

EXECUTIVE SUMMARY OF REGIONAL MINING GEOLOGICAL STUDIES CARRIED OUT DURING THE YEAR 2011 – 2012.

1. Udaipur Region: Bauxite Mines in Jamnagar District of Gujarat by Shri H.C. Singh, Senior Mining Geologist.

The present mining geological study covers 25 lease holds (area-955.04 ha) out of 136 MLs during the RMGS 2011-12. in the bauxite mining belt at Jamnagar district of Gujarat State. The stratigraphy of the area established by the previous workers of GSI showing distribution of bauxite deposit below the Gaj beds in Kalyanpur, Taluka, Jamnagar district: Bauxite deposits of Jamnagar district occur as lenticular pocket concentration within lateritic sheets of relatively smaller extensions upto depth ranging from 2 to 6m and OB upto1.5m. Bauxite mine sections revealed following 4 different zones. (1) Hard massive zone (2) Nodular or concretionary zone (3) Pisolitic & Oolitic Zone Powdery/Clayey or earthy zone. In the approved documents, proposal for 107 trial pits and 28 Boreholes were made. Out of which 91 trial pits and 28 Boreholes were made. During inspection, necessity of exploration for 57 trial pits and 1 Borehole were established. Total reserves as on 1/04/2011 are 43.85 million tonnes in 25 ML areas of Jamnagar district out of which 0.69 million tonnes from one ML area is in forest remaining in non forest. Insitu bauxite is mixed grade. High and low grades in the ratio of 10:90 developed after sizing and sorting during the mining process. The production pattern indicates rising tendency during 2006-07 to 2007-08 in Gujarat state from 5.9 million tonnes to 11.9 million tonnes and sudden slump 2.6 million tonnes during 2009-10 further expected to be lowered to the tune of .4 million tonnes during 2010-11 which is due to the state govt. policy .Jamnagar district contributes over 90% of the state production. The data received by the Regional office also indicates the same pattern from production 3.7 million tonnes (2007-08) to merely 0.24 million tonnes (2010-11) for the 25 ML areas covered during the program year. According to estimates about 6 to 7 million tonnes of stock is lying in the ML areas. The cost of production of low grade ranges from Rs 140 to 392/ tonne and high grade Bauxite ranges from Rs 414 to 530/tonne except Virpur Pillidhar ML of M/s Natraj Ceramics where cost is Rs1439/tonnes during 2009-10. Total mineralized area is 955.04 ha.The proposed area for breaking was 234 ha out of which

land degraded was 175 ha during mining process. Plantation was proposed for 10560 plants out of which survived 3670 under the ML areas. Forest area, marine national park, marine sanctuary falling within the CRZ boundary are the major points to be given due attention while clearance in Virpur, Mewasa, and MotaAsota villages. The violation of, rule 12 for 4 cases, rule 13(1) for 14 cases, rule 15 for 1 case, rule 20(2) for 2 cases, rule 23E(2) for 11 cases, rule 23B(2) for 4 cases, rule 23F for 1 case, rule 42 for 8 cases, rule 45 for 12 cases were pointed out to the lessees out of which 17 lessees complied.

2. Ajmer Region: Iron ore in Jaipur, Jhunjhunu, Sikar, Alwar and Bhilwara districts, Rajasthan by Shri S. Thirunavukkarasu, Junior Mining Geologist.

0.1 There are Seventeen iron ore mining leases under the jurisdiction of Ajmer regional office in in the State of Rajasthan. The mining leases are located in the north eastern part of the State covering the districts of Sikar, Jhunjhunu, Jaipur, Alwar and Bhilwara. These leases are located in Survey of India Top sheets number- 44P, 45M, 54A, 54B and 45K/11 and are bounded by Latitude: 25°30' – 28°02' north and Longitude: 74°30' - 76°37' east. The total area covered by these leases is 1987.0793 hectares.

0.2 The rocks of the area belong to the Delhi Super Group of Pre Cambrian Age which has been further divided into Raialo group, Alwar Group and Ajabgarh Group. In the area under study mostly rocks of Ajabgarh and Alwar group are exposed which are surrounded by the sandy alluvium of recent age. The major rock types exposed in the area are quartzites, biotiteschists, gneisses, phyllites, feldspathic quartzite gneiss, calcareous schist etc.

0.3 The individual leases comprise of hillocks rising to a height varying from 1m to 158 m with an average height of around 63.6m above general ground level. These hillocks are mostly surrounded by flat to undulating sandy alluvial plain. The maximum height of the hillocks in the leases is 630m above MSL and the minimum height is 360m above MSL with an average height of 474 above MSL. Similarly the minimum height varies from 499 to 276m above MSL and the average being 410m above MSL.

0.4. The regional strike of the rocks varies from NNE-SSW to NE-SW with dip of around 65° to 80° towards NW. In the individual leases the strikes of the rocks vary from NS to NE-SW. The dip is mostly 60° to 80° north westerly to vertical and in few cases south easterly dips have also been noted.

0.5. Iron ore deposits mostly outcrop on the hillocks. The host rock and the iron ore bands form a conformable sequence. The width of Iron ore bands vary from 8.0 to 75.0m with an average width of about 42.0 m. The iron ore bands are associated within and interlayered with the mica schist, phyllite, quartz vein & calc gneisses. The ore bands generally follow the strike of the formations in the form of irregular lenticular bodies thickening and thinning in an irregular manner.

0.6. Mineralogically most of the ore in the leases are a mix of varying proportions of magnetite and hematite constituting 65 to 85% of the ore followed by quartz varying from 20 to almost 35%. Other minerals are found in minor amount to traces. In all the leases except Tatiyawas the total Fe content in the ore is below 60% and the ores are characterized by high silica content. The entire iron ore resources available in the leases under study can be grouped as low-grade or as unclassified grade because of low iron content and high silica content in these ores.

0.7 The exploration so far carried out in the leases is on a very low scale mainly because of non working of many mines due to lack of regular demand or want of environmental clearance from the Ministry of Environment & Forest, Govt. of India.

0.8 There is a further need for exploration in these leases mainly by core drilling to prove the depth persistence of iron ore bands within the leases and by regional geological mapping and shallow pitting & trenching to prove the occurrence of iron ore in the region /belt.

0.9 Total 903 m of diamond core drilling in 13 bore holes is proposed in 11 lease holds to upgrade the existing resources of iron ore in these lease hold areas. The suggested exploration is proposed on a promotional basis or on Public Private Partnership (PPP) basis as core drilling is a costly investment and the lessees who are not able to market their existing reserves due to poor quality and lack of regular demand may not be in a position to go in for further investment until there is regular demand for the ore on a sustainable basis.

0.10. During 2010-11 only six mines reported production of iron ore and the total production was only 50000 tons. The main reason of this low level of production is lack of regular demand for the poor grade iron ore of the State which is mainly used as concrete weight pipe coating.

0.11. As the ROM ore available in all the leases is of poor grade having high silica in form of quartz, the entire iron ore resources available in all the leases can be subjected to suitable beneficiation to reduce the silica content to acceptable limits for the iron and steel industries.

0.12. No mechanical beneficiation units for up gradation or value addition of ROM have been established in any lease excepting Tatiyawas mine. The present practice of wining of iron ore involves manual sizing & sorting out the lumps visually from the impurities and waste rocks like schist, phyllite, ferruginous quartzite, gneiss etc. The undersize fines intermixed with waste material are subjected to screening in which smaller fractions of iron ore mixed with fines is screened.

0.13. As there is no significant processing of the ROM, there is hardly any generation of tailings or slimes in any of the leases. However some quantity of fines is generated in some of the leases during sorting and dressing of the iron ore, which is stacked separately. The total quantity of such sub grade/fines stacked in the mines is about 1200 tonnes. This sub grade/fines is generally sold to the cement industries as a corrective raw material as per demand.

