIS

1. Mineral	Iron
2. Location	The area of investigation falls in parts of Survey of India Toposheet Nos 73 G/5, being one of the most important iron and manganese mining centers of Odisha. It is well connected with other parts of the State as well as with the neighboring State of Jharkhand. National Highway No.215 connecting Panikoili on National Highway No.5 with Rourkela via Kendujhar, Joda, Barbil and Koira passes through the area. The other important mining centers in the vicinity are Kalta, Tensa and Barsuan. The nearest rail head Barbil is 30km away, on Tatanagar-Barbil section of the South-Eastern Railway.
3. Total Area	16.602 Sq. km.
4. Exploration Agency	MECL
5. Background	The Banded Iron formation (B.I.F) and associated Volcano-Sedimentary sequence of Iron ore group of Bonai-Kendujhar belt, North Odisha, received attention of geoscientists and mining agencies as early as 1930's. Geological Survey of India has been carrying Iron ore exploration work in this belt since 1960's. In addition, several Iron ore bodies also occur within the synclinal valley, which are mostly associated with the upper shale formation of Koira Group of rocks. The exploration for Iron ore in Malangtoli Deposit, Sundargarh District, Odisha, has been carried out by Geological Survey of India, Eastern Region, State Unit: Odisha, Bhubaneswar. The Principal Secretary, Ministry of Mines, Government of Odisha, has allotted the twelve sub-blocks of Malangtoli Iron Ore Deposit of Odisha state to MECL for taking up of exploration for Iron Ore. MECL requested DGM,Odisha to provide the basic data for preparation of proposal & accordingly MECL prepared proposal for preliminary exploration(G-3) level and put up for evaluation of TCC of NMET & approval of E.C. In case the results of G-3 level are encouraging then MECL will take up the G-2 level exploration after approval from TCC & EC of NMET to facilitate Government of Odisha for auctioning of block in view of MMDR Amendment Act 2015. D-Sub- Block for preliminary exploration for Iron is one of the 12 blocks for which exploration proposal (G-3) is prepared and put up for approval of Technical cum Cost Committee of NMET (TCC), for G-3 level exploration for iron ore.
6.Regional Geology	The present study area is a part of the Bonai-Kendujhar belt of Sundargarh&Kendujhar district. The little metamorphosed Precambrian volcano sedimentary rocksexposed in this belt between the SinghbhumGranite in theeast and BonaiGranite inthe west are classified as 'Iron Ore Group' (Sarkar&Saha, 1963) or 'Koira Group'(Murty and Acharya, 1975). These rocks are disposed in the form of a low northerly plunging 'Horse-shoe' shaped Synclinorium(Jones, 1934). The base of the Koira Group is marked by a pronounced unconformity over the SinghbhumGranite in the eastern side and has a sheared inter-fingering contact relationship with Bonai Granite on the western side. The Basal Formation comprises of gritty sandstone, which ranges from ortho-quartzite on one hand to pebbly sandstone and conglomerate on the other. This arenaceous unit is followed by mafic volcanics which is found all along the outer periphery of the Horse-Shoe Synclinorium. The volcanic formation comprises predominantly of Lower Volcanic Flows dominantly of mafic composition and an upper tuffaceous zone. The lava is pillowed at the bottom part and amygdaloidal at the top

indicating its sub-aqueous and subsequent sub-aerial character. The lava grades into purple colour tuffaceous shale conformably towards the upper part and described as 'Lower Shale Formation' (Murty and Acharya, op. cit.). By the appearance of jasper and banded jasper interbanded with the greenish and black shale towards the top, the lower shale graded into the 'Banded Iron Formation'.

The litho-stratigraphic succession of this area, as worked out by earlier workers, based on regional field studies is shown below.

Table Showing Litho-stratigraphic succession of the area

Jones (1934)		Saha(1994) Modified after Sarkar & Saha (1977)		Murthy & Acharya (1975)	
	Upper shales, epidiorite and ash bed B.H.Q. with iron ore bodies Shales with occasional sandstones Purple sandstone with basal conglomerate ----------Unconformity---------- Older Dharwars	IRON ORE GROUP	Singhbhum Granite Upper Shale with volcanics BHJ with iron ore, ferruginous quartzite Lower shale and acid, intermediate tuffs, local dolerite	KOIRA GROUP	Mixed facies formation Upper Shale Formation Banded Iron Formation Volcanic Formation

The stratigraphy of the area modified after Murty and Acharya (op. cit) is given below:	
Kolhan Group	
KOIRA GROUP	Upper Shale Formation
	Banded Iron Formation
	Volcanic Formation
	Basal Sandstone – Quartzite
Singhbhum and Bonai Granites and metamorphosed sediments	

The 'Banded Iron Formation' is represented by BHJ/ BHQ, inter-bedded with black or green shale and banded ferruginous chert. Due to high resistance to erosion these litho-units form high ridges conspicuously mark the outline of the 'Horse-Shoe' Synclinorium" and depict the major structural pattern of the belt.

7. Objective

The present exploration programme has been formulated to fulfill the following objectives:-

i) To prove the existence / occurrence of iron ore in strike and dip continuity in the block by drilling bore holes at 400m X 400m grid interval.
ii) To find out the quality and grade of iron ore.
iii) To estimate resources of iron ore at G-3 level of UNFC.
iv) To carry out preliminary exploration as per Minerals (Evidence of Mineral Contents) Rules- 2015, Mineral Auction Rule 2015 and MMDR Amendment Act-2015.

8. Time Schedule

12 Months

9.Cost Estimate

Rs. 210.885 lakhs

10. Justification	i) In view of MMDR Amendment Act and Mineral Auction Rule 2015, DMG Odisha requested MECL to take up the preliminary exploration in this block. DMG, Odisha has requested MECL to take up exploration work under NMET funding. ii) The mineralized zones intersected in GSI boreholes drilled in adjacent L-Block are continuous both in strike and dip direction. Hence the continuity of the zones requires further proving in this area. iii) The present exploration will establish the resources and grade of the Iron ore in G-3 level. Based on the results of this programme decision will be taken for taking up G-2 level exploration in the block and will eventually lead to enable the State Government of Odisha for auctioning of the block.

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1.0.0 Introduction

1.1.1 The Banded Iron formation (B.I.F) and associated Volcano-Sedimentary sequence of Iron ore group of Bonai-Kendujhar belt, North Odisha, received attention of geoscientists and mining agencies as early as 1930's. Geological Survey of India has been carrying Iron ore exploration work in this belt since 1960's. In addition, several Iron ore bodies also occur within the synclinal valley, which are mostly associated with the upper shale formation of Koira Group of rocks. The exploration for Iron ore in Malangtoli Deposit, Sundargarh District, Odisha, has been carried out by Geological Survey of India, Eastern Region, State Unit: Odisha, Bhubaneswar.

1.1.2 The Principal Secretary, Ministry of Mines, Government of Odisha, has allotted the twelve sub-blocks of Malangtoli Iron Ore Deposit of Odisha state to MECL for taking up of exploration for Iron Ore. MECL requested DGM,Odisha to provide the basic data for preparation of proposal & accordingly MECL prepared proposal for preliminary exploration(G-3) level and put up for evaluation of TCC of NMET & approval of E.C. In case the results of G-3 level are encouraging then MECL will take up the G-2 level exploration after approval from TCC & EC of NMET to facilitate Government of Odisha for auctioning of block in view of MMDR Amendment Act 2015.

1.1.3 D-Sub- Block for preliminary exploration for Iron is one of the 12 blocks for which exploration proposal (G-3) is prepared and put up for approval of Technical cum Cost Committee of NMET (TCC), for G-3 level exploration for iron ore.

1.2.0 Location & Accessibility

1.2.1 The area of investigation is 1.5 km WNW of Sirkagutu and falls in parts of Survey of India Toposheet Nos 73 G/5 and is one of the most important iron and manganese mining centers of Odisha. It is well connected with other parts of the State as well as with the neighboring State of Jharkhand. National Highway No.215 connecting Panikoili on National Highway No.5 with Rourkela via Kendujhar, Joda, Barbil and Koira passes through the area. The other important mining centers in the vicinity are Kalta, Tensa and Barsuan. The nearest rail head Barbil is 30km on Tatanagar-Barbil section of the South-Eastern Railway. The sub-block location is shown as Plate No-I. The block co-ordinate of D-sub-block, Malangtoli Iron Ore Deposit is given in Table No.1.2

Table No.1.2

BLOCK COORDINATE OF MALANGTOLI IRON ORE DEPOSIT D- SUB- BLOCK, DISTRICT- SUNDERGARH, G-3

DMS & UTM Coordinate (WGS-84) of Sub Block -D				
Pillar No	Latitude	Longitude	Easting	Northing
D -1	21 50' 0.406"	85 19' 59.161''	327723.313	2415324.156
D -2	21 48' 41.867"	85 19' 58.742''	327685.150	2412908.825
D -3	21 48' 42.374"	85 19' 47.680''	327367.629	2412927.856
D -4	21 49' 26.349"	85 19' 46.939''	327361.005	2414280.536
D -5	21 49' 10.836"	85 18' 40.783''	325455.995	2413824.139
D -6	21 49' 26.893"	85 18' 12.609''	324652.340	2414326.863
D -7	21 49' 4.735"	85 18' 12.064''	324629.186	2413645.560
D -8	21 48' 57.279"	85 18' 19.062''	324827.634	2413414.038
D -9	21 48' 39.670"	85 18' 11.208''	324596.117	2412874.950
D -10	21 47' 54.629"	85 18' 12.890''	324629.184	2411489.174
D -11	21 47' 54.987"	85 18' 37.297''	325330.321	2411492.489
D -12	21 47' 48.856"	85 18' 37.139''	325323.717	2411303.980
D -13	21 47' 48.632"	85 19' 3.730''	326087.393	2411288.743
D -14	21 47' 22.646"	85 19' 11.716''	326308.065	2410487.044
D -15	21 47' 22.259"	85 19' 19.348''	326527.154	2410472.757
D -16	21 47' 25.305"	85 19' 19.423''	326530.327	2410566.413
D -17	21 47' 25.286"	85 19' 17.489''	326474.770	2410566.433
D -18	21 47' 58.166"	85 19' 17.437''	326484.278	2411577.672
D -19	21 47' 58.427"	85 19' 43.191''	327224.059	2411577.667
D -20	21 47' 54.454"	85 19' 43.348''	327227.245	2411455.429
D -21	21 47' 54.334"	85 19' 36.661''	327035.143	2411453.821
D -22	21 47' 50.019"	85 19' 38.646''	327090.716	2411320.495
D -23	21 47' 41.927"	85 19' 34.760''	326976.403	2411072.837
D -24	21 47' 36.146"	85 19' 34.827''	326976.398	2410895.022
D -25	21 47' 32.476"	85 19' 39.402''	327106.581	2410780.726
D -26	21 47' 28.347"	85 19' 39.450''	327106.584	2410653.724
D -27	21 47' 28.375"	85 19' 42.158''	327184.375	2410653.743
D -28	21 47' 30.595"	85 19' 42.248''	327187.700	2410721.990
D -29	21 47' 30.662"	85 19' 43.734''	327230.405	2410723.589
D -30	21 47' 34.794"	85 19' 43.963'	327238.359	2410850.597
D -31	21 47' 34.845"	85 19' 49.074"	327385.178	2410850.576
D -32	21 47' 27.876"	85 19' 49.017"	327381.221	2410636.263
D -33	21 47' 27.447"	85 19' 44.877"	327262.165	2410624.356
D -34	21 47' 23.185"	85 19' 44.512"	327250.261	2410493.393
D -35	21 47' 23.021"	85 19' 41.059"	327151.024	2410489.423
D -36	21 47' 11.020"	85 19' 41.060"	327147.054	2410120.334
D -37	21 47' 10.742"	85 19' 39.129"	327091.495	2410112.385
D -38	21 47' 4.671"	85 19' 38.509"	327071.663	2409925.865

