ANNEXURE-C

JUSTIFICATION FOR USE OF FOREST LAND AT SUKINDA CHROMITE MINE IN THE DISTRICT OF JAJPUR

Brief History:

The occurrence of chrome ore in the Sukinda Valley was discovered by the Company way back in 1949. It is by virtue of this discovery and subsequent efforts made by the Company for infrastructure development and geological exploration that even till date the largest known deposits of Chromite ore of the country rests within the Sukinda Valley.

The mining lease for the Sukinda Chromite Mine was originally granted under Prospecting License by the then Raja of Sukindagarh Estate over an area of 7 sq. miles (1813 ha) for a period of 20 years in the year 1952. After the abolition of Estate, the mining lease was vested with the State Government who ratified the mining lease obtained from the then Raja of Sukindagarh for a period of 20 years with effect from 12.01.1953.

Subsequently, 1st renewal of this lease was granted for a period of 20 years with effect from 12.01.1973 over a reduced area of 1261.476 ha.

The 2nd renewal Lease Deed over a further reduced area of 406 ha was executed on 18.05.1998 for a period of 20 years with effect from 12.01.1993.

It may be pertinent to note here that the State Government had as per the Agreement entered into with the Company during the takeover of the sick Charge Chrome Plant at Bamnipal in 1991; had agreed to renew this entire chromite leasehold area over 1261.476 ha for its 2nd renewal. Although the State Government had recommended for the renewal of the entire lease area of 1261.476 ha, the Central Government later passed an order for the above further reduction to 406 ha.

Clearances obtained:

Subsequent to the recommendations of the Sharma Committee Report dated 16.8.1995, Central Government Order dated 17.08.1995 and Hon'ble Supreme Court's judgment dated 23.07.1996, the State Government communicated the decision of the Central Government; reducing the Company's chromite mining lease-hold to 406 ha and demarcating the reduced lease area of 406 ha vide the State Government's memo no. III (G) SM-34/96-7746 dated 07.08.1996.

The leasehold area of 406 ha comprises 73.697 ha of forest land and 332.303 ha of Non-Forest land as per HAL records. The entire forest land within the lease is 73.697 ha which had been broken prior to 25.10.1980 and the diversion of the same had already been approved by the Ministry of Environment and Forests for the 2nd lease renewal period.

The validity period for the 2nd renewal of the Mining Lease is from 12.01.1993 to 11.01.2013.

The lease is due for its 3rd renewal for a further period of 20 years from 12.01.2013 to 11.01.2033. The Company has applied for 3rd Renewal of the Mining Lease in due time (one year before the schedule date of expiry in accordance with Rule 24A (1) of the Mineral Concession Rules, 1960) for a further period of 20 years. Dy. Director of Mines has received the same in Form-D by DDM, JK Road with RML Sl no. 364 vide his letter vide Memo No. 48, dated 04.01.2012.

On 03.11.2014, MoEF granted Stage-I Forest Clearance with one year working permission to the Company over 73.697 ha of forest land as per Hal ROR.

That on 01.12.2014, the State Government *vide* order No. 9414/SM, Bhubaneswar issued Express Orders under Section 8(3) of the MMDR Act in respect of the Sukinda Chromite Mine of the Company.

That on 04.12.2014, the Company communicated its acceptance of the terms and conditions mentioned in the aforesaid Express Order dated 01.12.2014 *vide* letter No. TSL/ML/1331/2014 to the Joint Secretary to Government, Steel and Mines Department, Government of Odisha.

The Company submits that it has all other statutory clearances in respect of its Sukinda Chromite Mine which are set out hereunder:

a) Environment Clearance granted on 06.09.2013
b) Consent to Operate valid up to 31.03.2016
c) Mining Plan approved on 22.05.2012
d) Stage-I Forest Clearance 03.11.2014 (Renewal of Forest Clearance)

In the meantime MMDR Amendment Act' 2015 was published on 27.03.2015 with effect from 12.01.2015. Govt. of Odisha was pleased to extend the validity period of above mining lease over 406 ha under Section 8A(6) of MMDR, 1957 as amended by the MMDR Amendment Act' 2015 from 12.01.2013 to 31.03.2020 vide its letter no. 7099/SM, Dt. 30.07.2015 (**Annexure-XXXVI**). With the above amendment of the Act and order from Govt. of Odisha the 2nd Renewal period is now been from 12.01.1993 to 31.03.2020. The Supplementary Lease Deed has been executed on 24.08.2015 for the period from 12.01.1993 to 31.03.2020.

This Forest Diversion Proposal is over 330.972 ha of forest land as on 25.10.1980(as per Sabik ROR). within the existing subsisting Mining Lease as per the MoEF guidelines dated 10.03.2015.

Location and Operational Factors:

The chrome ore occurs within the Company's lease-hold in the form of three parallel near vertical narrow bands stretching from east to west. The lease-hold area covers all tracks of lands in Villages Kalarangiatta, Kaliapani, Mahulkhal and part of Forest Block No 27.

The topographical location of the Sukinda Chromite Mine falls in Survey of India's Topo-sheet No. F 45N/16 and F 45N/12 with latitude between 20° 59' 44" N and 21° 01' 30"N and longitude between 85° 45'35"E and 85° 47'48"E.