0.14. Since no previous work on beneficiation of iron ore of this area has been carried out by IBM, one bulk sample of ROM Iron ore lumps has been collected from the Thakhauron Ki Dhaniiron ore mine of M/s. P.S.L. Holder Pvt. Ltd. The sample has been sent to Regional Ore Dressing Laboratory of IBM, Ajmer to carry out Bench Scale Beneficiation studies and Bench scale beneficiation study for Metallurgical Industries,

3. Dehradun Region: Limestone mines Of Sirmour district Of Himachal Pradesh by Shri A. K. Vig, Assistant Mining Geologist.

1. The mines, covered under the study, are located in Sirmour district. These mines fall in Survey of India toposheet no. 53 F/6, 10, &14. These mines are located from 70 km – 125 km from Dehradun. Most of the mines are approachable by partly tar/ kutchra road, these mines are located between latitudes 30°34'29" (Dhanwasa Mona Banor of MC Goyal) to 30° 41'46" (Barwana of Sunder Singh) longitudes 77° 25'28" (Borli of Om Parkash) to 77° 44'47" (Bharli Rudhana of SC Chawla).
2. Total lease area covered under the current study is 251.445 hectares out of which only 4.41 hectares falls under forest area belonging to Sunny limestone mine of M/s Ahuja Plastic. Total percentage of the forest area is 1.75. All the remaining mines do not fall under the forest area.
3. Limestone mines of Sirmour district (H.P.) are located in steep rugged and uneven mountainous terrain with steep slopes and all the mines covered under the study fall in Trans-Giri tract of Sirmour district of Himachal Pradesh lesser Himalayas. The area is mainly drained by Khajyar stream, which meet in Tons river Giri at about 18 km. and several seasonal/perennial nalas, which meet in Tons river in Banuar-Shiva Rudana area. Apart from this the area is marked by several other seasonal/perennial nalas, which are the main natural reasons causing the continuous land degradation by carrying out lots of loose material from upper reaches. The lowest and highest mRLs of area are as 825 mRL and 2062 mRL, which fall in area of Barwas of M/S Barwas&Bhimgoda of M/S KN Cements mine respectively.
4. Formations exposed in the area belong to lesser Himalayas, which are represented by high quality limestone, dolomite, shale and phyllites etc. These formations are underlain and overlain by infra Krols and Tal formations respectively.
5. Limestone is the pre-dominant formation, which is extensively exposed in the area. Contact between limestone and dolomite is gradational. However, it is complex in nature and frequent changes in quality and quantity are observed. It is generally gray, dark gray & sometime off white in colour. It is fine to medium grain. High-

grade limestone exhibits cryptocrystalline texture. Sometime fine calcite crystals are also noted in the limestone.

6. Regional strike of formation in this belt is NW-SE to NNW-SSE, dipping at 30° - 82° angles mostly inside the hill. However, variations in trend of formation are observed frequently from place to place. These variations may be resulted due to local disturbances because of warping of local folding of strata. The limestone is thickly bedded and sometimes is intensely fractured. Brecciating limestone is also observed due to local movement.
7. As a general practice the reserves of limestone are classified as proved, probable and possible category under insitu geological reserves and recoverable reserves. The reserves/ resources estimation of limestone of Simour district of Himachal Pradesh has been in accordance with the cut-off grade of Cao- (+)34% & Mgo- (-)4% as suggested in circular No. 3/2010. It is evident from the table-2 above that Cao ranges from 48-55% and Mgo ranges from 0.39-3% in almost all the mines of district Sirmour. In the present study reserves have been estimated under as per in the UNF Classification of reserves with the new threshold values as per the recent notification vides CCOM" s Circular No. 3/2010.
8. In the mining leases covered under the present study exploration has been proposed by pitting of 2-4m x 2-3m x1.6-2.5m dimension of pits. Most of the mines are of small as far as working is concerned and these are worked by open cast methods manually, barring Baldhwa of M/S JS Thakur & Sons. They have proposed recently switching over to mechanized mining from manual means of working. Exploration has not been practiced by bore hole drilling in any of the mines of the area covered under the present study. Although it has been proposed in few mines, but almost in all the mining leases proposals have not been implemented. However, the MLs are granted over small area ranging from 2.6 hectare to 31.25 hectares, and have been worked extensively by number of pits up to a maximum depth of 100m. Violation of Rule13 (1) was pointed out where the MP/MS is not yet expired and where the MP/MS has already been expired the violation of Rule 12(3) was pointed out.
9. Under Rule 47 of MCDR 1988 the owner, agent ,mining engineer, geologist or manager of every mine or the holder of a Prospecting Licence shall send information in form J regarding notice of shaft sinking and boreholes. Not a single Prospecting Licence is reported

for limestone in district Sirmour and no boreholes have been dug for the mines covered under the RMGS, hence information is nil in this regard.

10. Total reserves of limestone have been estimated of the order of 171121.51 thousand tonnes under UNFC. Reserves under 111 & 121/122 categories are 126239.04 & 34318.52 thousand tonnes respectively. Resources under UNFC under 333 categories have been estimated of the tune of 36921.65 thousand tonnes in respect of mines covered in the present study.
11. The mines of Sirmour district covered under Study are small scale mines worked either by manual /means semi mechanized. These mines are worked by opencast method using dumpers/tippers, air compressors and drill machines like jackhammers along with combination of simple implements like crowbars chisels, pick axes etc. Mining machinery like JCB is also being used for excavation, road leveling and loading purposes in Baldhwa and Bhootmari mines. A large number of pits of varied dimensions in these mines have been developed without forming systematic benches of proposed height of 6m. Regular and separate benches in soil are also rarely observed as insignificant quantity of soil is being generated.
12. Limestone production from 2006-07 of 686585 tonnes was reported from 20 number of mines, which has gone up to 686830 tonnes in 2010-11 from 20 no. of working mines. Maximum production of 830044 is reported during the year 2009-10 from 21 mines.
13. Generation of sub grade ore/mineral reject has not been reported for limestone of district Sirmour (H.P.). Almost entire quantity of mineral is dispatched to mineral consuming industries. The fines of low grade limestone mixed with fines of high grade limestone generated due to blasting operations was earlier taken as sub grade mineral. The quantum of such material is very less of the production. At present, due to installation of pulverizing units in the district Sirmour, all such material is being used, hence no sub grade material is being left at the site.
14. In reply to our letter dated 7/7/2011, State Geologist, geological Wing, Department of Industries, Govt. of H.P. vide his letter No-Udyog-Bhu (Khani-4)Major-79/2002-6086 dated 30/9/2011 informed this office that presently there is no ongoing

Reconnaissance Permit and Prospecting Licence in district Simour (H.P.).

15. The study of 25 mines revealed that an insignificant quantity of waste has been generated during the year 2010-11 in 22 working mines covered under study. Approximately 81450 tonnes of waste has been generated during the year 2010-11 against a production of 686830 tonnes (provisional). Thus it gives ore to over burden ratio as 1:12 approximately which is more or less as per the proposals incorporated in the mining plan/Scheme of Mining because the production figure is expected to be increased since all the returns are not made available from the lessee. So far nearly 8 lakh tonnes of waste has been generated in these mines.
16. Non serious violations of rule 42(i)(b)(ii) & 42(i)(c)(ii) for appointment of part time Mining Engineer & Geologist respectively were also issued. Out of 25 mines under study in 9 cases part time Mining Engineer has not been appointed. In two mines degree holder Mining Engineer has been appointed and in rest of the mines permitted part time Mining Engineer has been appointed. A total no of 56 violations were pointed out in respect of 15 nos. of mines. As on date total nos. 28 of violations have so far been complied. One Court case has been filed & two mines were suspended under rule 13(2) of MCDR 1988 for non- submission of Scheme of mining.