Pillar No	Latitude	Longitude	Easting	Northing
D -39	21 47' 3.734"	85 19' 22.492"	326611.269	2409902.040
D -40	21 46' 56.381"	85 19' 22.716"	326615.247	2409675.830
D -41	21 46' 55.984"	85 19' 9.043"	326222.357	2409667.892
D -42	21 47' 24.365"	85 19' 8.159"	326206.472	2410541.025
D -43	21 47' 24.249"	85 18' 31.545"	325154.749	2410548.950
D -44	21 47' 41.801"	85 18' 31.753"	325166.641	2411088.698
D -45	21 47' 41.777"	85 17' 51.683"	324015.715	2411100.618
D -46	21 46' 17.656"	85 17' 53.229"	324031.594	2408512.970
D -47	21 46' 19.194"	85 19' 7.813"	326174.705	2408536.803
D -48	21 46' 29.518"	85 19' 7.831"	326178.678	2408854.311
D -49	21 46' 29.990"	85 19' 16.253"	326420.771	2408866.195
D -50	21 46' 41.217"	85 19' 16.261"	326424.755	2409211.478
D -51	21 46' 41.803"	85 19' 35.873"	326988.321	2409223.384
D -52	21 46' 22.963"	85 19' 35.953"	326984.340	2408643.938
D -53	21 46' 23.740"	85 19' 58.915"	327644.221	2408660.700
D -54	21 45' 52.813"	85 19' 58.954"	327635.076	2407709.536
D -55	21 45' 52.503"	85 17' 28.882"	323323.609	2407747.107
D -56	21 47' 29.545"	85 17' 29.020"	323360.604	2410731.615
D -57	21 49' 59.687"	85 17' 28.780"	323404.894	2415349.364
D -58	21 46' 35.047"	85 17' 46.099"	323832.669	2409050.092
D -59	21 47' 27.632"	85 17' 46.168"	323852.504	2410667.333
D -60	21 47' 27.394"	85 17' 30.984"	323416.285	2410664.836
D -61	21 47' 27.260"	85 17' 30.973"	323415.923	2410660.718
D -62	21 46' 34.578"	85 17' 31.943"	323425.858	2409040.161
D -63	21 45' 59.185"	85 19' 5.036"	326088.228	2407922.296
D -64	21 46' 14.669"	85 19' 4.971"	326091.546	2408398.526
D -65	21 46' 14.388"	85 18' 37.327"	325297.312	2408398.552
D -66	21 45' 58.581"	85 18' 37.414"	325294.493	2407912.380

1.3.0 Physiography & Drainage

1.3.1 The D-block of Malangtoli area is a highly rugged terrain with elongated hills having general extension along N-S direction in the central part, East-West trending in southern and northern part. The area is an undulating country bordering the plateau which rises about 1000.00m above MSL and 300m above the surrounding plains and has an elevation in the block varies from 700m to 1000ml. The area of the block falls on the ridge with steep slope and has arcuate shape with its convexity pointing towards West. The main drainage of the area is Baitarni River which flows in a northward direction east of the Pipokri-Sirkagutu plateau and forms the eastern boundary of the Malangtoli area. The most important tributary of the Baitarni River is the Mohalda Nala which flows in a northeastern direction at the southeastern foot of

the Pipokri-Sirkagutu plateau. A number of perennial streams radiate from the plateau, the notable among these Jalpa, Nalpani, Kasijoda, Sirkagutu, Khandahar and Malangtoli Nalas. All these streams ultimately flow into Baitarni River with only exception of Malangtoli nala which flows northwards into Kundra River. Khandahar nala originates from plateau and flows towards South-East part of the block.

1.4.0 Climate, flora and fauna:

1.4.1 The area experiences a humid-tropical climate. The period between December and March is very cold when the mercury drops down to sub-zero, bringing in occasional layers of frost during winter. It is very hot during summer with temperature rising to nearly 50°C during peak period. During rainy season, heavy rains bring in flash floods. Over precipitation during monsoon has resulted in development of tropical forest comprising densely packed tall trees and the thick green cover. The forests are inhabited by elephants, wild boar, bear, monkeys and occasional tiger and leopard.

2.0.0 Previous Work:

2.1.1 H.C.Jones (Hayden-1920; Pascoe-1921, 1923, 1924, 1925, 1927; Fermor-1923; and Jones-1922 and 1934) and M.S.Krishnan (Pascoe-1927,1928; and Jones-1934) carried out traverses in parts of the area under report, while covering the entire Singhbhum- Keonjhar-Bonai iron ore region between 1919 and 1927, for delineating the geological set up and rapid assessment of the potentialities of the various iron ore deposits in the region. They estimated a reserve of about 2970 m.t. for the entire area. Out of this, about 200 m.t. was their estimates for the ore deposits now included in the Malangtoli block. The area covering parts of the Malangtoli block was geologically mapped on 1:63,360 scale by B.C.Gupta during the field season 1938-39. A preliminary survey of the various deposits of iron ore in the Malangtoli block was carried out by P.C. Mathur and P.V.S. Kurup (Mathur & Kurup-1962) and a reserve of about 608 m.t. of ore with average Fe of 60%. The present detailed investigation was planned on the basis of the data available from the above mentioned earlier work.

The detail appraisal of Iron ore deposits in Pipokri - Sirkagutu area of Malangtoli Blocks, Kendujhar & Sundargarh Districts, Odisha was taken up by GSI at the instance of Government of India for blocking out resource & reserves (100 M.T.) of high grade Iron ore for exploitation in connection with the export trade through Paradip Port. Later on, in order to cover the revise target, i.e., 150 million tonnes of lump iron ore with average Fe content of 63% and above, several other deposits near Pipokri & around Sirkagutu were also investigated in detail. For convenience of reference, the deposits selected for investigation were designated as A to S, beginning from Pipokri area in the North to Sirkagutu area in the South.

One such sub block - L situated near the eastern part of proposed exploration block has been already explored by GSI by carrying out geological mapping in 3.4 sq. km. area on 1:2000 scale, core drilling of 3551.29 m in 95 boreholes, 52 Cu.m in 5 nos deep pit and 135 Cu.m in 40 nos shallow pits.

GSI estimated 95.27 million tonnes of reserves over an area of 1.03 sq. km with 61.57 to 64.75% of Fe.

3.0.0 Regional Geological setup:

3.1.1 The present study area is a part of the Bonai-Kendujhar belt of Sundargarh and Kendujhar Districts. The little metamorphosed Precambrian Volcano-Sedimentary rocks exposed in this belt between the Singhbhum Granite in the east and Bonai Granite in the west is classified as 'Iron Ore Group' (Sarkar & Saha, 1963) or 'Koira Group' (Murty and Acharya, 1975). These rocks are disposed in the form of a low northerly plunging 'Horse-Shoe' shaped Synclinorium (Jones, 1934), which is shown in Plate No. II (After GSI).The litho-stratigraphic succession of this area, as worked out by earlier workers, based on regional field studies is shown below:

Table Showing Litho-stratigraphic succession of the area

Jones (1934)		Saha(1994) Modified after Sarkar & Saha (1977)		Murthy & Acharya (1975)	
	Upper shales, epidiorite and ash bed B.H.Q. with iron ore bodies Shales with occasional sandstones Purple sandstone with basal conglomerate ----------Unconformity---------- Older Dharwars	IRON ORE GROUP	Singhbhum Granite Upper Shale with volcanics BHJ with iron ore, ferruginous quartzite Lower shale and acid, intermediate tuffs, local dolerite	KOIRA GROUP	Mixed facies formation Upper Shale Formation Banded Iron Formation Volcanic Formation

The stratigraphy of the area modified after Murty and Acharya (op. cit) is given below:	
Kolhan Group	
KOIRA GROUP	Upper Shale Formation
	Banded Iron Formation
	Volcanic Formation
	Basal Sandstone – Quartzite
Singhbhum and Bonai Granites and metamorphosed sediments	

3.1.2 The base of the Koira Group is marked by a pronounced unconformity over the Singhbhum Granite in the eastern side and has a sheared inter-fingering contact relationship with Bonai Granite on the western side. The Basal Formation comprises of gritty sandstone, which ranges from ortho-quartzite on one hand to pebbly sandstone and conglomerate on the other. This arenaceous unit is followed by mafic volcanics which is found all along the outer periphery of the Horse-Shoe Synclinorium. The volcanic formation comprises predominantly of Lower volcanic flows dominantly of mafic composition and an upper tuffaceous zone. The lava is pillowed at the bottom part and amygdaloidal at the top indicating its sub-aqueous and subsequent sub-aerial character. The lava grades into purple colour tuffaceous shale conformably towards the upper part and described as 'Lower Shale Formation' (Murty and Acharya, op. cit.). By the appearance of jasper and banded jasper interbanded with the greenish and black shale towards the top, of the lower shale graded into the 'Banded Iron Formation'.

The 'Banded Iron Formation' is represented by BHJ / BHQ, inter-bedded with black or green shale and banded ferruginous chert. Due to high resistance of erosion, these litho-units form high ridges conspicuously mark the outline of the 'horse-shoe' synclinorium and depict the major structural pattern of the belt.

The 'Banded Iron Formation' is overlain by the 'Upper Shale Formation' comprising of thick sequence of tuffaceous purple, white and buff coloured shale, black shale, banded ferruginous shale with inter-bedded chert and BHJ / BHQ bands which spread over the entire core of the synclinorium. The 'Upper Shale Formation' can be divided into two horizons / zones (Patel, et.al, 2005) namely, lower manganiferrous shale horizon/ zone and upper ferruginous shale horizon/ zone. These two horizons / zones exhibit conformable relationship and are characterized by their typical litho-assemblages. The manganiferrous horizon / zone comprising predominantly of manganiferrous grayish green

shale, carbonaceous black shale with inter-beds of chert locally grading to dolomite hosts almost all the major manganese ore deposits of the area, whereas, ferruginous shale horizon/ zone comprising of banded ferruginous shale with inter-beds of BHJ / BHQ and BFC gives rise to isolated iron ore deposits within the core of the synclinorium, the Regional Geological Map of the Bonai-Kendujhar Iron Ore belt is shown in Plate No.III (After GSI).

A younger sequence of conglomerate and sandstone, exposed on the northern and north eastern part of the belt are unconformably overlying the Koira Group of rocks, is arenaceous rock sequence which have been described as Kolhan Series (Dunn, 1940) or Kolhan Group (Murty and Acharya, 1975). It is differentiated from the basal sandstones and conglomerate by the presence of jasper pebbles, iron ore pebbles and fragments of BHJ.