Sukinda Chromite Mine is a fully mechanized operation with deep hole drilling and blasting as well as excavation by using shovel-dumper combination. It was the first mine in the Sukinda Valley to be fully mechanized. The Chrome ore produced from this mine is crushed and beneficiated to produce different products of suitable quality for Plants owned by Tata Steel Ltd. It was also the first mine in the Sukinda Valley to commission a chrome ore beneficiation plant for upgrading the low grade ores for conservation of the mineral. Together with the beneficiation plant, it was also the only mine in the valley to set up a well-designed zero discharge tailings dam for safe disposal & storage of the tailings. It was also the first and only mine in the Sukinda Valley to include Pyroxenite as a second mineral. The use of Pyroxenite as a flux mineral for the production of iron & steel was established in our country for the first time due to the in-house R & D efforts made by the Company.

The lease has been obtained for mining of Chrome & Pyroxenite Ore. The Chrome Ore produced from this mine will be supplied to the Company's Beneficiation Plant, its sale, for use in Ferro Alloys Plants at Bamnipal, Joda ,TS Alloys at Athagarh and upcoming ferro chrome plant at Gopalpur. Besides, company plans to produce ferro chrome from other ferro chrome plants within the State and outside on conversion agreement using the chrome ore produced from the mines. Similarly Chrome Concentrate produced through beneficiation is/shall be sold in domestic as well as in export market. The Pyroxenite ore will be supplied to the company's Steel Plant/s.

Exploration by drilling:

The Company has been successful in firming up the resources of all the chrome ore bodies below 100m depth within the lease area to facilitate the commencement of underground mining. The soft friable variety of chrome ore together with the adjacent soft and weak strata conditions which is found in the two major chrome ore bodies & expected to have the highest reserves posed the greatest challenge for undertaking such exploratory drilling. The difficulty in drilling through such soft strata was due to the frequent collapse of these holes leading to jamming of the drill rod string. The core recovery with the available drilling equipment in our country by adopting conventional drilling methods was also very poor, which would have otherwise led to erroneous results. The Company overcame this challenge by adopting the latest drilling techniques and engaged expert agencies from Australia with more powerful drill rigs at thrice the cost to drill through such treacherous strata conditions. The commitments made in the approved Mining Plan for such exploratory drilling were fully met as per schedule both with respect to total meterage and depth. Ore body model and 3D rock body model was subsequently developed for the first time in the country for chromite ore using the latest computerized Mine Planning software (SURPAC) to capture the geological data and arrive at accurate reserve estimates. This was again made possible after imparting extensive training to our team of geologists and mining engineers. The Ore body models so developed were again validated for its accuracy by engaging expert agencies.

Underground Mining:

While underground mining for chromite ore has been undertaken in our country, the same was confined and limited to only the hard siliceous and lumpy chrome ore band, the resources of which & similar types of ore in our country is very low. The quantum of production from these existing underground mines with respect to world standards and demand is also abysmally low. Underground mining was considered to be a major challenge for the remaining and major part of chrome deposit in the Sukinda Valley due to the existence of the soft and friable nature of the ore and its adjacent strata. The Company in order to conserve the mineral and mine out maximum amount of such soft and friable chrome ore from greater depths adopted a strategy of steepening of the opencast pit slopes. This was possible only after undertaking extensive geological, geo-technical and geo-hydrological studies with the assistance of CIMFR, Dhanbad and South African mining experts and geo-scientists over a period of 8 years. This has not only helped to extend the depth of the opencast pit from a planned depth of ~ 80m to a depth of ~ 100m, but has also helped in reducing the generation of overburden.

The Company has simultaneously undertaken extensive geological, geo-technical, pre-feasibility and detailed feasibility studies over the last 7 years with the assistance of South African, Australian & German expert agencies together with our own scientists from CIMFR, Dhanbad & Nagpur; for undertaking underground mining of the chromite ore in all the 3 chrome ore bands within its lease. All the 3 chrome ore bands are required to be mined simultaneously in order to meet the chrome ore quality demands of the downstream plants, just as is being met presently from the opencast mines. The feasibility study for underground mining has been completed. Based on the feasibility study, the Company has already submitted the Mining Plan for approval and has also applied for Environmental Clearance, which is under process. Further work on detailed design of the underground mine is presently in progress. The Company proposes to start the underground mine during the current lease period itself, in order to ensure meeting all its future requirements for chrome ore upon completion of the opencast workings to the planned depths. The underground mine has been designed to have a rated capacity of 2.4 MTPA during the present period of the ML and Mining Plan. The Company proposes to invest ~ Rs. 4500 Crores for developing this fully mechanized underground mine at Sukinda to its rated capacity.

The company is already operating a number of underground coal mines in the country. The company has also recruited mining engineers with adequate underground metal mining experience for undertaking underground mining operations at Sukinda. The company therefore possesses the necessary technical know-how for undertaking such underground mining.