4. Nagpur Region: Manganese lease holds in Balaghat district of Madhya Pradesh by Dr. A. K. Ghoshal, Junior Mining Geologist.

- 0.01 Madhya Pradesh is the third largest producer of manganese ore in the country, contributing to the extent of 22% of India's production of manganese ore. The entire production from the state comes from Balaghat district.
- 0.02 Mining geological study of manganese leases in Balaghat district was included in the Annual Programme Year 2011-12 with the main purpose of highlighting the problems & prospective relating to reveal the disposition of ore body in dip direction with

sufficient area available within existing mining lease and if, additional area will be required for further exploitation of ore along dip direction. The total lease area covered under the study aggregating to 80.932 hectares. In addition, old abandoned mine (now a freehold area) near Paunia village was also covered is around 10 ha area.

- 0.03 Manganese ore deposits of Balaghat district are reportedly syngenetic and syn-sedimentary type, occurring as three distinct horizons in the lower part of Sausar sedimentary sequence. These deposits occur as small lenses, veins of varying sizes and shape.
- 0.04 Manganese content in these deposits varies from 25 to 48% and generally is of medium to high grade.
- 0.05 The "insitu" reserves as per the approved mining plan and as per UNFC are to the order of 524650 tonnes out of which about 419720 tonnes are recoverable.
- 0.06 During 2011-12 total production of manganese ore from Balaghat district (all grades) was of the order of 523459 tonnes (43 reporting mines out of 55 leases) out of which 88% production is from mines of M/S MOIL. The remaining production is from other mines in Balaghat district. Out of this total production 82% comes from ores analyzing 35-46% Mn (in equal proportions) and the rest analyzing between 25-35% Mn.
- 0.07 Of the 10 leases covered in the district aggregating to about 80.932 hectares are open cast mine workings and freehold area aggregating to 25 hectares. The freehold area covered near Paunia village, are all old abandoned opencast workings.
- 0.08 Out of 10 mines only seven mines reported production, only three mines between 1000 and 7500 tonnes per annum, and remaining below 650 tonnes.
- 0.09 Comprehensive exploration strategy needs to be worked out within the lease as well as outside the lease area by way of collecting and correlating the geological information to be gathered afresh by verifying the exposed ore body in the pit / workings.

- 0.10 Summary of the status of development presented in the report reveals that a comprehensive exercise to be attempted for identifying the disposition of ore body in dip direction with sufficient area available within existing mining lease and if, additional area will be required for further exploitation of ore along dip direction to promote sustainable development and production of manganese. This is necessary because of folding in ore body.
- 0.11 No mining lease should be granted without detailed prospecting in the applied area. Sufficient area should be made available while granting ML considering the geological disposition of ore body along its dip direction for systematic development and scientific mining. This can be achieved, if the ML is granted through PL route and core drilling is carried out as per CCOM circular.
- 0.12 A review of quantum and quality of exploration carried out in the different leases during the study shows that systematic exploration is required in majority of the leaseholds. It is necessary to carry out geological mapping in detail with supportive data from the old / abandoned / water logged pits after dewatering and re-sampling of pits. This is felt desirable for systematic development of the leases and to promote scientific mining.
- 0.13 The status of compliance of MCDR shows that there is a backlog of development in majority of the leases and the situation has to be rectified as early as possible for promoting scientific mining in this sector. As a long term strategy, since the resources position, mining and utilisation scenario shows a possibility of accelerating production of ferro-manganese / high grade ores from this sector, a balanced scheme of exploration & development programme was necessary to be drawn out at the mine level of private non captive leases.

5. Jabalpur Region: Bauxite mines of Jabalpur district of MP by Shri Kanhaiya Lal, Senior Mining Geologist.

As per the Annual programme for the year 2011-12, this Regional Mining Geological Study of cluster of 25 bauxite mines of Satna district were taken up for the RMGS. The bauxite mines of these districts are

generally underlain by lithomarge clay, sandstone and overlain by siliceous/ ferruginous clay/laterite and soil. Exploratory work has been done by owners itself by putting trial pits/ trenches and ultimately mineralized area has been converted into working pits. Bauxite occurs on the Upper Bhandar and Upper Rewa sand stone.

1) To review and high light all problems and prospects in the mining belt which impede the optimal development of belt with respect to the present status of exploration and development of belt and gaps therein with respect to monitoring and implementation of mining plans/schemes. About 50% mines are closed due to so many reasons such as many of the mine owners do not have approved MP/MS, pit pass, environment clearance etc. Presently Mine owners who have no approved MP/MS, are being served notice against the violation of rule 12(3) and 13(1) simultaneous with suspension of mining activities under rule 13(2) of MCDR, 1988 by the IBM. State Govt. has also stopped the issue of pit pass to the mine owners which have either higher production than proposal given in production programme of MP/MS or have no Approved mining plan/ mining. So, to restart the mining activity, mine owners are advised to submit mining plan/ mining scheme/ modified due time.

2) To review the reserves position in the belt and identify the gaps of exploration while estimating the reserves/ resources under UNFC.

Reserves of bauxite (in 000'tonnes): -

All India: 818558.78

Madhya Pradesh: 13942.1

% share of Madhya Pradesh: 1.56%

Reserves of mines covered under the study (in tons): -

Proved (111): 3369044

Probable (121&122): 169607

Possible (332&333): 00.0

Total of all grades: 3538651T

The reserve of Madhya Pradesh is 13942.1 thousand tones. Based on production 1026.416 thousand tones for the year 2009-10, the life of the resources of bauxite mines of Madhya Pradesh will be about 13.58 years. In the mines covered under the study, with the present production level of 43793 tones for the year 2010-11 and total reserves available as on 1.4.2011 is 3538651tonnes, the life of the mines/deposits of Satna District will be 80.8 years.

Although 50% mines are closed due to so many reasons and if all of them start working, the life of mines/ deposits may decrease. There are total 36 bauxite mines in Satna Dist. Out of which 4 mines have recently closed due to falling under forest area. From remaining 32 mines, 25 mines have been taken under the study. Remaining mines are of very small category.

3) To review the total generation of low grade and sub grade ore and waste as per the present market and supply scenario. No sub grade is generated in any of the mines covered under the study.

4) To identify the problems related to scientific development of mines. Bauxite of this area is mostly of alum, metal & refractory grade. Some owners are working with simultaneous back filling. Some owners have developed proper benches within ore and over burden. Some of the mine owners have started manual sorting and screening of dumps and back filled area owing to more demand of consuming industries. It is because of probably changed in advanced technology.

5) To define short term and long term strategy for systematic development of mines and to high light the issues related to environment aspects in the respective mining belt / region together with remedial measures. Mining of bauxite is being done by manual open cast method on small scale. The reserves of bauxite are substantial but reserves of high grade (Alum/ chemical) containing more than 50% alumina are limited. The country has large resources of bauxite, occupying the sixth place in the world of the total resources. The resources of metallurgical grade bauxite are quite adequate while those of the chemical and refractory grade bauxite are relatively limited considering the future requirements. With the abundance of bauxite resources, Eastern Ghat regions of Odisha and Andhra Pradesh are likely to be the hubs for bauxite mining activities in future. The refractory and chemical grade bauxite can be preserved for future use. Indonesia & Vietnam have abundant bauxite resources and may stand main competitors for India in the international marketing the future. For increasing reserves/ of the country, new bauxite bearing areas should be searched out and made available.