The iron ore bodies associated with the 'Upper Shale Formation', occur at much lower topographic elevations (450-650 m) within the core of the synclinorium compared to the major iron ore deposits belonging to the 'Banded Iron Formation' and occurring at the ridge tops (750-950 m).

Structure:

In general the Iron Ore Super Group of rocks in the Bonai-Kendujhar belt are disposed in form of an *"Omega"* and referred to as "Horse Shoe Synclinorium" (Jones, 1934). This belt is 60 km long and 25 km wide extending from south of Malangtoli in Kendujhar district up to Chakradharpur in West Singhbhum district (Jharkhand). The structural fabrics in the above, little metamorphosed volcano-sedimentary litho-sequence indicate at least two phases of deformation and folding. The earlier phase is the most prominent and resulted in formation of two synclines intervened by an anticline trending NNE-SSW with a low north-north easterly plunge. The western limb is slightly overturned to the east and dip westerly (65^0-75^0) whereas, the eastern limb is a normal one with moderate to low (30^0-45^0) westerly dip. This phase of folding is affected by a later NW-SE to WNW-ESE trending fold resulting in broad warps and formation of structural domes and basins in the area. The western syncline known as Koira syncline, due to steep dip and overturned nature of its limb forms a deeper basin with thick sequence of younger shales in the core region. On the other hand, the eastern syncline known as Bamebari syncline is a shallower basin and exposes younger litho members within the core region as outliers. The Upper shale unit within the Koira syncline is mostly continuous whereas, in Bamebari syncline it occurs as isolated patches.

Local Geology:

The area under investigation lies within the Upper Shale Formation of the Koira Group. The Upper Shale Formation as described by Murthy & Acharya (1975) can be subdivided

in to two units' namely lower manganiferrous shale horizon and upper ferruginous shale horizon.

Local stratigraphic succession as worked out in the areas under investigation (i.e. in Malangtoli Iron Ore) is as follows:

Upper Shale Formation	**Ferruginous Shale Unit:** Shales of different colouration like pink, yellow, variegated with narrow inter beds of BHJ/BHQ and derived Iron ore.
	Manganiferrous Shale Unit: Manganiferous shale with associated manganese ore followed up by massive chert (brecciated at places).
Banded Iron Formation	Coarsely banded jaspellite followed up by finely banded jaspellite.

The rock formation is gently folded into more or less parallel doubly plunging anticlines and synclines resulting in several elongated basins in which iron ore is deposited.

3.2.0 Description of rock types

Banded Iron Formation (BHJ & BHQ):

These rocks serve as important marker horizon. Major iron ore bodies are closely associated with these litho units. It encompasses BHJ, BHQ and ferruginous quartzite of the area. Megascopically BHJ comprises alternate bands (laminations less than 5mm thick) of haematite and dark brown to red jasper. Magnetite is rare and usually associated with hematite in minor proportion. BHQ is found to occur towards the upper part of BHJ profile or as thin layers within BHJ. Both BHJ and BHQ are sheared at various places and are traversed by fine silica and haematite veins.

They are discontinuously exposed along strike for a maximum length of 100m in a single outcrop. The BHJ bands in the valley area are affected by shearing showing unevenness of the jasper bands. The shear zones are filled with fragments of BHJ, BHQ and laminated ore. Megascopically, the individual jasper bands / laminations are seen to be much thicker as compared to that of the iron oxide rich bands / laminations within the BHJ. The Jasper contains small discrete aggregates of quartz, opaque grains and ferruginous materials. The quartz occurs as anhedral to subhedral grains and haematite forms anhedral grains and masses.

Manganiferrous Shale :

This is the overlying unit of BHJ/BHQ having gradational contact. The shale unit is often enriched in manganese minerals and hence called manganiferrous shale. The bedding is marked by colour banding and constitutes clay minerals, sericite and needle sized amphiboles. The opaque shows a preferred orientation parallel to bedding plane,

Ferruginous Shale:

It occupies the central valley and represented by a finely laminated rock having varied shades of colour ranging from white, maroon, dark gray, brownish and purple to green etc. The coloration of the shale largely depends on the mineral composition (Murthy & Acharya, 1975). It is mostly composed of clayey micaceous minerals, with lenses of chert. The upper shale contains several unmappable units such as carbonaceous shale, banded shale, sandy claystone, shales and mudstones etc. Most of the area containing this unit is lateritised extensively.

Iron ore:

The thinly laminated, hematite ore bodies exposed in the valley area are very often lateritised near the surface. However, insitu bouldery outcrops of hard and soft laminated, massive and brecciated ores are found at the identified blocks where exploration have to be carried out. 'Canga' zones occur near to the iron ore bodies within the hard lateritised duricrust and contain mostly iron ore floats. Detrital Iron ores deposited in the saddle region adjacent to the main iron ore bodies occur at several places in the area.

Laterites:

Most part of the area is covered by laterite of various types. The laterites have been developed mostly over the shale unit of the area and depending upon the composition of the shale, different types of laterites have been developed. The shale rich in alumina has given rise to bauxitic laterite and those rich in manganese or iron have developed manganiferrous and ferruginous laterites respectively. Ferruginous laterite occupies most of the high lands in the vicinity and is wide-spread. Aluminous laterite/ bauxite occurs in form of small patches and narrow bands, spread over the area. The yellowish black laterite covering major part of the area has been the host for pockets of manganese concentration.

Alluvial soil:

The low lying areas, river banks etc are filled up with alluvial soil

3.3.0 Mineralisation Details

Nature of Ore and Mineralogy:

The ore is powdery to soft laminated varieties with partings of ferruginous shale. Thin layers of moderately Hard Laminated ore are present on the surface, followed by powdery and soft laminated at depth, which are inseparable. The mineralization of iron ore is mainly bedded type associated with ferruginous shale of Upper shale Formation of Iron Ore Super Group. Biscuity ore, ochre, goethite also occurs in the area.

4.0.0 Objective of the proposed exploration programme

4.1.1 The present exploration programme has been formulated to fulfill the following objectives:-

i) To prove the existence / occurrence of iron ore in strike and dip continuity in the block by drilling bore holes at 400m X 400m grid interval.
ii) To find out the quality and grade of iron ore.
iii) To estimate resources of iron ore at G-3 level of UNFC.
iv) To carry out preliminary exploration as per Minerals (Evidence of Mineral Contents) Rules- 2015, Mineral Auction Rule 2015 and MMDR Amendment Act-2015.

5.0.0 Proposed Scheme of Exploration

5.1.0 In accordance with the objectives set for preliminary exploration in Malangtoli, D-Sub-Block, the exploration programme is proposed to carry out drilling at 400m x 400m grid interval, pitting sampling and other associated geological and laboratory work. The exploration shall be carried out as per Mineral (Evidence & Mineral Contents) Rule -2015, Mineral Auction Rule-2015 and MMDR Amendment Act-2015.

The details of different activities to be carried out are presented in subsequent paragraphs.

5.2.0 Topographic Surveying

The triangulation network would be laid down in the block area with the help of DGPS & Total Station and the same would be tied up with the triangulation network of adjoining block explored by GSI. The locations of the proposed boreholes will be fixed on the ground and reduced levels and co-ordinates of boreholes would be determined, keeping GSI co-ordinates and benchmarks intact. The contouring would be done at 5 m interval on 1:10,000 scale to prepare a detailed topographic map of the block. The block boundary will be surveyed by DGPS & total station in WGS-84 Datum for demarcation of Block Boundary points and ancillary area to facilitate the State Governments for Auctioning of Blocks.

5.3.0 Geological Mapping

The area of the block is 16.602 sq.km calculated by autocad software which is almost equal to the area (16.569 sq.km.) supplied by DGM, Govt. of Odisha.
The geological map of the block will be prepared on 1:10000 scales by taking a few rapid geological traverses in the block area. All the geological and structural features will be mapped and marked on the map. This map will be used as a base map for the purpose of exploration work. The new subsurface exploration data which will be generated through this exploration program will also be utilized for interpretation and preparation of geological map.

5.4.0 Exploratory Drilling

The drilling work is proposed at 400m x 400m grid interval to estimate the iron ore resource at G-3 Level as no exploration has been carried out by any other agency. The adjoining L-Sub-Block located on the eastern side of this D block is already explored by GSI at 200m x 200m grid interval.

Considering the borehole data of adjoining L-block of GSI, the average depth of the boreholes has been considered 60.00m. The borehole closure depth will be judiciously taken care of by field geologist during the course of exploration. The boreholes will be closed in BHJ/BHQ or lower shale to intersect the full thickness of iron ore.

The bore hole location plan at 400m x 400m grid is shown as plate No. IV. A total of 95 nos. of coring bore holes will be drilled on above proposed grid to establish the deposit of G-3 level which involves 5700.00m of drilling in the block.

Table No. 5.1		
Details of Proposed Boreholes		
SL. NO	PROPOSED CORING BOREHOLE No.	PROPOSED DEPTH TO BE DRILLED (m)
1	PBH 1	60.00
2	PBH 2	60.00
3	PBH 3	60.00
4	PBH 4	60.00
5	PBH 5	60.00
6	PBH 6	60.00
7	PBH 7	60.00
8	PBH 8	60.00
9	PBH 9	60.00
10	PBH 10	60.00
11	PBH 11	60.00
12	PBH 12	60.00
13	PBH 13	60.00
14	PBH 14	60.00
15	PBH 15	60.00
16	PBH 16	60.00
17	PBH 17	60.00
18	PBH 18	60.00
19	PBH 19	60.00
20	PBH 20	60.00
21	PBH 21	60.00
22	PBH 22	60.00
23	PBH 23	60.00

24	PBH 24	60.00
25	PBH 25	60.00
26	PBH 26	60.00
27	PBH 27	60.00
28	PBH 28	60.00
29	PBH 29	60.00
30	PBH 30	60.00
31	PBH 31	60.00
32	PBH 32	60.00
33	PBH 33	60.00
34	PBH 34	60.00
35	PBH 35	60.00
36	PBH 36	60.00
37	PBH 37	60.00
38	PBH 38	60.00
39	PBH 39	60.00
40	PBH 40	60.00
41	PBH 41	60.00
42	PBH 42	60.00
43	PBH 43	60.00
44	PBH 44	60.00
45	PBH 45	60.00
46	PBH 46	60.00
47	PBH 47	60.00
48	PBH 48	60.00
49	PBH 49	60.00
50	PBH 50	60.00
51	PBH 51	60.00
52	PBH 52	60.00
53	PBH 53	60.00
54	PBH 54	60.00
55	PBH 55	60.00
56	PBH 56	60.00
57	PBH 57	60.00
58	PBH 58	60.00
59	PBH 59	60.00
60	PBH 60	60.00
61	PBH 61	60.00
62	PBH 62	60.00
63	PBH 63	60.00

64	PBH 64	60.00
65	PBH 65	60.00
66	PBH 66	60.00
67	PBH 67	60.00
68	PBH 68	60.00
69	PBH 69	60.00
70	PBH 70	60.00
71	PBH 71	60.00
72	PBH 72	60.00
73	PBH 73	60.00
74	PBH 74	60.00
75	PBH 75	60.00
76	PBH 76	60.00
77	PBH 77	60.00
78	PBH 78	60.00
79	PBH 79	60.00
80	PBH 80	60.00
81	PBH 81	60.00
82	PBH 82	60.00
83	PBH 83	60.00
84	PBH 84	60.00
85	PBH 85	60.00
86	PBH 86	60.00
87	PBH 87	60.00
88	PBH 88	60.00
89	PBH 89	60.00
90	PBH 90	60.00
91	PBH 91	60.00
92	PBH 92	60.00
93	PBH 93	60.00
94	PBH 94	60.00
95	PBH 95	60.00
	Grand Total	**5700.00**

NOTE: The highlighted proposed no in above scheme should be taken up in order of priority for drilling.