Backfilling of open pits:

Backfilling of worked out areas has already been commenced from April' 2014. Around 10.6 ha of the OB II quarry has been already backfilled as per the approved Mining Plan. The backfilling of the remaining worked out quarries continued in full swing till the completion of the open pits up to the maximum planned pit depths and completion of the area available for overburden disposal, as per the approved Mining Plan.

Waste dump stabilization:

The overburden dumps have been suitably terraced as envisaged in the approved Mining Plan/ Scheme of Mining. Coir matting along the slopes of such dumps together with plantation has been undertaken as per the approved Progressive Mine Closure Plan. Further, toe walls, garland drains & settling pits have been provided for the waste dumps within the lease area to arrest the escape of material in harmful quantities. These again have been constructed as per the approved Mining Plan/ Scheme of Mining.

Mine water discharge & effluent treatment:

Presence of hexavalent chromium in mine water of Sukinda valley was reported way back in the year 1990. Tata Steel was the pioneer in finding out a suitable method of treating the hexavalent chromium in the mine water at Sukinda by engaging National Environmental Engineering Research Institute (NEERI), Nagpur by conducting a study in 1991. Based on the findings of NEERI the company established an effluent treatment plant in the year 1993 and used pickle liquor as the reagent for treatment, which was first of its kind in the country. As an endeavor towards a better environment, a pilot plant was established in the year 1998 to introduce automation in the dosing system and removal of suspended solids from the mine water. After successful trial of the pilot plant, a full-fledged effluent treatment plant with latest technologies of automatic dosing and suspended solid removal mechanism was established in 2002 to ensure that the water quality meets all the parameters prescribed by statutory authorities at an expenditure of about Rs 50.00 lakhs.

In the course of mining ground water gets accumulated in the quarry floor. Mine water is first pumped out to a reservoir tank. From the reservoir, water is reused within the lease as makeup water for chrome ore beneficiation, sprinkling on the haul road, vehicle washing in the work shop and gardening. The excess water is discharged out of lease boundary, after proper treatment in our effluent treatment plant (ETP).

During 2005-06, to take care of the surface run-off, the two earlier ETPs located at the lease boundary near the Geological camp and Jagannath temple were modified for Ferrous Sulphate solution treatment facility and settling pits and capacities augmented to remove hexavalent chromium and suspended solids. Garland drains were constructed all around the waste dumps and mineral storage yards within the lease to course all mine discharge water from the lease through these ETPs. The treatment of all water to render it hexa-free is therefore being regularly ensured through these 3 ETPs.

New ETP:

We have now installed new ETP (capacity 4500 KL /hr) in three modules having clari-flocculator of each having of 1500 KL/hr at the cost of Rs 33 crores. We have commissioned two modules of new ETP (capacity 3000 KL /hr). It is under full operation. The third module (capacity 1500 KL/hr) is in construction phase. This new ETP has the facilities of:

- Flash Mixer
- Clari-flocculator
- Automated Dosing system

- Filtering system
- Sludge drying & handling system
- New system will have a backup system to take care of maintenance and breakdowns.
- Reagent Handling, Solution preparation and dosing system
- Storage area has been provided for chemicals
- Lime /NaOH solution preparation system comprising of solution preparation tank conveyor for transferring the chemicals has been provided
- Dosing pumps are interlocked with flow transmitter to avoid wastage of chemicals
- Ventilation of Area has been incorporated.

Further to above, automation has been considered to avoid human interference and to regulate the dosing system based on input parameters.

- Dosing pumps shall also be interlocked with ORP transmitter and based on inlet concentration of Cr6+ dosing of FeSO4 shall be regulated.
- Pressure gauge for all pumps & blowers except Dosing pump
- Level Switches
- pH Transmitter
- TSS Analyzer
- Cr+6 Analyzer
- Flow Transmitter
- Online Data Transmission

A separate treatment plant exists to treat and supply potable water to camp residents. In addition to providing septic tank & septic pit a mechanical Sewage Treatment Plant with facilities of aeration, settling, filtration, activated carbon filter, Chlorination etc. has been installed to treat sewage generated from camp. This again is the only such plant within the Sukinda Valley.

Two Oil & Grease separation systems exist to treat workshop effluent. The treated water from oil separation is again recycled for vehicle wash.

Water treatment and recycling system in Chrome Ore Beneficiation Plant (COBP) is done with the help of a thickener. The underflow of thickener which contains tailing is discharged at the tailing dam. The water from the tailing dam is again recycled and reused in the plant. In no case water is let to go outside the plant. One online Herbal Treatment Plant has also been installed at the beneficiation plant to treat hexavalent chromium in the chrome concentrate. The chrome concentrate is stored over concrete plots. Such hexa-free concentrate product also ensures that there is no leaching effects from the same when it is stored in the mine and port storage yards.

Leaching effects from the tailing pond area:

The tailings from the chrome ore beneficiation plant is pumped for storage in a tailings pond. After settlement of the tailings within the pond, the water is re-circulated back to the plant, to make it a zero discharge system. There is as such no discharge from the tailings pond area since the pond is encircled on all sides by a high and extremely wide embankment, which with the settlement of the tailings is virtually impervious. The stability of the tailing embankment is being studied and assessed on a continuous basis by an independent agency such as IIT, Kharagpur. The topography of the area is such that any inadvertent discharge shall be restricted to remain within the lease area only and not beyond. The water quality from the nearby tube-wells within the lease area is being regularly monitored and there are no adverse results to suggest that there is any leaching effect due to such tailings storage.