6) To study the overall techno-economics of the belt and future prospects of development of the mineral based industries in the region. Resources of bauxite in the country as on 1.4.2005, as per UNFC system, are placed at 3,290 million tones. These resources include 899 million tons reserves and 2,390 million tones remaining resources. By grades, about 86% resources are of metallurgical grade.

The resources of refractory and chemical grades are limited and together account for about 3%. By States, Odisha alone accounts for 55% of country's resources of bauxite followed by Andhra Pradesh (19%), Gujarat (6%), Chhattisgarh (5%), Madhya Pradesh (4%), Jharkhand (4%) and Maharashtra (3%). Major bauxite resources are concentrated in the East Coast bauxite deposits in Odisha and Andhra Pradesh. In 2009-10 reported consumption of bauxite was 9.93m.t. as compare to 9.93 m.t.in previous year. Alumina industries was the principal consumer of bauxite counting for 86.5% consumption in 2009-10, followed by cement 9.2% and refractory 3.9% as given in table below. Gujarat was the main supplier of abrasive and refractory grade bauxite. Alumina plant draws supplies mostly from their captive mines. Exports of bauxite decreased substantially to 476 thousand tonnes in 2009 - 10 from 1.71 million tonnes in 2008-09. Exports were mainly to Kuwait (38%) and UAE and China (25% each). In 2009-10, imports of bauxite increased to 54,345 tonnes from 45,612 tonnes in the previous year. Imports were mostly from China.

6. Kolkata Region: Iron ore in Singhbhum (w) district of Jharkhand by Shri M.G.Bhattacharyya, Jr. Mining Geologist.

0.0.1 PREFACE

0.0.1.1 The Regional Mining Geological Study of iron ore in Singhbhum (w) district of Jharkhand covering twenty five Iron Ore mines/leases has been programmed for Kolkata regional office under MCCM Division during the year 20011-12 to review the Iron ore resources as per UNFC system with notified threshold value of Haematite Iron ore as new cut-off vis-à-vis exploration carried out and supplemented by feasibility study.

0.0.1.2 Iron ore deposits in the area covered during the study consisting essentially of haematite and occurs on the banded hematite Quartzites/Jasper. Generally the deposits occupy the crests or the slopes of the hills. It is observed that good grade deposits are in the high hills with steeper slope. Occasionally narrow, irregular deposits are also found in the plateau. But towards the interior, where the terrain is flat or gentle sloping, the concentration of iron is poor and the ore becomes shally admixed with laterite. The depth of ore concentration vary from deposit to deposit. Generally at or near the

surface the deposit consist of hard massive or lumpy ore and hard laminated ore followed by friable and soft laminated ore.

0.0.1.3 EXPLORATION

0.0.1.3.1 It is observed that Mining Plan/Scheme of Mining have been approved in all the twenty-five mines covered during the study. A review of exploratory work carried out in all the mines revealed the following: -

i) Geological mapping in a scale of 1:2000 have been completed in all the leasehold. However, in the leases namely Noamundi of Tata Steel Ltd., Gua (Durgaiburu) & Sukri of SAIL, the geological mapping have been done in 1:5000 scale.

ii) Many trial pits have been carried out in almost all the leases. Out of which, records of 991 nos. of trial pits are available.

iii) In Meghahatuburu of SAIL, records of two trenches (294 mtrs.), one tunnel of 458 mtrs., one adit of 150 mtrs. and in Ajitaburu of SAIL, records of 5 nos. of adits (1298.85 mtrs.) are available.

iv) As per the available record a total nos. of 2591 borehole (Core & DTH) has been drilled in the area covering a total meterage of 1,35,417.73 mtrs. in all the twenty five leaseholds.

v) In most of the leases, the targeted exploration of the approved mining plan could not be achieved for want of forest clearance.

vi) Big companies & Large mechanized mines by and large adhere to carry out systematic exploration within their lease hold to delineate the ore geometry, whereas no serious attempt has been made so far by small mine operators by giving due regards to systematic exploration

vii) Though a low trend to exploration expenditure/investment affects scientific mining & proper knowledge of deposit. However, there is also a casual trend in exploration in small mine operators.

0.0.1.4 RESERVE

0.0.1.4.1 A review of the resource position of these leases as per the approved mining plan/scheme and subsequent exploration and/or depletion of production from the reserve/resource estimated in the approved mining plan/scheme revealed that though some exploratory work has been carried out by some lessees as mentioned in earlier paragraph but as such no additional reserve has been estimated by any lessees for their lease holds except re-estimation and conversion of the earlier estimated reserve (proved, probable & possible) into the category of UNFC in the Mining Plan/Scheme of mining/ Modification in Mining Plan/Scheme of Mining. However, it is observed that in most of the above document, reserve /resources of Iron ore has been

estimated up to a cut-off of 45%Fe. As such no incremental increase of reserve has been observed in any of the mine/lease after 2010.

0.0.1.4.2 The total reserve/resource position of Iron ore as on 1/4/2012, considering the cut-off as 45%Fe, in all twenty five Iron mines/leaseholds covered during the study is as follows.]

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Category of reserve & code	Quantity in Million tonnes
Proved Mineral Reserves(111)	1348.4883
Probable Mineral Reserves(121)	11.615
Probable Mineral Reserves(122)	112.0559
Feasibility Mineral Resources(211)	388.325
Pre- Feasibility Mineral Resources(221)	743.692
Pre- Feasibility Mineral Resources(222)	181.19
Measured Mineral Resources(331)	27.471
Indicated Mineral Resources(332)	47.03
Inferred Mineral Resources(333)	115.769
Reconnaissance Mineral Resources(334)	82.22

0.0.1.5 MINING

0.0.1.5.1 SYSTEMATIC DEVELOPMENT

0.0.1.5.1.1 In most of the leaseholds of the area, separate benches are formed in overburden and in the ore zones. However, in some mines, proper developments by formation of systematic benches could not be adhered to because of non-availability of forest clearance over the lands adjacent to the pits / quarries and in a few mines/leases because of selective mining. Violation of Rule-13(1) of MCDR-1988 has been pointed out in the cases where unsystematic development has been observed.

0.0.1.5.1.2 Mining in almost all the mines is done by mechanized means. Conventional drilling, blasting and shovel-dumper combination is resorted to for working the iron ore deposit by forming opencast quarries. The bench height in mechanized mines is usually kept at 6 to 12 m. and bench width of 12 to 50 m. on an average. Deep blast holes of 100 to 150 mm. dia are drilled with

Electric Drillmaster. Blast holes are drilled with slurry /ANFO / Gelatinous /LOX explosives for shattering the rock masses. Shattered materials are handled with both electric and hydraulic shovels like Electric HEC (4.6 Cu.m.), Tata Hitachi Ex 1100E (5.5 Cu.m.), Poclains PC 1500 E i.e Electrical (6.5 Cu.m.) and PC 1000E (5.5 Cu.m.) and back hoes like Poclain& Tata Hitachi Ex 200, both with buckets of 3.2 Cu.m. and hauling is done by 50 tonner BEML and HM dumpers.

0.0.1.5.2 CONSERVATION OF MINERALS

0.0.1.5.2.1 Sub-grade minerals are being stacked separately. In general, the leaseholders of the area are conscious about the sub-grade minerals. In some of the Iron Ore mine, where the generation of the sub-grade mineral is of low order, instead of stacking separately, these are being blended with the high grade Iron ore to the extent of tolerance limits of the acceptable grade and dispatched to the consumers. However, in a few mines, the sub-grade Iron ore (Fe content 45% to 54%) generated are being mixed with waste and are being dumped either over the lean iron ore/sub-grade pockets or thrown in the forest areas along the hill slopes without creating any separate sub-grade dump, proposed in the approved mining plan/scheme of mining. Violation of Rule-13(1) of MCDR-1988 has been pointed out in the above cases.

