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CONTENTS

PRESIDENT'S COLUMN

It is indeed my displeasure to note that for the first time the December issue of SGAT Bulletin could not be published, due to want of technical papers, strange but sorrowful experience for a professional body like SGAT. In spite of repeated requests no elite members are contributing suitable articles for the Bulletin. Can a professional society of 32 years old do survive without wholehearted support of its esteemed members? Still, it is not too late to make fresh positive attempts to balance up the glory of SGAT through active participation of members. Your suggestions to improve the qualities of the activities so far rendered by the Society are solicited.

In addition, you all are aware of the fact that lots of non mining institutions and individuals are mispropaganding the mining scenario in Odisha and also in other states of the country. Medias are also promptly spreading these messages through their publications. This, no doubt gives a wrong signal to the integrity of mining professionals.

It is thus suggested that all mining technocrats irrespective of their personal and professional differences should be united to fight out this unethical propaganda against mining industries. Please do remember that a sustainable growth of mining industries of the country shall only be responsible in shinning county's economic growth. In view of this, priority from all regulatory and regulating agencies should be given to achieve overall growth of mining industries. This can practically be achieved mostly due to the cooperation of mining professionals.

Dr. S.K. Sarangi
(President, SGAT)

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BLASTING PRODUCTIVITY IMPROVEMENT AT TUNNELING WORKS OF LOHARI-NAG PALA HYDROELECTRIC POWER PROJECT, UTTARAKHAND

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ABSTRACT

The ever increasing need for rapid tunnel excavations has driven CIMFR, Nagpur to develop two new underground blasting techniques with simple modifications in explosive loading patterns. The first technique was in-hole delay cut blasting technique by inserting multiple delay detonators in cut holes to improve the solid blasting efficiency. The second one was bottom hole decking technique by inserting air-deck at the bottom of the blastholes by means of plastic spacer at the bottom of the hole and remaining portion of the hole is conventionally charged. These techniques were successfully applied at Lohari-Nag Pala Hydroelectric Power Project (LNPHEPP) and the overall improvement achieved in pull per round was 30-50%. The technique also resulted in reduced ground vibrations by 20 to 25%, which resulted in reducing rock mass damage. These techniques resulted in substantial improvements in both hard and medium hard rock formations of tunnels.

Key Words: *Tunnel blasting; In-hole delay cut; Bottom-hole decking*

1. INTRODUCTION

It is high time to concentrate upon underground mining vis-à-vis blasting, as the cost of opencast mining is going to increase in near future due to higher stripping ratio. The ever growing demand for metals and minerals is pressing the need for progress of underground blast rounds. The chances of explosive malfunctioning is high in solid blasting due to close proximity of charges. Katsabanis and Ghorbani (1995) found that the sympathetic detonation might occur if different charges are separated at less than 8 times the hole diameter. Ramulu et al (2005) applied the in-hole delay solid blasting technique successfully for blasting productivity improvement in coal mines.

There is a restriction for longer rounds of blasts in rock tunnels or drifts due to confinement proportional to area of cross section of the opening. However, plenty of new ideas and efforts are being experimented to improve the yield per blast round and implemented in coal and rock tunnels. It is known that in solid blasting, a cut is blasted initially towards which the rest of the shots are fired. The confinement, which is maximum in the cut holes in absence of any free face, is released to a great extent one the cut is developed and hence, the balance holes are blasted with minimised confinement. The efficiency of a blasting round vastly depends on the success of cut development. Wedge type cut prevails over others in India. Innovations in various explosive accessories like relays, shock tubes and others are applied in opencast blasting not yet introduced in underground metal mines due to field constraint. Hence, blast rounds deeper than 3m, are not common in India considering the prevalent restrictions. The pull to hole depth ratio also lies in a mediocre range of 0.6-0.7.