R&D efforts for recovery of Nickel and Cobalt values from overburden dumps:

The Company was the first to conduct a geological exploration programme to assess the reserves of such nickel ore within its lease. The Company has taken up a number of studies of the recovery of Nickel and Cobalt values from the overburden dumps with the assistance of renowned research laboratories such as RRL, Bhubaneswar & NML, Jamshedpur. The Company has provided all assistance to NALCO who were entrusted to carry out a feasibility study for setting up a plant for such recovery. However, the study so far has suggested that the processes are not economically viable. The Company has further conducted other advanced studies on bio-leaching and acid leaching processes with the collaboration of IISc, Bangalore. However, despite our best efforts no economically viable process has been so far been established. Presently, company has also made an agreement with Ortech, Canada to conduct bench scale trial for recovery of nickel from overburden through beneficiation.

R&D for lean chrome ore beneficiation:

Further, feasibility studies were taken up for beneficiation of the tailings to maximise the recovery of chrome values which is otherwise lying as subgrade mineral within the tailings pond. Preliminary pilot scale studies suggest that this should be possible by further adopting column floatation and spiral techniques. The company has plans to set up the tailing beneficiation plant in future. With the tailing beneficiation unit coming up the in process as well as the old tailing shall be treated and the Cr_2O_3% in the final tailing would be brought down the threshold value of 10% Cr_2O_3.

Mine Development & Mineral Conservation:

The Company was the first to establish a separate Mine Planning Cell in the early 1990s. Total Station Survey together with computerized mine planning software such as SURPAC were put to use for the first time in the Sukinda Valley since then. The mine has been fully mechanized and developed to continuously enhance the production levels over the years. The development plans as envisaged in the approved Mining Plans have been adhered to. Various geo-technical studies have been undertaken to scientifically design the pits. DGPS survey instruments have been recently introduced to keep abreast with the recent technology. The Company has also installed one Slope Stability Radar for real time monitoring of the pit slope stability. This again is the first of its kind in the Chrome valley and second such installation in the country.

The Company was the first to commission a fully mechanized chrome ore beneficiation plant in 1990, for upgrading the low grade chrome ore which hitherto had no commercial use. The Company was the first and only one to start the mining of Pyroxenite ore in the Valley in 2000 and include the same as a second mineral.

The Chrome Ore Beneficiation Plant was further modernized in 2005 with the introduction of Floatex Density Separators, high frequency screens, belt filter, additional panels of spirals and shaking tables to capture the ultra-fines and thereby increase the chrome recovery and production capacity from a level of 1 LTPA to 5.30 LTPA.

Employment:

The Company has provided direct employment to ~ 600 persons within the mine. All such employees are being paid wages as per the Steel Wage Board. As many as ~2000 persons are engaged in other ancillary operations of the mine. Another ~1500 persons get indirect employment for the transportation of the chrome ore from the mine and railway sidings. Besides the above, the mine provides livelihood to at least ~ 1000 persons who are engaged in the different shops in the market place within and just outside the mine.

During the full-fledged underground mining ~1700 persons would be directly employed who would be recruited from the locality and outside based on the competency.

Corporate Social Responsibility & Community Development:

Some of the major infrastructure development projects undertaken outside the lease area in recent past was the construction of: 2 lane tarred and RCC road over ~ 20 km distance connecting the Sukinda Valley to the National Highway, other connecting roads & culverts to villages, Sub-station to provide electrical power to the nearby villages, School buildings in the nearby villages within a radius of 15 km, number of tube wells and deep bore wells, irrigation and income generation projects (poultry, mushroom cultivation, banana plantation), community centers & low cost toilets in the villages etc.. Besides, the only English medium schools & other High Schools within the colony provide quality education to the nearby communities. Other basic infrastructures like Hospital with ICU & Multispecialty ambulance facility, Bank, Post office, Telephone Exchange, Mobile Towers, and Market Complex have been developed by the company which also caters to the needs of the communities living close to the mine. Besides the company has engaged full time staff and officer's, doctor's & ambulances through Tata Steel Rural Development Society (TSRDS) to provide: medical aid, assistance for developing various income generation projects, afforestation programmes and various other training for self-employment, awareness on Aids & sanitation, recreational/ games/ sports/ culture development programmes for improving the living conditions in the surrounding villages on a daily basis. The Company on a number of occasions has deployed the 'Lifeline Express' (hospital on wheels) at the Jajpur Road, Dhenkanal & Daitary Railway Stations to provide free surgical treatment to the nearby communities. The Company on an annual basis also sponsors and organises Family Planning, Eye Cure, Blood Donation, Mega Medical Health Check-up Camps to take care of the health of the surrounding communities.