0.0.1.5.3 STATUS OF PRODUCTION

0.0.1.5.3.1 Status of yearly production of iron ore during the last five years in the working mining leases, in West Singhbhum district, Jharkhand reflects that though the mining activity is concentrated within the broken area only and numbers of mines have been closed for want of forest clearance but there is an increasing trend in the production. A production of 21.73 million tonnes was reported during 2006-07. Whereas, during 2007-08, it was 24.34 million tonnes i.e. an increase of 2.61 million tonnes (12%). During 2010-11, the production was 26.40 million tonnes. The same is the increase of 1.34 million tonnes (5.35%) against the production of 2009-10 i.e. 25.06 million tonnes. If the production figure of 2006-07 is considered, the increase during 2010-11 is 4.67 million tonnes (21.49%). All the production figures are of R.O.M.

0.0.1.6 BENEFICIATION

0.0.1.6.1 Out of the 25 leases covered under the present study, processing of the ore by way of crushing & screening, is carried out in

thirteen leases. However, out of the thirteen mines, in two mines namely Noamundi of Tata Steel Ltd. and Kiriburu of SAIL, both dry & wet circuits are in operation. In other eleven mines, the R.O.M. iron ore is subjected to dry mechanical crushing and screening to make them to the desired size range.

0.0.1.6.2 Tata steel has set up a 6 million tones per year capacity pellet plant at Jamshedpur. Pellets is supplied from this plant to the company's steel plant at Jamshedpur. Tata steel has also installed India's first automated Jigging and Hydrocyclone Plant, with 1.6 million tones per year at Noamundi Iron Mines. The Jigging Plant provides the company with greater competitive advantage through more efficient use of raw materials and enhanced productivity. The Hydro Cyclone Plant, on the other hand, will help to recover iron values from the slime discharged by the washing plant, as well as reduce the alumina levels. The potential benefits of the Jigging plant are: a) Efficient use of iron ore fines so as to conserve prime natural resources. b) Reduction in coke consumption. c) Increase in the productivity of blast furnaces.

0.0.1.7 ENFORCEMENT OF M.C.D.R, 1988

0.0.1.7.1 During the present study, violation of Rule 13(1) of MCDR-1988 was observed in seven nos. of mines. Out of the seven mines, mining operation was suspended under rule 13(2) of M.C.D.R-1988 in two mines namely Khasjamda Iron Ore mines of M/S Sri Ram Mineral And Co. &Karampada Iron ore mine of M/S Shah Brothers.

0.0.1.7.2 Rule 13(2) has not been imposed in other five mines since the violation have been complied by taking the following remedial measures.

- i) By constructing retain wall in Monoharpur (Dhobil) Iron ore mine of SAIL
- ii) Removing the sub-grade & waste dumped haphazardly over in-situ iron ore in Ghatkuri Iron ore Mines of O.M.M.Ltd.
- iii) Systematising the haphazardly developed benches in Ghatkuri Iron Ore mine of M/s Runta Mines Ltd.

However, the violation pointed out could not be adhered to in one mine because of non-availability of forest clearance.

0.0.1.7.3 Violation of Rule 42(1) (c) (i) of M.C.D.R-1988 has been pointed out in twelve nos. of mines followed by show cause notice. The violation has been complied in 11 nos. of mines by appointing full time geologist as defined under the rule. Violation of rule Rule 33(2) of MCDR-1988 was pointed out in Gua Iron ore mine (Durgaiburu&Topailore lease) of SAIL since due to excessive siltation

from fines/waste dump at Gua Iron ore mine (Durgaiburu Lease-1443.756 hec&Topailore lease) huge siltation has taken place in Dam no.1 of Durgaiburu lease and Dam nos 2, 3& 4 of Topailore lease resulting in escape of materials to the natural surface water body/nala namely D.B. nala and finally causing pollution to most important perennial river of the region namely Karo. The company has complied with the rule by de-silting the above dams &nala. Moreover a new check dam has been constructed.

0.0.1.7.4 Violation of provisions of the rules Rule 23E(2), 28 (1) (a), (b), 45(5)(a), 45(5)(b) of M.C.D.R, 1988 have also been observed in some of the leaseholds during the present study and pointed out the same to the respective leaseholders for rectifications followed by show-cause notice in case of non-compliance. However, violation of the above rules have been complied in almost all the mines.

0.0.1.8 ENVIRONMENT

0.0.1.8.1 Out of the total leasehold area of 9016.028 hect. for 25 numbers of the mines/leaseholds covered under the present study, forest lands under Reserve Forest, Protected Forest and other Unclassified Forest comprises of 8221.542 hectares which is 91.18% of the total leasehold area. Out of total forest lands of 8221.542 hectares under different categories within the 25 mines/leaseholds covered under the study, the demarcated broken area 2267.8018 hectares and which is about 25.15 % of the forest lands.

0.0.1.8.2 The total land degradation in the mining leasehold due to actual mining i.e pits & quarries & dump in the areas is 1354.4702 hectares which is only around 15% of the total areas held under the lease i.e. 9016.028 hec. However, in most of the leaseholds such measures could not be initiated since most of the quarries/pits have not yet reached to its ultimate depth.

0.0.1.8.3 The following protective measures to mitigate environmental hazardous due to mining are taken.

- i) The dumps are adequately terraced.
- ii) Overall slopes are maintained between 35° to 40°.
- iii) Dump slopes are vegetated with grass & other local plants to arrest erosion. In one mine Coir matting has been done.
- iv) Garland drains & toe walls have been provided.

0.0.1.8.4 Considering the sustainable development in the area as well as the immediate need of the community the following strategy have been adopted by the lessees.

- i) Improving accessibility to basic services like education, drinking water, community healthcare facilities & livelihood;
- ii) Diversifying the livelihood option of the community in both farm as well as non-farm sector;
- iii) Promotion of community based institutions with a view to achieve sustainability of various development interventions.

7. Bhubaneswar Region: Iron ore mines of Keonjhar district of Odisha by Dr. M. K. Somani, Senior Mining Geologist.

The outcome of the study as per the objectives is as follows:

- (i) to review the resource estimation as per UNFC system with notified threshold value as new cut off vis-a-vis exploration carried out and supplemented by feasibility study;
- (ii) to explain and discuss the potential for establishing further continuity (both laterally and downdip) and further requirements of drilling (Core/DTH).

Keeping in view the nature of mineralisation and the degree of exploration done, further requirement of exploration in each of the mine covered during the study were proposed in the mining plan/scheme. In all it requires 139 boreholes to prove the ore body along the strike, depth /or barren proving in the mines covered during the study in years to come.

The remaining exploration as committed in the mining plan/scheme will be carried out in the remaining/ next scheme /plan period. The same will be monitored through MCDR inspection. Violations for the same are being pointed out during various inspections for implementation of MCDR' 1988.

The resources have been classified under UNFC codification in the mines covered under study. The total economically mineable reserves in study area as on 01.04.2011 is 112.79 million tonnes and average production based on production of Iron ore in the study area

during last five years is 9.15 lakh tonnes. The life of the deposit in the study area is 12.33 years say 13 years.

- (iii) exploration expenditure incurred/ proposed to critically assess the incremental increase of mineral reserve/resource by way of appointing geologist

Regarding the expenditure incurred in exploration no information is being supplied as it is presently not mandatory to provide the same. Presently only two mines are working of which only one mine has carried out exploration during this year but no incremental increase in reserves has been reported.

- (iv) Suggestions for taking into considerations constrains and future measures for improving and eradicating issues related to low grade resources, exploration and beneficiation of Iron ores.