5.5.0 Core Logging

The borehole cores would be logged systematically. Details of the lithounit viz. colour, structural feature, texture, mineralisation, besides the recovery and rock quality designation (RQD) would be recorded. The details of nature of ore as Massive, Laminated, Lateritic, Limonitic ore and Fine/Blue Dust ore will be recorded in detail.

5.6.0 Sampling:

The drill core will be splitted into two equal halves and one part would be preserved in the core box. The other half will be powdered to (-) 100 # size and the same would be divided into four parts by thorough coning and quartering. One part of 100gm sample will be sent to chemical laboratory for analysis, second part to be preserved in the camp as duplicate sample, third part to be utilized for preparing composite sample for individual ore band and the fourth part would kept as either check sample or sample to be used for any other specific purpose. The length of each sample will be kept 0.50 m-1.0m depending upon the width of particular type of iron ore and its physical character (like lumpy, powdery, friable massive etc.). The primary core samples will be analyzed for three radicals i.e. Fe, SiO_2, and Al_2O_3.

The mineralized zone including the cores of immediate footwall and hanging wall rocks (5 m length each) would be sampled at 1.0 m interval, as far as possible, depending upon the intensity of mineralisation, change in lithology and core recovery etc. It is envisaged that:

a) Around 935 **nos.** of primary samples including check samples would be generated from the mineralized zone intersection, so obtained from the drill holes of Malangtoli Iron Ore in D-Sub-Block. All the primary and check samples would be analysed for 3 radicals i.e. Fe%, SiO_2% & Al_2O_3% (Core Samp. + Check Samp.)

b) Around 5% of Primary samples (40 **nos.**) will be sent to NABL accredited external labs for analysis of 3 radicals i.e. Fe%, SiO_2% & Al_2O_3% as External Check Samples.

c) Composite samples would be prepared from mineralized zones of primary drill core samples from each borehole. It has been envisaged that **100 nos.** of composite sample would be generated and will be analysed for 7 radicals i.e. Fe, SiO_2, Al_2O_3, P, Mn, S & V_2O_5.

5.7.0 Petrological Studies: Thin and polished section studies on drill cores as well as out-crop samples would be studied for detailed petrographic and mineragraphic characteristics. These samples would be drawn from ore zones and host rocks. A provision of 15 specimens for petrographic and 15 specimens for mineragraphic studies has been kept for the purpose.

5.8.0 Bulk Density Determination: In addition to specific gravity determination, 15 nos. of bulk density determination study will be carried out.

5.9.0 Quantum of work

The quantum of work proposed by MECL in D-Sub- Block is given in Table 5.2.

Table: 5.2 Proposed Quantum of work in D-Sub- Block

SL NO	Item of work	Unit (m)	TOTAL
1	Survey (1:10000) a) B.H. fixation (Hilly Terrain)	Nos.	10
	b) R.L. & coordinate determination	Nos.	10
	c) Traverse	Line km	20
	d) Contouring (5m Contour Interval)	Sq. Km	16.60
	e) DGPS Survey (Demarcation of Block Boundary points)	Sq. Km	16.60
2	Drilling (coring) *Borehole depth may vary from 60 m to 130m upto Contact of Lower Shale/BHJ/BHQ	M	1000 m (10 Bhs.) at 400mx400m grid
3	Pitting (for Bulk density sample collection) (1m x 1m x1m) (30 Nos)	Cu.m	15
4	Geological work a) Geological Core Logging	M	1000 m (10 Bhs.)
	b) Sampling (Primary+ Check) for 3 radicals Fe%, SiO_2% & Al_2O_3%,	Nos.	935
	c) Composite sample for 7 radicals (Fe%, SiO_2%, Al_2O_3%, P%, Mn%, S% & V_2O_5%)	Nos.	100
5	Chemical Analysis a) Primary (850) +Internal Check samples (85) for 3 radicals (Fe%, SiO_2% & Al_2O_3%.	Nos.	935
	b) Composite sample 7 radicals (Fe%, SiO_2%, Al_2O_3%, P%, Mn%, S% & V_2O_5%)	Nos.	100
	c) External Check Samples for 3 radicals (Fe%, SiO_2% & Al_2O_3%)	Nos.	40
6	Petrological Studies	Nos.	15
7	Mineragraphic Studies	Nos.	15
8	Bulk Density Determination	Nos.	15
9	**Report Preparation**[As per Mineral (Evidence of Mineral Contents) Rule-2015]/ UNFC	Nos.	1

Time schedule and Cost estimates

6.1.0 Time schedule:

The proposed exploration programme is planned in such a way that all the activities like, tendering process, camp setting, winding, drilling, survey and associated geological work and laboratory work will be completed within 11 months' time. Report writing will take another 4 months' time including overlapping of three months of Laboratory studies. Thus the total duration of the project for completion of the above exploration will be 12 months from the date of commencement of the project.

The bar chart showing activities wise time schedule is placed at Table-6.1.

6.2.0 Cost estimates:

Cost has been estimated based on actual and provisional escalation as per RBI indices as on 31-03-17 and same has been for the subsequent years. The total estimated cost is **Rs. 210.885 Lakhs**. The details of cost estimates are given in Table 6.2 and summary is given below:

Summary of Cost Estimates

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Drilling	13309475/-
2	Geology	2117670/-
3	Laboratory Studies	1707960/-
4	Preservation of Core	549600/-
	Sub Total (1+2+3+4)	17684705/-
5	Exploration Report (1% of 1+2+3+4)	176847/-
6	Peer Review	10000/-
	Sub Total	17871552/-
7	GST@18%	3216879/-
	Total	**21088431/-**
		Say- Rs. 210.885 Lakhs

7.0.0 Justification

i) In view of MMDR Amendment Act and Mineral Auction Rule 2015, DMG Odisha requested MECL to take up the preliminary exploration in this block. DMG, Odisha has requested MECL to take up exploration work under NMET funding.

ii) The mineralized zones intersected in GSI boreholes drilled in adjacent L-Block are continuous both in strike and dip direction. Hence the continuity of the zones requires further proving in this area.

iii) The present exploration will establish the resources and grade of the Iron ore in G-3 level. Based on the results of this programme decision will be taken for taking up G-2 level exploration in the block and will eventually lead to enable the State Government of Odisha for auctioning of the block.

Table-6.2 Cost Estimate for Iron Ore Exploration Malangtoli D Sub - Block District- Sundargarh, Odisha								
SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Grand Total	
				Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90					(Rs)
A	DRILLING							
1	Surface Drilling (4 rigs) *	m	9000	9000	1000	9000000	1000	9000000
2	Pitting (1m x 1m x 1m)	Cu.m.	395	1673	15	25095	15	25095
2	Transportation	Km	8.8	31	3000	93000	3000	93000
3	Accomodation (One time/ Drill)		185925	663715	4	2654860	4	2654860
4	Camp Setting	- do-	68606	244910	4	979640	4	979640
5	Road Making (Hilly Terrain)	Km	7800	27844	20	556880	20	556880
	Sub Total A					13309475		13309475
B	GEOLOGICAL WORK							
1	Survey Party days (1 party)	day	1180	5840	90	525600	90	525600
2	Geologist Party days (1 party)	day	1541	7802	120	936240	120	936240
3	Bulk Sampling Party days (1 party)	day	2566	13434	30	403020	30	403020
4	Core Sampling Party days (1 party)	day	525	2809	90	252810	90	252810
5	SUB TOTAL B					2117670		2117670
C	LABORATORY STUDIES							
1	Chemical Analysis							
	i) Primary & Check samples							
	a. For 3 radicals Fe, SiO_2 & Al_2O_3 [core samp + Internal Check Samp	Nos	262(110 +76x2)	1374	935	1284690	935	1284690
	b) External Check Samples from NABL Labs for 3 radical (Fe, SiO2 & Al2O3)	Nos	262(110 +76x2)	1374	40	54960	40	54960
	ii) Composite Samples							
	a) Composite Samples for 7 radicals (Fe%, SiO2%, Al2O3%, P%, Mn%, S% & V2O5%)	Nos	268	2982	100	298200	100	298200
2	Physical Analysis							
i)	Preparation of thin section	Nos	100	538	15	8070	15	8070
ii)	Petrographic Studies	Nos	228	1436	15	21540	15	21540
iii)	Preparation of polished section	Nos	100	538	15	8070	15	8070
iv)	Mineragraphic Studies	Nos	364	2023	15	30345	15	30345
v)	Density Determination	Nos	24	139	15	2085	15	2085
	Sub-Total C					1707960		1707960
D	Preservation of Core							
i)	GI Core boxes	Nos.		2000	250	500000	250	500000
ii)	Transportation of Core Boxes	Km	8.8	31.0	1600	49600	1600	49600
	Sub-Total D					549600		549600
	Total A+B+C+D							17684705
E	EXPLORATION REPORT - 1% of (A+B+C+D)				1			176847
F	PEER REVIEW OF DGR (Lump Sum)	Nos		10000	1	10000	1	10000
	Grand Total : A to F							17871552
G	GST @ 18%							3216879
H	GRAND TOTAL							21088431
Notes:								Say 210.885 Lakhs
1	Revised Rates of Promotional Work done by MECL on behalf of Govt. of India Vide letter No. 37(I) /2006-M.I. dated-02/07/2014 and based on actual escalation as per RBI indices as on 31-03-2017 and the same has been considered for subsequent year.							
2	*Outsourcing rate has been considered in drilling. Moreover handling Charges will be applicable and will be desided later by NMET committee.							

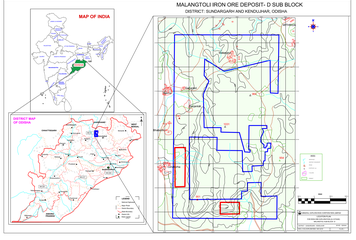
Mineral Exploration and evaluation 18%(SAC Code: 998343)

Table 6.1: TIME SCHEDULE /ACTION PLAN , G3 LEVEL OF IRON ORE EXPLORATION IN MALANTOLI D- SUB BLOCK ODISHA.