The Company and employees of the mine has rendered its services for providing rescue, relief work and aid on various emergency situations faced by the district and State through Tata Relief Fund. Some of such occasions in the recent past were during the Super Cyclone, Coromandel train mishap at Jajpur Road Station, Super cyclone Phailin, flood relief on various occasions in the district and State. Besides, the company has provided assistance in the event of fires in the local villages in the vicinity on a number of occasions.

Economic Development of the State:

The Company has been operating a number of iron, manganese and dolomite mines within the State since many years. The Company also operates the TRL refractory plant at Belpahar & Tata Sponge Iron Plant at Bileipada.

Besides setting up of the Integrated Steel Plant at Kalinganagar, Dhamra Port & Ferro Chrome Plant at Gopalpur the Company and the Group has been instrumental in setting up of the following infrastructure in the recent past, to name only a few:

- Stadium at Keonjhar
- Technical Training Institute at Berhampur
- Xavier Institute of Management, Bhubaneswar
- Institute of Mathematics & Applications at Bhubaneswar
- Industrial hub at Gopalpur
- 6 cabins in Koira CHC
- ICU at Bolangir
- Tarred road to Sonakhan Railway Siding
- Aid for Construction of Adivasi Residential School at Jamudih, Dist. Sundergarh.
- Ginger Hotel
- 500 bedded Hospital in Kalinganagar and Barhampur
- 30 nos. of Model Schools in various districts.

Companies like Tata Consultancy Services, Tata AIG, Tata Sky, Tata Teleservices, Rallies India, Tata Housing. Tata Consulting Engineers and Tata Motors also have a significant presence in the State.

Expansion Plans for the Chrome Sector:

The Company during the current lease period has already expanded the chrome ore beneficiation plant capacity located within the mine from a level of ~ 1 LTPA to ~ 6 LTPA of chrome concentrate. The expansion was completed in 2005 at a further investment of ~ Rs. 28 Crores.

As stated earlier, the Company proposes to increase the production capacity of the mine to a level of 2.4 MTPA of chrome ore together with underground mining. The investment envisaged for the development of the underground mine is ~ Rs. 4500 Crores.

The company has doubled its in-house Fe-Cr production capacity to ~ 1.1 LTPA after the takeover of the TS Alloys Plant (a 100% subsidiary) at Athgarh in the district of Dhenkanal in the year 2007. The Company under a joint venture is also setting up a captive power plant (2 x 67.5 MW capacity) within the same plant premises.

The Company is also setting up one Fe-alloy plants at Gopalpur of 0.55 LTPA capacities.In addition to the above Company is pursuing other avenues for value addition through conversion and other opportunities.

The Mining Plan/ Scheme of Mining including Mine Closure Plan has been duly approved by IBM vide letter no. 314(3)/2008-MCCM(CZ)/MS-17 dated 02.02.2009. This Scheme of Mining was in consonance with the lease period is valid upto 11.01.2013. Subsequently The Mining Plan and Progressive Mine Closure Plan for the period from 12.01.2013 onwards for further 20 years was approved by IBM vide letter no. 314(3) / 2011-MCCM (C) / MP- 37, dated 22.05.2012.

RECOGNISTION OF EXCELLENCE:

Sukinda Chromite Mine to its credit is the First Mine in Asia to Bag ISO 9001- Quality Management System (Apr'94), First Beneficiation Plant in India to Bag ISO 9001-Quality Management System (Jul'93), First Chromite Mine & Beneficiation plant in Asia to Bag ISO 14001-Environment Management System (Jan'99), First Mine in World to Bag SA-8000 Social Accountability System (2004).

The mine has been awarded with National Safety Awards for 12 times and has also been adjudged for its best performances in Annual Mine safety Week and ME&MC week functions celebrated under the aegis of DGMS & IBM respectively. The Mine has also been awarded with Quality Excellence Award for Safety & Environmental Sustainability during 2012-13, Greentech CSR (Gold) Award-2014, Aqua Foundation Excellence Award-2014, CII- 16th National Award for Excellence in Energy Management-2015, CII- Environment Safety Health Award-2014, FIMI Gems Granite Environment Award-2015, National Energy Conservation Award-2014 , Asian Leadership CSR Award2014, Greentech Gold Award for Safety excellence (2014, 2015) and Greentech Gold Award for Environmental excellence consecutively for 2012, 2013, 2014 & 2015.

Apart from above, the mine has been awarded with CII Productivity award, Orissa Safety Award, FII Award (for rural development), Rajiv Gandhi National Award, Best Exporter Award to name a few.