1. Forest area clearance takes much of the time and energy of mine management. Forest area clearance process should be expedited. Only large Mining companies can afford the time and expense to obtain clearance of forest areas. Even, there is restriction for exploration by Government agencies like Geological Survey of India to carry out exploration in forest areas. Grounds should be cleared for carrying out exploration specially drilling in forest areas since that involves minimum area degradation. Since exploration involves minimum area degradation, forest clearance for exploration should be separate from main clearance for taking up mining activities.

2. No leases should be granted without prospecting license stage. The applied area should be prospected by the applicant by carrying out geological mapping, trial pitting and borehole drilling to cover at least 20% of potentially mineralized zone following a regular pattern of drilling with G1 scale exploration prescribed by UNFC.

3. Exploration should be carried in the leaseholds in form of borehole drilling (Core drilling / RC drilling) at a grid interval of 100 x 100 m to cover the entire potentially mineralized zone with depth up to end of mineralization to bring the reserves in G-1 category.

4. Efforts should be directed towards utilisation of fines and blue dust by setting up pelletisation plants inside the country for value addition instead of exports.

5. R & D efforts are required to be intensified by the large units for using more lower and medium grade ores to sustain resources, since high-grade lumpy ore is fast depleting. The use of low grade Iron ore fines should be established technologically, so that the life of resources can be further increased. It is necessary to increase R & D efforts to use low-grade Iron ore in blast furnaces, produced

through DRI route. The smelting reduction processes like Romelt and Corex, may also be seriously encouraged. Total beneficiation of runoff mine iron ore followed by pelletisation should be adopted for utilisation of low grade fines ores.

8. Ranchi Region: Limestone mines of Bihar and Jharkhand States by N.K. Chaterji, Asst. Mining Geologist.

The outcome of the study as per the objectives is as follows:

(i) TO DETERMINE QUANTUM OF EXPLORATION ALREADY CARRIED OUT IN THE STUDY AREA, FIND OUT GAPS IN EXPLORATION THROUGH STUDY OF PLANS AND SECTIONS AND FIELD VISIT AND SUGGEST FUTURE REQUIREMENT OF EXPLORATION LEASE-WISE:

Keeping in view the nature of mineralisation and the degree of exploration done, further requirement of exploration in each of the mine covered during the study were proposed in the mining plan/scheme. In all it requires 177 boreholes and 65 trial pits to prove the ore body along the strike, depth /or barren proving in the mines covered during the study in years to come. Keeping in view the nature of mineralisation and the degree of exploration done, and based on observation during the study period, It has been envisaged that exploration should be continued up to full depth of mineralization i.e up to +35% CaO and till the base rock is properly ascertained.

(ii) ASSESSMENT OF LOW GRADE LIMESTONE RESOURCES WITHIN THE LEASEHOLDS:

The low grade resources estimation during the study period could not be considered due to lack of exploration data. It is a new beginning to educate and induce the lessees to carry out exploration in line with new threshold value to estimate the low grade resources for future requirement.

Almost all the mines are producing cement grade limestone under the study area in Jharkhand State except one in Bokaro district, which is having high silica limestone. Based on analysis of samples and study of recovery factor reserve/resource has been estimated in this mine.

Reserve- 121128 MT (0.12 million tones)

Resource- 193190 MT (0.19 million tones)

Total- 314318 (0.31 million tones)

The reserve/resources estimated of high Silica limestone are saleable at present in the local market @ Rs. 1050/- per MT in powder form. However, the market demand fluctuates very frequently because the demand is based on requirement of local market. Based on provisional economic value, the approximate cost of reserve/resources position has been attempted to assess. Thus @ Rs 1050/- per tonne, economic value of the deposit estimated is about Rs 33.00 crores.

(iii) STATUS OF BENEFICIATION PROCESS ADOPTED IN THE STUDY AREA, QUANTUM OF LOW GRADE ORES AVAILABLE FOR BENEFICIATION, FUTURE TREND AND SUGGESTION MEASURES FOR BENEFICIATION OF LOW GRADE ORES:

No beneficiation practice is adopted in the mines under the study area except for manual sizing, sorting and blending. Since all the mines except one in the study area are producing either cement grade or BF+HM grade limestone hence beneficiation practice is not adopted in this belt. The only one mine that is producing High Silica limestone is Karma (Chora) limestone mine of Sri Kailash Singh located in Bokaro district of Jharkhand State. The mine is located on further eastward of Ramgarh district of Jharkhand State and it has been an overall observation that mines located on the east of Ramgarh district have low grade of limestone (High Silica content) which may be due to low grade metamorphism (Amphibolite facies) suffered by the area which is evidenced by the presence of Amphibolite in the area with typical Ptygmatic folding.

(iv) SUGGESTIONS FOR TAKING INTO CONSIDERATIONS THE CONSTRAINTS AND ITS FUTURE MEASURES:

About 57% of total lease area under the study comes under forest land. Hence, it is mandatory for the lessess to obtain forest clearance and NOC from State Pollution Control Board to commence any mining activity which is time consuming process. Even after obtaining all clearances, the lessees are permitted to work in the permitted broken area only which is usually on an average 35-40% of the total leasehold area. Thus a considerable forest land bearing limestone is still unexplored within the study area for which permission by forest deptt./ MOEF should be given liberally in the interest of mineral conservation.

(v) ISSUES, PROBLEMS AND SUGGESTIONS :

The limestone of Bhawanathpur group may have alternative use in Cement Plant rather than only in Bokaro Steel Plant as BF grade limestone. The Bhawanathpur limestone in general is high in Magnesia(MgO) and low in Silica(SiO₂). With changes in Blast Furnace technology consumption of limestone in Blast Furnace reduced and only better quality limestone having < 4% MgO & < 6.5% SiO₂ is now being used as flux. With this stringent specification the Bhawanathpur limestone having about 4-16% MgO and 6-9% SiO₂ are not being accepted on regular basis by Bokaro Steel Plant, as per information gathered from mine management. Under the above circumstances, the Bhawanathpur limestone may be utilized in Cement industry with certain corrective measures instead of wasting the huge deposit from Mineral Conservation point of view.

(vi) ANY SUGGESTIONS/RECOMMENDATION ON MINERAL CONSERVATION, SCIENTIFIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION:

(a) The Archaen limestone belt of Jharkhand State under the territorial jurisdiction of this office has not been explored properly. The data gathered on the basis of current excavation going on. A complete exploration report is required to assess the grade wise reserve/resource position of Archaen limestone belt of this region. The mine owners of this belt are continuously persuaded for exploration but they are squeezed between financial constraints and lack of market.

(b) Further, the discontinuous limestone belt occurring on the East of Ramgarh district, which continues upto Bokaro district, requires a thorough investigation both quantitatively and qualitatively. A beneficiation study is also required for limestone occurring in this part of the belt as the grade of limestone reduces as we move further eastward from Ramgarh district.

9. Chennai Region: Limestone mines in Tirunelveli and Virudhunagr districts of Tamilnadu State by T.P.Baskar, Assistant Mining Geologist.

As per Annual programme for the year 2011-2012, Regional Mining Geological study of the Limestone deposits of Thirunelveli and

Virudhunagar Districts of Tamilnadu has been taken up. The Archean limestone occurs mainly in banded form as well as lensoid body.

During the study it is examined that the quantum of exploration carried out and to be carried out to arrive at the reserves / resources as per the UNFC norms. However except two mechanized mines, other manual mines have not estimated the reserves as per the UNFC as the exploration carried out so far that are materially different or in compatible with UNFC standard.

All the mines covered under the study are worked by open cast method. The mechanised captive limestone mines are forming regular benches of height ranging from 3 to 9 mts. in hanging wall and footwall side. The separate benches are formed in over burden and mineral in manual small mines also. The drilling and blasting is done by jackhammer drills / wagon drills, ANFO and slurry explosives.