Sl. No.	Activities	Unit	MONTHS												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
1	Tendering Period	Month													5 month
2	Camp Setting	Month													1 month
3	Core Drilling (4 rigs)	m.													1000 m (in 10 BHs)
4	Bulk Sampling Party days	Day													30
5	Survey Party days (1 Party)	day													90
6	Geologist Party days (1 Parties)	day													120
7	Sampling Party days, Core Sampling (1 parties)	day													90
8	Laboratory Studies	Nos.													1120
9	Report Writing	Month													4 months

MALANGTOLI IRON ORE DEPOSIT- D SUB BLOCK

DISTRICT: SUNDARGARH AND KENDUJHAR, ODISHA


MAP OF INDIA
DISTRICT MAP OF ODISHA
SUNDARGARH
KENDUJHAR
ANGUL
DHENKANAL
JAJPUR
KEONJHAR
BALASORE
BHADRAK
MAYURBHANJ
CUTTACK
JAGATSINGHPUR
KHORDHA
PURI
GANJAM
GOLAPALLI
MALANGTOLI
BARBIL
BANSPANI
BANSPANI
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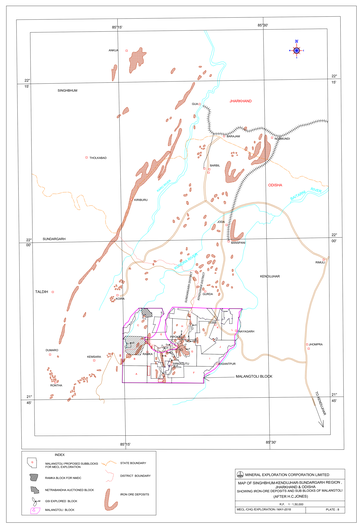
BARBIL



INDEX

- MALANGTOLI PROPOSED SUBBLOCKS FOR MECL EXPLORATION
- RAMKA BLOCK FOR IMEC
- NETRANANDIA AUCTIONED BLOCK
- GSI EXPLORED BLOCK
- MALANGTOLI BLOCK
- STATE BOUNDARY
- DISTRICT BOUNDARY
- IRON ORE DEPOSITS

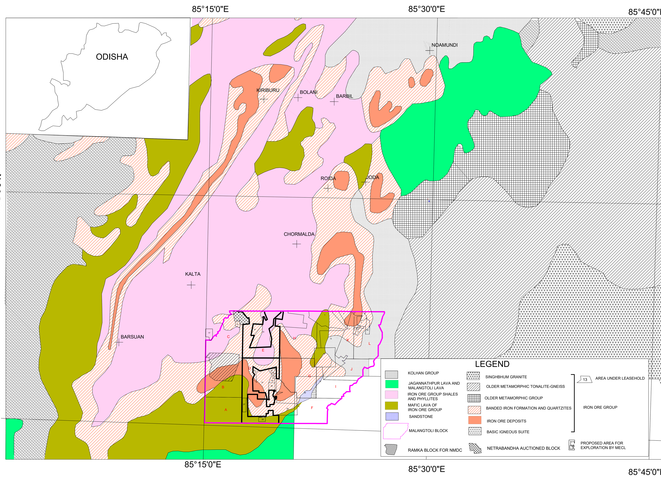
MECL MINERAL EXPLORATION CORPORATION LIMITED

MAP OF SINGHBHUM-KENDUJHAR-SUNDARGARH REGION, (JHARKHAND & ODISHA) SHOWING IRON ORE DEPOSITS & LOCATION OF MALANGTOLI (AFTER A.C.JONES)

R.F. = 1:50,000

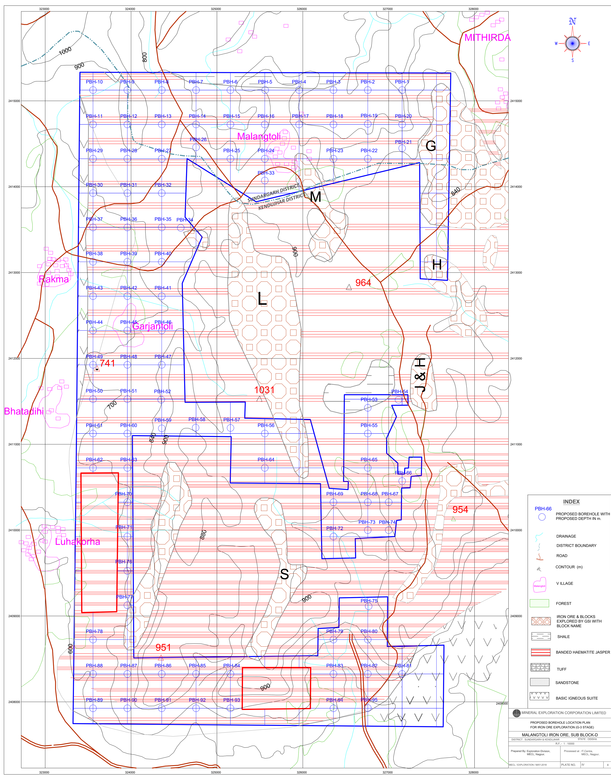
MECL CHG EXPLORATION YEAR:2016	PLATE : 3

REGIONAL GEOLOGICAL MAP OF SINGHBHUM-KENDUJHAR IRON ORE BELT WITH MALANGTOLI BLOCK



RF 1: 1,00,000

PLATE NO. : III


MITHIRDA
Malangtoli
Pakma
Bhatapani
Lunaborha
Gangarkhil
964
741
1031
954
951
G
M
H
L
J & H
S
INDEX
PBH-66
PROPOSED BOREHOLE WITH PROPOSED DEPTH IN m.
DRAINAGE
DISTRICT BOUNDARY
ROAD
CONTOUR (m)
V ILLAGE
FOREST
IRON ORE & BLOCKS EXPLORED BY GSI WITH BLOCK NAME
SHALE
BANDED HAEMATITE JASPER
TUFF
SANDSTONE
BASIC IGNEOUS SUITE
MINERAL EXPLORATION CORPORATION LIMITED
PROPOSED BOREHOLE LOCATION PLAN
FOR IRON ORE EXPLORATION (G-3 STAGE)
MALANGTOLI IRON ORE, SUB BLOCK-G
Prepared By: Sajjadulla Ansari, MECL, Nagpur.
Processed at : Cuttack, MECL, Nagpur.
DATE : 14th MARCH, 2007 - 14th MAY, 2007
PLATE NO. 01
A

F. No. 6/2/2015-NMET
Ministry of Mines
National Mineral Exploration Trust

New Delhi, 16th August, 2018

OFFICE MEMORANDUM

Subject: Approval of mineral exploration projects in 5 blocks to be executed by MECL.

On the recommendation of Technical-cum-Cost Committee (TCC) of NMET, the Executive Committee in its 9th meeting, held on 8th August, 2018 approved mineral exploration projects in 5 blocks to be executed by MECL at an estimated cost of **Rs. 1741.22 Lakh**. The details of the Blocks are given in **Annexure I.**

2. The G-4 level exploration for manganese in Rengali & Tamiya Blocks shall be carried out in the extension area (excluding the area) where GSI has worked for G-3 level exploration.

3. The mineral exploration projects in these 5 blocks will be funded by NMET as per the costing recommended by the TCC and approved by the Executive Committee. MECL shall undertake exploration in these blocks as per Tripartite Agreement between Ministry of Mines (NMET), MECL and the respective State Governments and complete the same as per the approved cost estimates and time schedule, enclosed as **II** to **VIII**.

4. The Implementing Agencies shall submit progress on monthly basis to NMET. The TCC, NMET shall review the progress of projects and provide update to the Executive Committee.

16/8/2018
(Pradeep Singh)
Director, NMET

To
The Chairman-cum-Managing Director,
Mineral Exploration Corporation Limited,
Dr. Babasahib Ambedkar Bhawan,
Seminary Hills, Nagpur- 440 006.

Copy for information & necessary action to:
Sh. D. Mohan Raj, ADG, NM-II& Chairman, NMET TCC, Geological Survey of India, Seminary Hills, Nagpur- 440 006.

Annexure I

List of mineral blocks approved in 9th Executive Committee on 08.08.2018, to be executed by MECL

Sl. No.	*Block Name*	*Commodity*	*Stage*	*Duration*	*Estimated Cost (Rs. in Lakh* **Including GST*)***
1	Rengali Block, District: Bolangir, Odisha	Manganese	G-4	12-14 months	284.10
2			G-2	13-15 months	340.93
3	Tamiya Block, District: Bolangir, Odisha	Manganese	G-4	11-13 months	246.43
4			G-2	12-14 months	248.78
5	Sub Block-D of Malangtoli Block, Districts: Sundargarh & Kendujhar, Odisha	Iron Ore	G-3	12-14 months	210.89
6	Sub Block-E of Malangtoli Block, Districts: Sundargarh & Kendujhar, Odisha	Iron Ore	G-3	12-14 months	199.21
7	Sub Block-G of Malangtoli Block, Districts: Sundargarh & Kendujhar, Odisha	Iron Ore	G-3	12-14 months	210.88
				Total	**1741.22**

Annexure - II/1

Table-7.2 Cost Estimate for Manganese Ore Mineralisation in Rengali Block (G4),

SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Escalated rates (2019-20)			Grand Total	
				Esc. Rate	Qty.	Amount	Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90	(Rs)		(Rs)					(Rs)
A	**DRILLING**										
1	Surface Drilling (2 rig)	m	2035	8177	600	4906200	8177		0	600	4906200
2	Transportation	Km	8.8	31.0	2600	80600	31.0		0	2600	80600
3	Accomodation (One time/ Drill)		185925	663715	2	1327430	663715		0	2	1327430
4	Camp Setting / Winding	- do-	68606	244910	2	489820	244910		0	2	489820
5	Road Making (Flat Terrain)***	Km	5200	18563	5	92815	18563		0	5	92815
	Sub Total A					**6896865**			**0**		**6896865**
B	**GEOPHYSICAL WORK**										
1	Magnetic Survey	**Nos**	107	467	4384	2047328	449		0	4384	2047328
2	Gravity Survey	**Nos**	445	1842	4384	8075328	1974		0	4384	8075328
3	Resistivity Survey	**Line Km**	3473	14734	86.38	1272722.92	14734		0	86.38	1272722.92
	Subtotal B					**11395378.92**			**0**		**11395379**
C	**GEOLOGICAL WORK**										
1	Survey Party days (1 party)	day	1180	5840	60	350400	5840		0	60	350400
2	Geologist Party days (1 party)	day	1541	7802	90	702180	7802		0	90	702180
3	Bulk Sampling Party days (1 party)	day	2566	13439	90	1209510	13439		0	90	1209510
4	Core Sampling Party days (1 party)	day	525	2809	60	168540	2809		0	60	168540
	Sub-Total C					**2430630**			**0**		**2430630**
D	**Pitting & Trenching**										
	a) Pitting 5 Nos (1m x 1m x 1m) & Trenching (1m x 2mx 800 m) 7 Nos	Cu.m	395	1673	405	677565	1673		0	405	677565
	Sub Total D					**677565**					**677565**
E	**LABORATORY STUDIES**										
1	**Chemical Analysis**										
	i) Primary & Check samples										
	a. Primary Samples For 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	600	1548000	2580		0	600	1548000
	b) Check Samples for 6 radical (Mn, SiO_2, $P2O_5$, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	60	154800	2580		0	60	154800
	d) External Check Samples from NABL Labs for 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	30	77400	2580		0	30	77400
	ii) Composite Samples										
	a) Composite Samples for 6 Radicals (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles).	Nos	490 (110 +76x5)	2580	60	154800	2580		0	60	154800
2	**Physical Analysis**										
i)	a) X-RD Studies on composite	Nos	1137	5605	10	56050	5605		0	10	56050
ii)	b) ICP-MS studies (14 Trace elements- Cd,Sn,W,Sb,Ce,Nb,Ba,La ,Bi,Co, Ni, Sr, Mo, V**	Nos		4620	10	46200	4620		0	10	46200
iii)	Preparation of thin section	Nos	100	538	10	5380	538		0	10	5380
iv)	Petrographic Studies	Nos	228	1436	10	14360	1436		0	10	14360
v)	Preparation of polished section	Nos	100	538	10	5380	538		0	10	5380
vi)	Mineragraphic Studies	Nos	364	2023	10	20230	2023		0	10	20230
vii)	Specific Gravity determination	Nos	32	188.5	20	3770	188		0	20	3770
viii)	Bulk Density	Nos	24	139	5	695				5	695
	Sub-Total E					**2087065**			**0**		**2087065**
F	**Preservation of Core**										
i)	**GI Core boxes**			**2000**	**150**	**300000**	**2000**		**0**	**150**	**300000**
ii)	**Transportation of Core Boxes**	Km	8.8	31.0	1300	40300	31.0		**0**	**1300**	**40300**
	Sub-Total F					340300					**340300**
	Total A+B+C +D+E+F					**23827804**			**0**		**23827804**
G	**EXPLORATION REPORT 1% of A+B+C +D+E**									**1**	**238278**
H	**PEER Review**						**10000**	**1**	**10000**	**1**	**10000**
	Total A+B+C +D+E+F+G										**24076082**
I	**GST @ 18%**										**4333695**
	Grand Total :										**28409777**
										Say 284.097 Lakhs	