1. GEOLOGY & EXPLORATION :

a) PHYSIOGRAPHY:

Sukinda valley, best known for hosting the treasure of chrome wealth in the country is located in the eastern state of Orissa, India. This valley is bounded by Tomka-Daitari Range in North and Mahagiri Range in South having a general slope of 18-20° towards South-West with isolated mountains & ridges. The area has a tropical to sub-tropical climate with rainfall during monsoon months of June to September. The annual rainfall in the area is around 90 – 194 cm and the temperature varies between 8-9° C in winter to 46-47° in summer.

b) REGIONAL GEOLOGY:

The Sukinda ultramafic complex, bounded by latitudes 20°53' and 21°05' and longitudes 85°40' and 85°53', forms a part of the metamorphosed Pre-Cambrians of the Peninsular India consisting of sporadically occurring dismembered chromiferous ultramafic bodies (Banerjee, 1972). Chromite deposits are mainly associated with ultramafic rocks and based on genetic occurrences, categorized into two types – stratiform and podiform. Majority of chrome deposits, located in Sukinda chromite valley, mainly occur as bands, lenses and pockets in the serpentinized dunite-peridotite, partially or fully limonitized/lateritized at the central part of the valley. They are well differentiated layered igneous complexes and belong to the well-known stratiform complexes of the world (Mohanty, 2006). Mineralization of grey ores normally vary from massive in the central part to banded, spotted and laminated in the contact zones with the ultra-basic rock. The brown ores have been formed due to alteration of chromite ores during lateritization / limonitization which also caused obliteration of all primary structures. Chromite ore also shows distinct variation in texture and chemical composition. Chromite bands are offset by a number of dykes, faults and shear zones.

The ultramafic intrusive, trending NE-SW, consisting of Dunite, Peridotite, Orthopyroxenite and chromite seams, has intruded low grade metamorphic rocks of the Archean Iron Ore Group (IOG) with faulted contact at both the margins, in the north with Banded Iron Formation of the IOG of Tomka-Daitari Ranges and in the south with Quartzite of Mahagiri Ranges. The intrusion has been subjected to a variable degree of alteration to serpentine-talc-chlorite-magnetite±magnesite±sulfide with cumulate igneous texture commonly retained. In extreme cases, particularly in the central part of the valley, extensive lateralization/limonitization process caused formation of saprolite, limonite and in-situ as well as transported laterites and thereby causing obliteration of all primary structures.

The chromite bearing ultramafics of Sukinda area have intruded into the Precambrian metamorphites in the form of lopolith, covering 2 to 5 km width and extending from Kansa in the east to Maruabil and beyond in the west in ENE-WNW direction, at the junction of quartzite and enstatite-peridotite rocks in 40-45 km long, shear zone. The ultramafic body consists essentially of dunite-peridotite within IOG rocks with chromite bands and subordinate amount of pyroxenite devoid of chromite mineralization. They are stratiform type deposits where bands and layers are indicative of gravitational settling.

Prevalent rock types in the area include Quartzite, Serpentinized Dunite-Peridotite, Pyroxenite, Dolerite and Laterite/Limonite. The Quartzite consists of quartz grains of almost quardrant to tabular habit. The dunite-peridotite suite is highly serpentinized and has given rise to serpentinite, talc-serpentinite having a grey to grayish green colour. Pyroxenite, relatively fresh and less altered, is greenish grey in colour and composed of coarse grained orthopyroxene (enstatite). Dolerite is dark grey (fresh) to green (weathered) in colour and consists of small to medium grained plagioclase laths and pyroxene.

The regional stratigraphy of Sukinda-Nuasahi belt (Mondal, 2009) is given below:

		Generalised Sequence	Zircon Ages	Other Methods
	Kolhan Group	**KG** (Time Equivalent to SMB)		2100-2200 Ma[3]
----------	Unconformity----------	----------	----------	----------
	Dolerite Dyke Swarms	**NDS**		950-2500 Ma[3, 6]
Singhbhum Mobile Belt (SMB)	**Dhanjori-Simlipal-Dalma-Jagannathpur-Malangtoli and Singhbhum Group**: Igneous and Sedimentary Sequences	**Late Archaean to Proterozoic Mobile Belts (SMB)**		2072 Ma[5] (~3.09-2.25 Ga)[7]
----------	Unconformity----------	----------	----------	----------
	Mayurbhanj Granite	**SBG-B**	3.1 Ga[1]	
	Singhbhum Granite Type B	**SBG-B**		3.1 Ga[3]
Archaean Granite-Greenstone Terrain (AGGT) (Older Metamorphic Group, Iron Ore Group, Older Metamorphic Tonalite Gneiss, Singhbhum Granite, Bonai Granite, Nilgiri Granite, Mayurbhanj Granite	**Iron Ore Group Igneous and Sedimentary Sequences**: IOG Igneous Suites (Ultramafic-mafic-plutonic suite e.g., Nuasahi-Sukinda-Jojohatu (NSJ) ultramafic suite; Nuasahi-Nilgiri-Gorumahishani-Badampahar (NNGB) gabbro-anorthosite-diorite-mafic suite; Ultramafic-mafic suite e.g., komatiites and high-Mg basalts in Gorumahishani-Badampahar, Tomka-Daitari and Jamda-Koira belts; Felsic volcanics); IOG Sedimentary Sequences	**Iron Ore Group (IOG)**	3506.8 ± 2.3 Ma[9] age of zircon from dacitic lava within the Iron OreGroup; Tomka-Daitari Basin 3121 ± 3 Ma[4] ageof zircon from gabbroic suite, Nuasahi breccia zone 3285 ± 7 Ma[8] age of zirconfrom the pegmatitic biotite granodiorite overlain by IOG conglomerate	3205 ± 280 Ma[4] Sm-Nd isochron age of gabbroic suite from the Nuasahi massif
	Singhbhum Granite Type A	**SBG-A**	3328 ± 7 Ma[1]	3.3 Ga[3]
	Older Metamorphic Tonalite Gneiss	**OMTG**	Age clustering at 3.4 and 3.2 Ga[1]	3288 + 35 Ma[2] Sm-Nd isochron age with OMG
	Older Metamorphic Group	**OMG**	Age clustering at 3.55, 3.4 and 3.2 Ga[1]	3305 + 60 Ma[2] Sm-Nd isochron age