The community development done by the captive limestone mines have been reviewed and small mines in spite of carrying out some Community development towards education/ local festivals, the records are not being maintained .

It is concluded that major quantity of Limestone produced in the area is utilized in cement industry, chemical industry and the manufacture of Cem powder.

Many violations have been pointed out to majority of the mines under the study out of which Rule 13(1) is the main violation for which, after our efforts, Mining schemes are being submitted.

10. Hyderabad Region: Iron ore Mines with special reference to low grade Iron ore resources of Kadapa & Kurnool districts of Andhra Pradesh by Shri Debadurllav Dash, Junior Mining Geologist.

The State of Andhra Pradesh contributes about 0.35 % of the country's resources of Hematite ore and about 14% of Magnetite resources. The Reserves & resources of hematite ore in Andhra Pradesh are estimated at 163. 039 million tones and Magnetite at 1463.541 million tones as on 01.04.2005 as per IBM.

The Kadapa and Kurnool districts with total resources of Iron ore of 51.812 million tonnes are contributing about 0.35% of total resources of Iron ore in India and about 32 % of hematite reserves of the State. Andhra Pradesh has been contributing to the overall production in India with 2.5% during 2005-06, with maximum contribution being about 4 to 5% during 2007-08 & 2008-09. The production in Andhra Pradesh has been on decreasing trend since 2007-08, with slight improvement in production level during the year 2010-11. The contribution of Iron ore mines of Kadapa and Kurnool districts to overall production in A.P. varies from 14.29% during the year 2005-06 to 86.59% during the year 2010-11.

With the market demand situation during the last few years, high scale of mechanisation in the mines has resulted in depletion of high grade ores in most of the mines. The top layer of high grade ores have been depleted due to large scale mining during the last few years. For long term sustenance of Iron & Steel Industry, augmentation of resources through detailed exploration, drawing a systematic inventory of entire resources including low grade Iron ores, optimum utilization of resources through technology change for consumption of low grade Iron ores and quality up-gradation of low grade ores through developing cost effective beneficiation technology is the urgent need of the hour.

Taking above factors into consideration, a Regional Mining Geological studies on Iron Ore mine of Kadapa and Kurnool districts of Andhra Pradesh was taken during the annual programme year 2011-12 covering 27 mines. In Kadapa & Kurnool districts, forming a part of the well known Cuddapah basin, the rocks in the study area belong to the Papaghni and Nallamallai groups of the Cuddapah Super group of middle Proterozoic age.

The iron ore mines occurring in the area have reported chemical analysis varying from 40 to 65% Fe. The average grade cited in the approved Mining Plan/ Scheme of Mining has been furnished in Annexure 7. In some cases grade of ores have been cited to be varying from 64 to 65%. During the field visit of the mines in the both the districts it was observed that ores occurring in the mines are mostly low grade ores with grade variation varying from 30 to 55/60% Fe. Presently, +45% Fe is considered as cut off grade in most of the mines in the study area. It is reported that the low grade ores from the study area are blended with higher grade ores and fed to sponge plant. This is possible due to high tumbler index (85) of ores in the study area although high silica content is major concern.

In the study area, total 245 trial pits, 7 trenches and 467 DTH drill holes with total meterage of 13011 m have been reportedly carried out. The depth range of DTH drill holes are varying from 12 to 81 m. In two mines, drill holes have been reportedly drilled up to 70 to 81 m. Expected depth persistency based on exploration carried out is varying from 2m to 6m in case of float ores and in case of in situ ores it is varying from 10m to 81m. The expected strike length persistency based on exploration carried out is varying from 80m to 2236m. However, the exploration has been carried out following the strike and dip direction in a random manner without any grid pattern. Exploration in the study area cannot be prescribed as per UNFC.

However, resources have been estimated based on exposures in existing quarries, trial pits and taking into consideration proximity of boreholes drilled. In few cases, the chemical analysis of the borehole samples have been furnished up to 59 to 67% Fe. However, as per local geology it is highly unlikely to encounter such high grade ores in the area. Both the mines were found to temporarily discontinued due to low grade ores encountered. Total 124 trial pits at a grid pattern of 50 x 50 m have been suggested for float ore zone in the study area. Total 552 drill holes have been suggested in case in situ ore zone at a grid pattern of 100 x 100 m to cover the entire potentially mineralised zone up to the depth of mineralisation. The grid pattern of 100 x 100 m has been suggested since although the deposit is of bedded type, ore body occurs as pockets, lenses and thin bands with strike persistency.

In the study area, most of the mines have not employed any Geologist. Based on MCDR inspections carried out, violation of Rule 42 (c) (i) & (ii) have been pointed out to the mines. Details of cost of exploration since 2005-06 based on cost production cited in Annual Return is reported as Rs 8,38,92,730.

The length of influence for float ore has been considered from 23m to 330 m for G1 scale resources. In case of in situ ores, the length of influence considered varies from 35m to 460m. Since the deposit in both the districts have regular bedded disposition, the deposits may be considered as stratified and regular deposit. In that case, as per UNFC for G1 scale resources maximum 200 m influence should be taken. Similarly, specific gravity has been considered from 2 to 3.5 without carrying out any test to determine the specific gravity. Thus specific gravity test of Iron ore from the area should be carried out. Similarly, without carrying out any test on recovery%, the recovery% of float ore

have been taken from 20 to 75% and for in situ ore it has been considered from 60 to 100%. Thus recovery% of different fraction of Iron ores should be carried out for Iron ores of study area. The average grade of the ores in the study area has been reported as varying from 38% to 67% Fe. Since ores occurring in the study area are mostly low grade, thus in some of the mines highly erroneous information i.e. Fe grade form 59 to 67% Fe have been cited in approved Mining plan / scheme of Mining.

The up-dated resources of the study area as 01.04.2011 in terms of UNFC are as under:

Resources in 000' tonnes

111	122	211	222	333	Total
18118	12808	6070	294	14522	51812

Based on the above grade-wise distribution resources for the both districts have been classified. The grade-wise resources details have been furnished as ANNEXURE 3 A.

The grade-wise resources are as follows:

Resources in terms of 000' tonnes

<45% Fe	45 to 50% Fe	50 to 55% Fe	>55% Fe	Total
10293.3	15092.58	11334.371	16469	52516.79

The average production envisaged in approved Mining Plan / Scheme of Mining varies from 8900 t to 6 lakh tones. It is observed that the life of the deposit mine-wise varies from one year to 64 years. The mine-wise ore: over burden ratio have been determined. The stripping ratio in Kurnool district varies from 0.21 to 3.45 maximum. In Kadapa disrict, the stripping ratio varies from 0.22 to 4.83.

Low grade Iron ores from the study varying from +45% fe ores are consumed by the mostly sponge iron industries. The low grade ores varying from 30 to 45% Fe are being consumed by the cement industries as additive to balance the raw mix chemical composition. There is no beneficiation unit in the study area. The entire ROM production from these districts is of low grade and subjected to up-gradation by manual sorting, sizing and screening by most of the mines for float ores. In case of in situ ores, after drilling & blasting, the

blasted mass is manually sorted, sized and screened or fed to crushers and screening plant for sizing those to user specified sizes. It is observed that total 3790182 m³ of waste have been dumped in the study area. In some of the mines, the lessees have proposed for re-handling of the existing dumps to recover ores from it. Out of which, 1358607 t of low grade ores with grade variation of 30-45% Fe have been envisaged to be recovered by the lessees.