Note:

1. **Goel Committee rates for Manganese ore are not available, hence Gold rates are taken on actual escalation as per RBI Indices as on 1.3.2017 and same**
2. **** Rate has taken from Schedule of Charges of differen activities of GSI as on 2014-15 and 40% escalation on the same has been concidered for FY 2018-19.**
3. *****Payment will be as per length of road made.**
4. **Statutory payments relating to forest clearance will be paid extra**
5. **In case of outsourcing handling charges will be paid as applicable for NMET blocks.**

Annexure- II/2

TABLE- 6.1 TIME SCHEDULE / ACTION PLAN FOR EXPLORATION PROPOSAL FOR MANGANESE ORE IN RENGALI BLOCK, (G-4 Level) DISTRICT - BALANGIR, ODISHA

			1	2	3	4	5	6	7	8	9	10	11	12	
1	Camp Setting	Month	↔												1 month
2	Surface Drilling (2 rigs)	m.							↔	↔					600 m (in 5 BHs)
3	Geophysical Work	Months		↔	↔	↔	↔	↔							5 month
4	Geophysical Report preparation	Months							↔	↔					2 month
5	Pitting Trenching (5 Pit & 7 Trenches)	Cu.m							↔	↔					1005.00
6	Survey Party days (1 Party)	Party days							↔	↔					60 Days
7	Geologist Party days (1Party)	Party days							↔	↔	↔				90 Days
8	Bulk Sampling Party days, (1 party)	Party days							↔	↔	↔				90 Days
9	Sampling Party days, Core Sampling (1 party)	Party days							↔	↔					60 Days
10	Laboratory Studies	Nos.								↔	↔	↔			815 Nos.
11	Camp Winding	Months	Continue to G2												
12	Report Writing with Peer Review	Months									↔	↔	↔	↔	4 months

Annexure - III/1

Table-7.2 Cost Estimate for Manganese Ore Mineralisation in Rengali Block (G 2),

SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Escalated rates (2019-20)			Grand Total	
				Esc. Rate	Qty.	Amount	Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90	(Rs)		(Rs)					(Rs)
A	DRILLING										
1	Surface Drilling (2 rig)	m	2035	8177	2350	19215950	8177		0	2350	19215950
2	Transportation	Km	8.8	31.0	0	0	31.0		0	0	0
3	Accomodation (One time/ Drill)		185925	663715	0	0	663715		0	0	0
4	Camp Setting / Winding	- do-	68606	244910	2	489820	244910		0	2	489820
5	Road Making (Flat Terrain)***	Km	5200	18563	5	92815	18563		0	5	92815
	Sub Total A					**19798585**			**0**		**19798585**
B	**GEOLOGICAL WORK**										
1	Survey Party days (1 party)	day	1180	5840	150	876000	5840		0	150	**876000**
2	Geologist Party days (1 party)	day	1541	7802	270	2106540	7802		0	270	**2106540**
3	Bulk Sampling Party days (1 party)	day	2566	13439	30	403170	13439		0	30	**403170**
4	Core Sampling Party days (1 party)	day	525	2809	240	674160	2809		0	240	**674160**
	Sub-Total B					**4059870**			**0**		**4059870**
C	**Pitting & Trenching**										
	a) Pitting 5 Nos (1m x 1m x 1m) & Trenching (1m x 2mx 800 m) 7 Nos	Cu.m	395	1673	5	8365	1673		0	5	**8365**
	Sub Total C					**8365**					**8365**
D	**LABORATORY STUDIES**										
1	**Chemical Analysis**										
	i) Primary & Check samples										
	a. Primary Samples For 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	900	2322000	2580		0	900	2322000
	b) Check Samples for 6 radical (Mn, SiO_2, $P2O_5$, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	90	232200	2580		0	90	232200
	d) External Check Samples from NABL Labs for 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles).	Nos	490 (110 +76x5)	2580	45	116100	2580		0	45	116100
	ii) Composite Samples										
	a) Composite Samples for 6 Radicals (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles).	Nos	490 (110 +76x5)	2580	200	516000	2580		0	200	516000
2	**Physical Analysis**										
i)	a) X-RD Studies on composite	Nos	1137	5605	20	112100	5605		0	20	112100
ii)	b) ICP-MS studies (14 Trace elements- Cd,Sn,W,Sb,Ce,Nb,Ba,La,Bi,Co, Ni, Sr, Mo, V**	Nos		4620	10	46200	4620		0	10	46200
iii)	Preparation of thin section	Nos	100	538	30	16140	538		0	30	16140
iv)	Petrographic Studies	Nos	228	1436	30	43080	1436		0	30	43080
v)	Preparation of polished section	Nos	100	538	30	16140	538		0	30	16140
vi)	Mineragraphic Studies	Nos	364	2023	30	60690	2023		0	30	60690
vii)	Specific Gravity determination	Nos	32	188.5	40	7540	188		0	40	7540
viii)	Bulk Density	Nos	24	139	5	695				5	695
	Sub-Total D					**3488885**			**0**		**3488885**
E	**Preservation of Core**										
i)	**GI Core boxes**			**2000**	**600**	**1200000**	**2000**		**0**	**600**	**1200000**
ii)	**Transportation of Core Boxes**	Km	8.8	31.0	1300	40300	31.0		**0**	**1300**	**40300**
	Sub-Total E					1240300					**1240300**
	Total A+B+C +D+E					**28596005**			**0**		**28596005**
F	**EXPLORATION REPORT 1% of A+B+C +D+E**									**1**	**285960**
G	**PEER Review**						**10000**	**1**	**10000**	**1**	**10000**
	Total A+B+C +D+E+F+G+H										**28891965**
I	**GST @ 18%**										**5200554**
	Grand Total :										**34092519**
										Say 340.925 Lakhs	

Note:

1. Goel Committee rates for Manganese ore are not available, hence Gold rates are taken on actual escalation as per RBI Indices as on
2. ** Rate has taken from Schedule of Charges of differen activities of GSI as on 2014-15 and 40% escalation on the same has been
3. ***Payment will be as per length of road made.
4. Statutory payments relating to forest clearance will be paid extra
5. In case of outsourcing handling charges will be paid as applicable for NMET blocks.

Annexure - III/2

TABLE- 6.1 TIME SCHEDULE / ACTION PLAN FOR EXPLORATION PROPOSAL FOR MANGANESE ORE IN RENGALI BLOCK, (G-2 Level) DISTRICT - BALANGIR, ODISHA

			1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Camp Setting	Month														
2	Surface Drilling (2 rigs)	m.	←	—	—	—	—	—	—	→						2350m (in 37 BHs)
3	Pitting (5 Pit)	Cu.m	↔													5.00
4	Survey Party days (1 Party)	Party days	←	—	—	—	→									150 Days
5	Geologist Party days (1 Party)	Party days	←	—	—	—	—	—	—	—	→					270 Days
6	Bulk Sampling Party days, (1 Party)	Party days	↔													30 Days
7	Sampling Party days, Core Sampling (1 Party)	Party days		←	—	—	—	—	—	—	→					240 Days
8	Laboratory Studies	Nos.		←	—	—	—	—	—	—	—	→				1400 Nos.
9	Camp Winding	Months									↔					1 month
10	Report Writing with Peer Review	Months										←	—	—	→	4 months