[1]Mishra et al. (1999); [7]Mishra and Johnson (2005); [2]Sharma et al. (1994); [3]Saha et al. (1988); [4]Auge et al. (2003); [5]Roy et al. (2002); [6]Roy et al. (2005); [8]Nelson et al. (2008); [9]Mukhopadhyay et al. (2008)

c) LOCAL GEOLOGY

Three chrome ore bands exist within the lease hold area, which are of varying thickness having NE-SW trend. These ore bodies are sub-vertical in nature. In general, Northern and Middle bands are brown, ferruginous & physically friable in nature whereas the Southern band is grey, hard lumpy & siliceous in nature.

Prevalent rock types in the lease area include Quartzite, Serpentinized Dunite-Peridotite, Pyroxenite, Dolerite, Laterite & Limonite.

The Quartzite consists of quartz grains of almost quardrant to tabular habit. The dunite-peridotite suite is highly serpentinized and has given rise to serpentinite, talc-serpentinite having a grey to greyish green colour. Pyroxenite, relatively fresh and less altered, is greenish grey in colour and composed of coarse grained orthopyroxene (enstatite). Dolerite is dark grey (fresh) to green (weathered) in colour and consists of small to medium grained plagioclase laths and pyroxene. All these rocks have been partly/fully weathered to form Limonite with secondary silica enrichment in the form of chert along fractures and pockets

The various rock types that were identified are as follows:

HUB : Hard Ultrabasics, category does not recognize metamorphic influences, unweathered grey rock
SUB : Soft Ultrabasics, weathered HUB, rock
LIM : Limonite, Completely weathered SUB, soil-like
CHT : Chert, locally overprinted on limonite to varying degrees, soil/ soft rock
DYKE : Dolerite
CRM : Chromite ore, does not distinguish weathering state

The material can be distributed into three broad groups as follows:

STRONG : Chrome (lumpy), Dyke ('hard') and HUB
INTERMEDIATE : Chrome (mixed), SUB and Dyke ('soft')
WEAK : Chrome (friable) and the limonite-chert (soil)

The country rock in the vicinity of the ore bodies at greater depths considered to be taken up for underground mining consists mainly of HUB. In the North and Middle ore bands the material near surface, and in close proximity to the ore at depth, has been preferentially weathered.

The HUB is partly or fully altered to serpentinite or talcose schist. The HUB in the vicinity of the North and Middle Ore Bands is generally much less altered than the HUB in the South Band. This is probably related to the presence of the shear zones in the north and south walls of the South Band.

RESERVE:

i) CATEGORY-WISE UPDATED RESERVE :

The category-wise updated reserve and resource of Chromite Ore as on 31.03.2015 is furnished below wherein the cutoff grade for chrome ore is considered to be 10% Cr_2O_3.

Chrome Ore Reserve & Resources (As on 31.03.2015)

Classification	Code (As per UNFC)	Quantity (in mill. Ton)
A. Mineral Reserve		
1. Proved Mineral Reserve	111	4.892
2. Probable Mineral Reserve	121 & 122	13.993
B. Remaining Resources		
1. Feasibility Mineral Resource	211	1.914
2. Pre-feasibility Mineral Resource	221 & 222	44.235
3. Measured Mineral Resource	331	0
4. Indicated Mineral Resource	332	0
5. Inferred Mineral Resource	333	16.396
6. Reconnaissance Mineral Resource	334	0
Total		81.429

Pyroxenite Reserve:

The category-wise updated reserve and resource of Pyroxenite Ore as on 31.03.2015 is furnished below.

Classification	Code (As per UNFC)	Quantity (in mill. Ton)
A. Mineral Reserve		
1. Proved Mineral Reserve	111	3.080
2. Probable Mineral Reserve	121 & 122	0
B. Remaining Resources		
1. Feasibility Mineral Resource	211	0
2. Pre-feasibility Mineral Resource	221	5.740
3. Measured Mineral Resource	331	0
4. Indicated Mineral Resource	332	0
5. Inferred Mineral Resource	333	8.740
6. Reconnaissance Mineral Resource	334	0
Total		11.820

MINING:

The Sukinda Chromite Mine Lease has been obtained for exploitation of both chrome and pyroxenite ores. The entire chrome and pyroxenite ore reserves as well as the working pits fall in the forest area.

To keep the Plants running and to safeguard direct employment of 600 employees, 2.40 MTPA of Chrome Ore (ROM) and 0.50 MTPA of Pyroxenite Ore (ROM) ore will be required to be supplied from this mine.

The table below indicates requirement of forest and Non-forest land for mining and ancillary activities.