Waste dump in the area varies from 5m height tot 20 m height. Protection measures in form of garland drainage and retaining wall were not observed in the study area. In some of the cases, it was also observed that waste dump area have encroached the 7.5m safety barrier zone. In some cases, waste dump have developed in different location than proposed in approved Mining Plan / Scheme. In one of the mines, waste dump has been developed The mining industry is contributing towards the community development directly and indirectly in respect of education, health, water supply, employment, recreation and communication etc. (Refer Annexure- VI) The details of expenditure towards community development have been obtained from 27 mines. As on 31.03.2011, total Rs 354 lakhs have been spent on community development.

It is observed that only two areas have been covered by Prospecting lease. The details is enclosed as ANNEXURE 9, 10 &11 .The pending PL applications have been collected from respective ADMG offices. In Kadapa district, 73 PL applications are pending in ADMG office, out of which 4 are forest land.

Reason cited for pending application in case PLs in forest land is that Statutory Proformas are not submitted and for which rejection Proposal to be submitted. Illegal mining is a common feature observed during the field visit. The 50m distance on either side of a PWD road is considered non-mineable in case of a regular lease. However, local villagers are engaged in removal of road side float ore manually and with the help JCB machine. During MCDR inspection of Ramalokota Iron ore Mine of Shri K. Chandrasekhar, Kurnool district, illegal mining by the local villagers of float iron ores occurring on either sides of the PWD road was observed.

Illegal mining is a common feature observed during the field visit. The 50m distance on either side of a PWD road is considered non-mineable in case of a regular lease. However, local villagers are engaged in removal of road side float ore manually and with the help JCB machine. It was also reported that false transit permit are obtained

from Kadapa and Kurnool areas and the permit is illegally used in some other areas. An exercise undertaken by this office to determine the difference between the actual excavation and reported production since the opening of the mine. The dimension of the quarries considered was based on in some cases actual measurement in the field and based on latest available surface plan. The details of the actual production as per measurement versus reported production by the mines is enclosed as

ANNEXURE-12. In some cases, excess production reported was more than one lakh tones. The matter has been reported to the Director of Mines & Geology for further necessary action.

11. Goa Region: Re-assessment of low grade iron ore resources of south Goa district of Goa by Dr. Sunil Kumar Jha, Senior Mining Geologist.

0.1 The Regional Mining Geological Study covered 20 leases in South Goa district of Goa State. All the leases lie in Survey of India topo sheet Nos: 48 I/3 and 48 I/4 and are confined by Latitude: 15⁰07'00"-15⁰31'00" North and Longitude: 73⁰ 40'00"74⁰ 13'00"East

0.2 The total area covered by the 20 leases is 1395.1122 hectare of which 410.1408 hectares is under forest cover constituting roughly 26% of the total area besides many privately owned lands also have thick vegetation cover.

0.3 Physio graphically three types of terrain are observed in the State which grade from the low lying coastal esturine plains in the West to undulating region in the central part and to the steep slopes of the Western Ghats on the Eastern boarder of the State.

0.4 The iron ore deposits of the State are mostly confined to the central undulating region which is made up of relict hills ranging from approximately 100 to 600m. The hills and valleys of the undulating region are generally aligned in a NW-SE direction.

0.5 Geologically the rocks of Goa State belong to the Goa Group of Dharwar Super Group of Archean to Proterozoic age. These rocks have been subjected to varying degrees of lateritisation during recent and sub recent times forming an extensive cover of laterite of varying thickness in the territory.

0.6 The major rock types of the region constitutes ortho-quartzite, meta-basalt, meta-gabbro, meta-acid volcanics, quartz-chlorite-amphibole schist, meta-conglomerate / breccia, meta-greywacke, quartz-chlorite schist, carbonaceous and manganeseiferous chert, quartzite, banded iron formation (BIF), quartz-sericite schist and magnesian limestone. All the litho-units are mostly obscured by a layer of lateritic cover over the maximum Part of the State.

0.7 Structurally the Goa group of rocks has under gone three phases of folding. The first phase of folding F1, imparted a WNW-ESE strike to the rocks. The second major deformation, F2, resulted in folds with a NW-SE strike, with the southwestern limbs of the folds being overturned. This was followed by a third folding episode, F3, which was relatively milder.

0.8 All the lease holds have been covered by surface geological mapping on 1:2000 scales. Exploration by way of drilling has been done in all the leases. Total number of bore holes drilled in the leases before the approval of the mining plan/scheme is 996 nos. with a cumulative depth of 44404.17m and the average depth of individual holes comes to about 44.58m. This constitutes both DTH and core drilling.

0.9 Against a proposed 152 bore holes to be drilled during previous two years 175 bore holes have been drilled in the leases. However, in the year 2011-12 the proposed boreholes (20 leases in covered in RMG study) are 74.

0.10 All the exploration so far carried out is mostly confined around the main working pits leaving large areas uncovered under any sub surface exploration. Therefore there is a lot of further scope of exploration in most of these leases to prove the depth persistence & lateral continuity of the already exposed ore body and to explore new ore bodies/bands in these leases.

0.11 Based on the field observations and examination of surface geological plans 74 bore holes are proposed to be drilled in a staggered pattern in 200 X 200m grid pattern in 13(workings leases) leases.

0.12 During 2011-12 only 13 mines reported production of iron ore out off 20 covered mines and the total production of all working leases during this year was 33.388 million tons(From 31st May 2011 to 19 April 2012) source from Annual return of IBM. Rest of the leases are

either non-working or operations are temporarily discontinued for environmental clearance.

0.13 All the mines covered under the study are having only haematitic ore or siliceous hematite ore of Goan origin. The grade of the ore available in these mines is mostly medium to low grade and the cut off grade for most of the leases is 52 to 54% Fe content.

0.14 In 08 leases stacks of low grade/ and sub grade material was observed .The total quantity of such material is around 1.5 million tons with average grade between 52 to 45% Fe. Below this grade the material is stacked separately as sub grade/ mineral reject for future use by suitable processing by beneficiation or blending depending upon market demand.

0.15 No wet beneficiation plant for up gradation of the ROM ore has been established by any of the lessee in the leases covered under the study. However one of the lessee has a centrally located beneficiation plant to which ore is fed from different leases of the lessee.

0.16 In all other working leases beneficiation by size reduction and screening of the ore practiced by establishing mobile screening plants.

12. Bangalore Region: Iron ore mines in Tumkur district, Karnataka State by Shri V.D. Jalnapurkar, Senior Mining Geologist.

The district covered under the study viz. Tumkur witnesses Iron Ore deposit of Archean Age.

The Iron Ore occurs mainly in banded form, reef form, etc. along with iron ore, some pockets of manganese ore are also noticed. Iron Ore is lumpy, massive, friable and fines are also noticed. The generation of low grade and sub grade ore as per present market and supply scenario has also been reviewed. In all leasehold areas iron ore is noticed to be of steel grade and sponge iron grade, Fe content ranging from 52% to 62%. However, some quantity of iron ore is used in cement industry. Total 28.449 million tonnes of reserves of iron ore have been estimated of all categories as on 1.4.2011, out of

which 13.498 million tonnes of iron ore is of proved category UNFC (111).

During the study a significant emphasis has been given on present status of the community development, it is noticed that all the mines are appreciably contributing towards community development activities.

However, the comprehensive guidelines for Regional Mining Geological Study, were received after completion of field work. Subsequently, Supreme Court of law imposed ban on mining operations of iron and manganese mines in Bellary, Tumkur and Chitradurga districts of Karnataka. Hence, certain aspects like cost on exploratory operations incurred/proposed, zero waste mining as per National Mineral Policy 2008, etc. could not be covered. In spite of non-receipt of guidelines, prior to undertaking the field work, utmost efforts have been made to cover maximum aspects prescribed in the guidelines.