Annexure-IV/1

Table-7.1 Cost Estimate for Manganese Ore Mineralisation in Tamiya Block (G4),

SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Escalated rates (2019-20)			Grand Total	
				Esc. Rate	Qty.	Amount	Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90	(Rs)		(Rs)					(Rs)
A	DRILLING										
1	Surface Drilling (2 rig)	m	2035	8177	310	2534870	8177		0	310	**2534870**
2	Transportation	Km	8.8	31.0	2600	80600	31.0		0	2600	**80600**
3	Accomodation (One time/ Drill)		185925	663715	2	1327430	663715		0	2	**1327430**
4	Camp Setting / Winding	- do-	68606	244910	2	489820	244910		0	2	**489820**
5	Road Making (Flat Terrain)***	Km	5200	18563	5	92815	18563		0	5	**92815**
	Sub Total A					**4525535**			**0**		**4525535**
B	GEOPHYSICAL WORK										
1	Magnetic Survey	**Nos**	107	467	3296	1539232	449		0	3296	**1539232**
2	Gravity Survey	**Nos**	445	1842	3296	6071232	1974		0	3296	**6071232**
3	Resistivity Survey	**Line Km**	3473	14734	79.9	1177246.6	14734		0	79.9	**1177246.6**
	Subtotal B					**8787710.6**			**0**		**8787711**
C	GEOLOGICAL WORK										
1	Survey Party days (1 party)	day	1180	5840	30	175200	5840		0	30	**175200**
2	Geologist Party days (1 party)	day	1541	7802	90	702180	7802		0	90	**702180**
3	Bulk Sampling Party days (1 party)	day	2566	13439	90	1209510	13439		0	90	**1209510**
4	Core Sampling Party days (1 party)	day	525	2809	30	84270	2809		0	30	**84270**
	Sub-Total C					**2171160**			**0**		**2171160**
D	**Pitting & Trenching**										
	a) Pitting 5 Nos (1m x 1m x 1m) & Trenching (1m x 2mx 800 m) 7 Nos	Cu.m	395	1673	605	1012165	1673		0	605	**1012165**
	Sub Total D					**1012165**					**1012165**
E	LABORATORY STUDIES										
1	**Chemical Analysis**										
	i) Primary & Check samples										
	a. Primary Samples For 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	1200	3096000	2580		0	1200	3096000
	b) Check Samples for 6 radical (Mn, SiO_2, $P2O_5$, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	120	309600	2580		0	120	309600
	d) External Check Samples from NABL Labs for 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	60	154800	2580		0	60	154800
	ii) Composite Samples										
	a) Composite Samples for 6 Radicals (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles).	Nos	490 (110 +76x5)	2580	100	258000	2580		0	100	258000
2	**Physical Analysis**										
i)	a) X-RD Studies on composite	Nos	1137	5605	10	56050	5605		0	10	56050
ii)	b) ICP-MS studies (14 Trace elements-Cd,Sn,W,Sb,Ce,Nb,Ba,La,Bi,Co, Ni, Sr, Mo, V**	Nos		4620	10	46200	4620		0	10	46200
iii)	Preparation of thin section	Nos	100	538	10	5380	538		0	10	5380
iv)	Petrographic Studies	Nos	228	1436	10	14360	1436		0	10	14360
v)	Preparation of polished section	Nos	100	538	10	5380	538		0	10	5380
vi)	Mineragraphic Studies	Nos	364	2023	10	20230	2023		0	10	20230
vii)	Specific Gravity determination	Nos	32	188.5	20	3770	188		0	20	3770
viii)	Bulk Density	Nos	24	139	5	695				5	695
	Sub-Total E					**3970465**			**0**		**3970465**
F	**Preservation of Core**										
i)	**GI Core boxes**			**2000**	**80**	**160000**	**2000**		**0**	**80**	**160000**
ii)	**Transportation of Core Boxes**	Km	8.8	31.0	1300	40300	31.0		**0**	**1300**	**40300**
	Sub-Total F					200300					**200300**
	Total A+B+C +D+E+F					**20667336**			**0**		**20667336**
G	**EXPLORATION REPORT 1% of A+B+C +D+E+F**									**1**	**206673**
H	**PEER Review**						**10000**	**1**	**10000**	**1**	**10000**
	Total A+B+C +D+E+F+G+H										**20884009**
I	**GST @ 18%**										**3759122**
	Grand Total :										**24643131**
									Say 246.431 Lakhs		

Note:

1. **Goel Committee rates for Manganese ore are not available, hence Gold rates are taken on actual escalation as per RBI Indices as on 1.3.2017 and**
2. **** Rate has taken from Schedule of Charges of differen activities of GSI as on 2014-15 and 40% escalation on the same has been concidered for FY**

Annexure- IV/2

TABLE- 6.1 TIME SCHEDULE / ACTION PLAN FOR EXPLORATION PROPOSAL FOR MANGANESE ORE IN TAMIYA BLOCK, (G-4 Level) DISTRICT - BALANGIR, ODISHA

			1	2	3	4	5	6	7	8	9	10	11	
1	Camp Setting	Month	↔											1 month
2	Geophysical Work	Month		↔	↔	↔	↔							4 month
3	Geophysical Report	Month						↔	↔					2 month
2	Surface Drilling (2 rigs)	m.						↔						310m (in 5 BHs)
3	Pitting Trenching (5 Pit & 7 Trenches)	Cu.m						↔	↔	↔				1605.00
4	Survey Party days (1 Party)	Party days						↔						30 Days
5	Geologist Party days (1Party)	Party days						↔	↔	↔				90 Days
6	Bulk Sampling Party days, (1 party)	Party days						↔	↔	↔				90 Days
7	Sampling Party days, Core Sampling (1 party)	Party days							↔					30 Days
8	Laboratory Studies	Nos.							↔	↔	↔			2695 Nos.
9	Camp Winding	Months	Continue to G2											
10	Report Writing with Peer Review	Months								↔	↔	↔	↔	4 months

Annexure - V/1

Table-7.2 Cost Estimate for Manganese Ore Mineralisation in Tamiya Block (G2),

SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Escalated rates (2019-20)			Grand Total	
				Esc. Rate	Qty.	Amount	Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90	(Rs)		(Rs)					(Rs)
A	**DRILLING**										
1	Surface Drilling (2 rig)	m	2035	8177	1590	13001430	8177		0	1590	**13001430**
2	Transportation	Km	8.8	31.0	0	0	31.0		0	0	**0**
3	Accomodation (One time/ Drill)		185925	663715	0	0	663715		0	0	**0**
4	Camp Setting / Winding	- do-	68606	244910	2	489820	244910		0	2	**489820**
5	Road Making (Flat Terrain)***	Km	5200	18563	5	92815	18563		0	5	**92815**
	Sub Total A					**13584065**			**0**		**13584065**
B	**GEOLOGICAL WORK**										
1	Survey Party days (1 party)	day	1180	5840	120	700800	5840		0	120	**700800**
2	Geologist Party days (1 party)	day	1541	7802	210	1638420	7802		0	210	**1638420**
3	Bulk Sampling Party days (1 party)	day	2566	13439	30	403170	13439		0	30	**403170**
4	Core Sampling Party days (1 party)	day	525	2809	180	505620	2809		0	180	**505620**
	Sub-Total B					**3248010**			**0**		**3248010**
C	**Pitting & Trenching**										
	a) Pitting 5 Nos (1m x 1m x 1m) & Trenching (1m x 2mx 800 m) 7 Nos	Cu.m	395	1673	5	8365	1673		0	5	**8365**
	Sub Total C					**8365**					**8365**
D	**LABORATORY STUDIES**										
1	**Chemical Analysis**										
	i) Primary & Check samples										
	a. Primary Samples For 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	900	2322000	2580		0	900	2322000
	b) Check Samples for 6 radical (Mn, SiO_2, $P2O_5$, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	90	232200	2580		0	90	232200
	d) External Check Samples from NABL Labs for 6 radical (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles)	Nos	490 (110 +76x5)	2580	45	116100	2580		0	45	116100
	ii) Composite Samples										
	a) Composite Samples for 6 Radicals (Mn, SiO_2, P_2O_5, Fe_2O_3, MnO_2 and Insolubles).	Nos	490 (110 +76x5)	2580	100	258000	2580		0	100	258000
2	**Physical Analysis**										
i)	a) X-RD Studies on composite	Nos	1137	5605	20	112100	5605		0	20	112100
ii)	b) ICP-MS studies (14 Trace elements- Cd,Sn,W,Sb,Ce,Nb,Ba,La,Bi,Co, Ni, Sr, Mo, V**	Nos		4620	10	46200	4620		0	10	46200
iii)	Preparation of thin section	Nos	100	538	20	10760	538		0	20	10760
iv)	Petrographic Studies	Nos	228	1436	20	28720	1436		0	20	28720
v)	Preparation of polished section	Nos	100	538	20	10760	538		0	20	10760
vi)	Mineragraphic Studies	Nos	364	2023	20	40460	2023		0	20	40460
vii)	Specific Gravity determination	Nos	32	188.5	30	5655	188		0	30	5655
viii)	Bulk Density	Nos	24	139	5	695				5	695
	Sub-Total D					**3183650**			**0**		**3183650**
E	**Preservation of Core**										
i)	GI Core boxes			**2000**	**400**	**800000**	**2000**		**0**	**400**	800000
ii)	Transportation of Core Boxes	Km	8.8	31.0	1300	40300	31.0		**0**	**1300**	40300
	Sub-Total E					840300					**840300**
	Total A+B+C +D+E					**20864390**			**0**		**20864390**
F	**EXPLORATION REPORT 1% of A+B+C +D+E**									**1**	**208644**
G	**PEER Review**						**10000**	**1**	**10000**	**1**	**10000**
	Total A+B+C +D+E+F+G+H										**21083034**
H	**GST @ 18%**										**3794946**
	Grand Total :										**24877980**
										Say 248.780 Lakhs	

Note:

1. **Goel Committee rates for Manganese ore are not available, hence Gold rates are taken on actual escalation as per RBI Indices as on 1.3.2017**
2. **** Rate has taken from Schedule of Charges of differen activities of GSI as on 2014-15 and 40% escalation on the same has been concidered for**
3. *****Payment will be as per length of road made.**
4. **Statutory payments relating to forest clearance will be paid extra**
5. **In case of outsourcing handling charges will be paid as applicable for NMET blocks.**

Annexure - V/2

TABLE- 6.2 TIME SCHEDULE / ACTION PLAN FOR EXPLORATION PROPOSAL FOR MANGANESE ORE IN TAMIYA BLOCK, (G-2 Level) DISTRICT - BALANGIR, ODISHA

			1	2	3	4	5	6	7	8	9	10	11	
1	Camp Setting	Month	Continue from G4											1 month
2	Surface Drilling (2 rigs)	m.												1590m (in 29 BHs)
3	Pitting (5 Pit)	Cu.m												5.00
4	Survey Party days (1 Party)	Party days												120 Days
5	Geologist Party days (1 Party)	Party days												210 Days
6	Bulk Sampling Party days, (1 Party)	Party days												30 Days
7	Sampling Party days, Core Sampling (1 Party)	Party days												180 Days
8	Laboratory Studies	Nos.												1240 Nos.
9	Camp Winding	Months												1 month
10	Report Writing with Peer Review	Months												4 months

Annexure - VI/1

Table-6.2 Cost Estimate for Iron Ore Exploration Malangtoli D Sub - Block District- Sundargarh, Odisha								
SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Grand Total	
				Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90					(Rs)
A	**DRILLING**							
1	Surface Drilling (4 rigs) *	m	9000	9000	1000	9000000	1000	9000000
2	Pitting (1m x 1m x 1m)	Cu.m.	395	1673	15	25095	15	25095
2	Transportation	Km	8.8	31	3000	93000	3000	93000
3	Accomodation (One time/ Drill)		185925	663715	4	2654860	4	2654860
4	Camp Setting	- do-	68606	244910	4	979640	4	979640
5	Road Making (Hilly Terrain)**	Km	7800	27844	20	556880	20	556880
	Sub Total A					**13309475**		**13309475**
B	**GEOLOGICAL WORK**							
1	Survey Party days (1 party)	day	1180	5840	90	525600	90	525600
2	Geologist Party days (1 party)	day	1541	7802	120	936240	120	936240
3	Bulk Sampling Party days (1 party)	day	2566	13434	30	403020	30	403020
4	Core Sampling Party days (1 party)	day	525	2809	90	252810	90	252810
5	**SUB TOTAL B**					**2117670**		**2117670**
C	**LABORATORY STUDIES**							
1	**Chemical Analysis**							
	i) Primary & Check samples							
	a. For 3 radicals Fe, SiO_2 & Al_2O_3 [core samp + Internal Check Samp	Nos	262(110 +76x2)	1374	935	1284690	935	1284690
	b) External Check Samples from NABL Labs for 3 radical (Fe, SiO2 & Al2O3)	Nos	262(110 +76x2)	1374	40	54960	40	54960
	ii) Composite Samples							
	a) Composite Samples for 7 radicals (Fe%, SiO2%, Al2O3%, P%, Mn%, S% & V2O5%)	Nos	268	2982	100	298200	100	298200
2	**Physical Analysis**							
i)	Preparation of thin section	Nos	100	538	15	8070	15	8070
ii)	Petrographic Studies	Nos	228	1436	15	21540	15	21540
iii)	Preparation of polished section	Nos	100	538	15	8070	15	8070
iv)	Mineragraphic Studies	Nos	364	2023	15	30345	15	30345
v)	Density Determination	Nos	24	139	15	2085	15	2085
	Sub-Total C					**1707960**		**1707960**
D	**Preservation of Core**							
i)	GI Core boxes	Nos.		2000	250	500000	250	500000
ii)	Transportation of Core Boxes	Km	8.8	31.0	1600	49600	1600	49600
	Sub-Total D					**549600**		**549600**
	Total A+B+C+D							**17684705**
E	**EXPLORATION REPORT - 1% of (A+B+C+D)**				**1**			**176847**
F	**PEER REVIEW OF DGR (Lump Sum)**	Nos		10000	1	**10000**	1	10000
	Grand Total : A to F							**17871552**
G	**GST @ 18%**							**3216879**
H	**GRAND TOTAL**							**21088431**
Notes:								**Say 210.885 Lakhs**
1	Revised Rates of Promotional Work done by MECL on behalf of Govt. of India Vide letter No. 37(I) /2006-M.I. dated- 02/07/2014 and based on actual							
2	*Outsourcing rate has been considered in drilling as provided by DGM(Jharkhand). Handling Charges will be as paid applicable .							
3	**Payment will be as per length of road made.							
4	statutory payments relating to forest clearance will be paid extra.							