Forest & Non Forest Land already Broken Prior to 25.10.1980										
Sl. No.	Pattern of Utilization	Area in Hect.								
		(As per HAL RoR) Stage-I Approved			Area applied for diversion, forest land as on 25.10.1980 (As per SABIK RoR)			Grand Total	Total Forest land in the lease	Remarks
		Forest Block No.27	K.F.	Total Forest	K.F	N.F.Land	Total Forest Land			
A	Mining	46.062	0	46.062	153.708	0	153.708	199.77	199.77	
B	Storing of Mineral/Ore (Stack yard)	0.41	0	0.41	36.67	0	36.67	37.08	37.08	
C	Dumping of OB * West Disposal, Feed Dump & Tailing Pond)	15.29	0	15.29	37.835	0.295	37.835	53.42	53.125	OB Dump 37.47ha & Tailing Pond 5.85ha. Total 53.420ha.
D	Storing of Tools & Machineries (Store & Workshop)	0	0	0	2.79	0	2.79	2.79	2.79	
E	Construction of Building, Power Station(COB Plant & ETP)	0	0	0	18.7	0	18.7	18.7	18.7	
F	Township/Housing Colony (Camp area)	0	0.085	0.085	35.233	0.862	35.233	36.18	35.318	
G	Construction of Road, Ropeway. Rly. Line etc.	7.19	0	7.19	11.819	0.041	11.819	19.05	19.009	
H	Magazine	0.48	0	0.48	0	0	0	0.48	0.48	
I	Green Belt	4.18	0	4.18	34.217	0.133	34.217	38.53	38.397	
Grand Total		73.612	0.085	73.697	330.972	1.331	330.972	406	404.669	

Thus the forest area of 153.708 ha has been proposed for mining which is the minimum requirement.

STORING MINERAL/ORE

The excavated ore (ROM) will be required to be processed by dressing, sorting and screening. Forest land to the extent of 0.410 ha has been approved in Stage-I storing minerals. Essentially this area besides storing the ore is also used for dressing and sorting the various grades of the excavated mineral (ROM ore) manually. The processed ore is required to be stacked grade wise in a geometrical shape for correct estimation of the production quantity and quality. These stacks are required to be not more than 1m in height and 100 tonnes in quantity for accurate estimation of the quantity & quality for the purpose of payment of correct royalty to the State Government. The analysed ore is inspected by the State Govt. authorities before the same is permitted to be despatched/ transported. Thus storing of mineral/ore is very much essential and the same has to be located suitably close to the working quarries so as to avoid chances of theft and pilferage. With new working pits to be taken up for mining in future, more areas adjacent to such pits shall therefore be essential.

For the said purpose additional already broken up forest land over 36.670 ha. is being proposed in the diversion proposal.

DUMPING OVERBURDEN

Overburden will be dumped on the old dump yard of Sukinda Chromite lease upto a quantity which is technically viable and also backfilling/ reclamation of the old quarries. The already approved forest area of 15.290 ha has been provided for dumping of Overburden and in addition, we require 37.835ha which is sufficient to accommodate additional OB to be generated from this project.

This patch of 37.835 ha has already broken up and being proposed in the diversion proposal.

STORING TOOLS & MACHINERY

For excavation of ore and to process the same for crushing, screening loading etc. and to meet the required production target, space for storing tools and machinery are essentially to be located near the mining face. For this purpose 2.790 ha of forest have already been broken up/ utilized is now asked for diversion.

However, forest land of 2.790 ha of already broken up forest land is required for storing tools and machinery in this proposal.

CONSTRUCTION OF BUILDING / WORKSHOP

In view deep mining pits for extraction of ore, setting up of new Rest shelter, Pit Offices, Canteen and Repair Shed adjacent to these pits shall be essential.

Additional broken up forest land of 18.700 ha on this account is included in the diversion proposal.

TOWNSHIP/ HOUSING COLONY

0.085 ha of forest land have already diverted area for the purpose of township/ housing colony as per Stage-I approval. Since, it is expected that it will be necessary to set up mineral separation/ beneficiation plants in future to exploit the sub-grade minerals, the township/ housing colony would require to be further expanded to provide accommodation to the employees engaged for operation & maintenance of these new plants.

Thus 35.233ha of already broken up forest land and 0.862 ha of Non-forest land is included in the diversion proposal.

CONSTRUCTION OF ROAD, ROPEWAY ETC.

7.190 ha of forest land have already broken up/utilized has been approved in Stage-I approval for the purpose of construction of road, ropeway etc. Proper haulage roads in the mining area as well as in other infra-structural areas for free and easy movement of heavy earth moving and other mining equipments. In addition an area of 11.819 ha of already broken up forest land and 0.041 ha of utilized Non-forest land is now sought or diversion.

In view of this already broken up forest land 11.819 ha has been asked for Road, Ropeway etc.

GREEN BELT:

4.180 ha of forest land have already broken up/utilized has been approved in Stage-I approval for the purpose green belt and 34.217 ha of already broken up forest land and 0.133 ha of utilized Non-forest land is now being asked for diversion.

Thus the already broken up forest land 330.972 ha is now being requested for diversion.

For TATA STEEL LTD.
By their Constituted Attorney

(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division