Mineral Exploration and evaluation 18%(SAC Code: 998343)

Annexure - VI/2

Table 6.1: TIME SCHEDULE /ACTION PLAN , G3 LEVEL OF IRON ORE EXPLORATION IN MALANTOLI D- SUB BLOCK ODISHA.

Sl. No.	Activities	Unit	MONTHS												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
1	Tendering Period	Month	←	—	—	—	→								5 month
2	Camp Setting	Month						↔							1 month
3	Core Drilling (4 rigs)	m.							↔	—	→				1000 m (in 10 BHs)
4	Bulk Sampling Party days	Day								↔					30
5	Survey Party days (1 Party)	day							↔	—	→				90
6	Geologist Party days (1 Parties)	day							↔	—	—	→			120
7	Sampling Party days, Core Sampling (1 parties)	day								↔	—	→			90
8	Laboratory Studies	Nos.								↔	—	—	→		1120
9	Report Writing	Month									↔	—	—	→	4 months

Annexure-VII/1

Table-6.2 Cost Estimate for Iron Ore Exploration Malangtoli' E' Sub - Block District- Sundargarh, Odisha								
SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Grand Total	
				Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90					(Rs)
A	DRILLING							
1	Surface Drilling (4 rigs) *	m	9000	9000	1000	9000000	1000	9000000
2	Pitting (1m x 1m x 1m)	Cu.m.	395	1673	15	25095	15	25095
2	Transportation	Km	8.8	31	3000	93000	3000	93000
3	Accomodation (One time/ Drill)		185925	663715	4	2654860	4	2654860
4	Camp Winding	- do-	68606	244910	0	0	0	0
5	Road Making (Hilly Terrain)**	Km	7800	27844	20	556880	20	556880
	Sub Total A					**12329835**		**12329835**
B	GEOLOGICAL WORK							
1	Survey Party days (1 party)	day	1180	5840	90	525600	90	525600
2	Geologist Party days (1 party)	day	1541	7802	120	936240	120	936240
3	Bulk Sampling Party days (1 party)	day	2566	13434	30	403020	30	403020
4	Core Sampling Party days (1 party)	day	525	2809	90	252810	90	252810
5	**SUB TOTAL B**					**2117670**		**2117670**
C	LABORATORY STUDIES							
1	**Chemical Analysis**							
	i) Primary & Check samples							
	a. For 3 radicals Fe, SiO_2 & Al_2O_3 [core samp + Internal Check Samp	Nos	262(110 +76x2)	1374	935	1284690	935	1284690
	b) External Check Samples from NABL Labs for 3 radical (Fe, SiO2 & Al2O3)	Nos	262(110 +76x2)	1374	40	54960	40	54960
	ii) Composite Samples							
	a) Composite Samples for 7 radicals (Fe%, SiO2%, Al2O3%, P%, Mn%, S% & V2O5%)	Nos	268	2982	100	298200	100	298200
2	**Physical Analysis**							
i)	Preparation of thin section	Nos	100	538	15	8070	15	8070
ii)	Petrographic Studies	Nos	228	1436	15	21540	15	21540
iii)	Preparation of polished section	Nos	100	538	15	8070	15	8070
iv)	Mineragraphic Studies	Nos	364	2023	15	30345	15	30345
v)	Density Determination	Nos	24	139	15	2085	15	2085
	Sub-Total C					**1707960**		**1707960**
D	**Preservation of Core**							
i)	GI Core boxes	Nos.		2000	250	500000	250	500000
ii)	Transportation of Core Boxes	Km	8.8	31.0	1600	49600	1600	49600
	Sub-Total D					**549600**		**549600**
	Total A+B+C+D							**16705065**
E	**EXPLORATION REPORT - 1% of (A+B+C+D)**				**1**			**167051**
F	**PEER REVIEW OF DGR (Lump Sum)**	Nos		10000	1	**10000**	1	10000
	Grand Total : A to F							**16882116**
G	**GST @ 18%**							**3038781**
H	**GRAND TOTAL**							**19920896**
Notes:								**Say 199.209 Lakhs**
1	Revised Rates of Promotional Work done by MECL on behalf of Govt. of India Vide letter No. 37(I) /2006-M.I. dated- 02/07/2014							
2	*Outsourcing rate has been considered in drilling as provided by DGM(Jharkhand). Handling Charges will be as applicable .							
3	**Payment will be as per length of road made.							
4	statutory payments related to forest clearance will be paid extra.							

Mineral Exploration and evaluation 18%(SAC Code: 998343)

Annexure - VII/2

Table 6.1: TIME SCHEDULE /ACTION PLAN , G3 LEVEL OF IRON ORE EXPLORATION IN MALANTOLI E- SUB BLOCK ODISHA.

Sl. No.	Activities	Unit	MONTHS												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
1	Tendering Period	Month	←	—	—	—	→								5 month
2	Core Drilling (4 rigs)	m.						←	—	→					1000 m (in 10 BHs)
3	Bulk Sampling Party days	Day							← →						30
4	Survey Party days (1 Party)	day						←	—	→					90
5	Geologist Party days (1 Parties)	day						←	—	—	→				120
6	Sampling Party days, Core Sampling (1 parties)	day							←	—	→				90
7	Laboratory Studies	Nos.							←	—	—	→			1120
8	Report Writing	Month									←	—	—	→	4 months

Annexure -VIII/1

Table-6.2 Cost Estimate for Iron Ore Exploration Malangtoli G Sub - Block District- Sundargarh, Odisha								
SL. N0.	Item of Work	Unit	Base Rate	Escalated rates (2018-19)			Grand Total	
				Esc. Rate	Qty.	Amount	Qty.	Amount
			1.4.90					(Rs)
A	DRILLING							
1	Surface Drilling (4 rigs) *	m	9000	9000	1000	9000000	1000	9000000
2	Pitting (1m x 1m x 1m)	Cu.m.	395	1673	15	25095	15	25095
2	Transportation	Km	8.8	31	3000	93000	3000	93000
3	Accomodation (One time/ Drill)		185925	663715	4	2654860	4	2654860
4	Camp Winding	- do-	68606	244910	4	979640	4	979640
5	Road Making (Hilly Terrain)**	Km	7800	27844	20	556880	20	556880
	Sub Total A					**13309475**		**13309475**
B	GEOLOGICAL WORK							
1	Survey Party days (1 party)	day	1180	5840	90	525600	90	525600
2	Geologist Party days (1 party)	day	1541	7802	120	936240	120	936240
3	Bulk Sampling Party days (1 party)	day	2566	13434	30	403020	30	403020
4	Core Sampling Party days (1 party)	day	525	2809	90	252810	90	252810
5	**SUB TOTAL B**					**2117670**		**2117670**
C	LABORATORY STUDIES							
1	**Chemical Analysis**							
	i) Primary & Check samples							
	a. For 3 radicals Fe, SiO_2 & Al_2O_3 [core samp + Internal Check Samp	Nos	262(110 +76x2)	1374	935	1284690	935	1284690
	b) External Check Samples from NABL Labs for 3 radical (Fe, SiO2 & Al2O3)	Nos	262(110 +76x2)	1374	40	54960	40	54960
	ii) Composite Samples							
	a) Composite Samples for 7 radicals (Fe%, SiO2%, Al2O3%, P%, Mn%, S% & V2O5%)	Nos	268	2982	100	298200	100	298200
2	**Physical Analysis**							
i)	Preparation of thin section	Nos	100	538	15	8070	15	8070
ii)	Petrographic Studies	Nos	228	1436	15	21540	15	21540
iii)	Preparation of polished section	Nos	100	538	15	8070	15	8070
iv)	Mineragraphic Studies	Nos	364	2023	15	30345	15	30345
v)	Density Determination	Nos	24	139	15	2085	15	2085
	Sub-Total C					**1707960**		**1707960**
D	**Preservation of Core**							
i)	GI Core boxes	Nos.		2000	250	500000	250	500000
ii)	Transportation of Core Boxes	Km	8.8	31.0	1600	49600	1600	49600
	Sub-Total D					**549600**		**549600**
	Total A+B+C+D							**17684705**
E	**EXPLORATION REPORT - 1% of (A+B+C+D)**				**1**			**176847**
F	**PEER REVIEW OF DGR (Lump Sum)**	Nos		10000	1	**10000**	1	10000
	Grand Total : A to F							**17871552**
G	**GST @ 18%**							**3216879**
H	**GRAND TOTAL**							**21088431**
Notes:								**Say 210.884 Lakhs**
1	Revised Rates of Promotional Work done by MECL on behalf of Govt. of India Vide letter No. 37(I) /2006-M.I. dated- 02/07/2014 and							
2	*Outsourcing rate has been considered in drilling as provided by DGM(Jharkhand). Handling Charges will be as applicable .							
3	**Payment will be as per length of road made.							
4	statutory payments related to forest clearance will be paid extra.							

Mineral Exploration and evaluation 18%(SAC Code: 998343)

Annexure- VIII/2

Table 6.1: TIME SCHEDULE /ACTION PLAN , G3 LEVEL OF IRON ORE EXPLORATION IN MALANTOLI G- SUB BLOCK ODISHA.

Sl. No.	Activities	Unit	MONTHS												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
1	Tendering Period	Month	←				→								5 month
2	Core Drilling (4 rigs)	m.						←		→					1000 m (in 10 BHs)
3	Bulk Sampling Party days	Day							← →						30
4	Survey Party days (1 Party)	day						←		→					90
5	Geologist Party days (1 Parties)	day						←			→				120
6	Sampling Party days, Core Sampling (1 parties)	day							←		→				90
7	Camp Winding	Month									← →				1 month
8	Laboratory Studies	Nos.							←			→			1120
9	Report Writing	Month									←			→	4 months