2. IN-HOLE DELAY CUT BLASTING

In view of the above conditions, an innovative in-hole delay pattern was evolved by the authors to improve the solid blasting efficiency in the coal mines. This essentially includes the use of multiple delay detonators in a single hole so that total permissible explosive quantity is distributed or segmented in different delays which are fired sequentially from

the top, where the confinement is originally smaller, to provide less confinement to the charge being fired in the next delay situated in the bottom part of the hole and having originally a larger confinement. Further, multiple delays provide additional time for the burden to be displaced more efficiently. Though this type of delay arrangement may be tried in all the holes for better fragmentation and output, but is especially useful in the cut holes or toe holes, where the confinement is larger than other holes in a round, to reap the major benefits in case of limited availability of delay detonators. The technique is briefly explained in Figure 1, which resembles to the in-hole delay initiation method used in opencast blasting using shock tubes.

This novel technique has been awarded a patent (IPMD, 2004) recently. The uniqueness of the technique is that it abides by all the existing safety criteria and uses the conventional electric delay detonators, without demanding for extra resources. As the confinement in the cut holes are maximum and the blast performance in the underground openings depend mainly on the development of the cut portion, the in-hole delay were used only in the cut holes. The salient features of the in-hole delay pattern are:

a) The collar portion of the hole was blasted prior to the bottom portion. Thus, the confinement at the hole bottom was less during firing.
b) Mid-column decking between the two charges in a hole was kept at least 0.6 m to avoid sympathetic detonation. This decking provided confinement for the bottom charge.

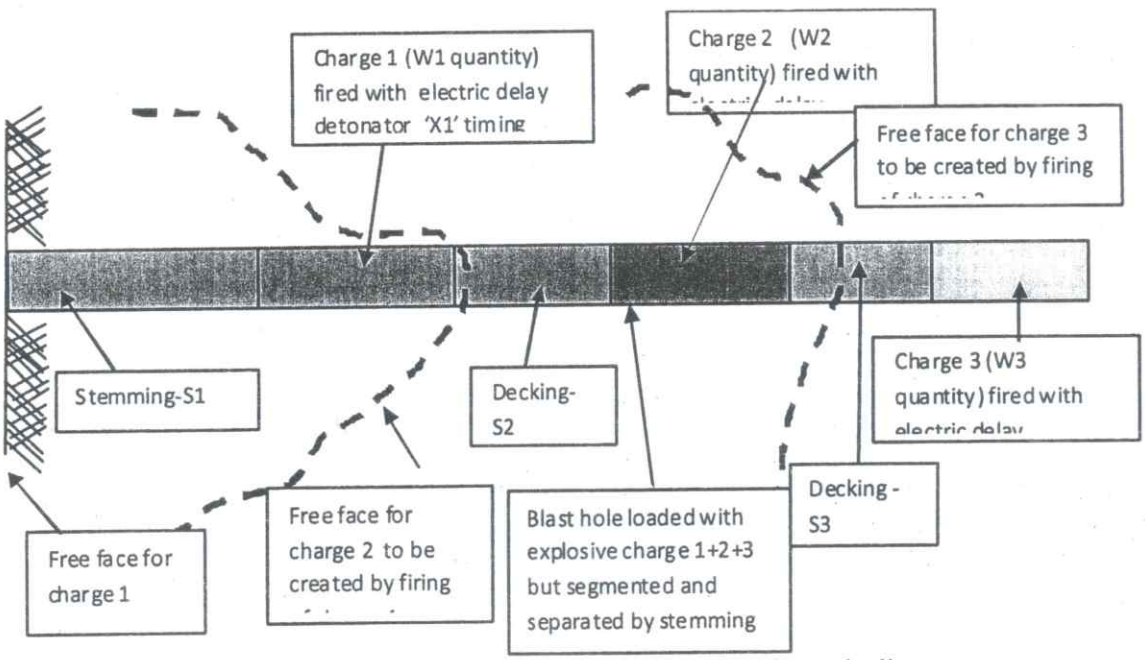


Fig. 1 In-hole delay solid blasting technique – a schematic diagram

3. BOTTOM HOLE DECKING TECHNIQUE

The mining and construction industry is striving to enhance the productivity by improving fragmentation to reduce the system cost. In order to achieve this objective, development of new techniques and their application is essential. The authors at CIMFR, experimented a blasting technique called 'bottom hole decking technique' to achieve the objective of blasting productivity improvement of the mining industry. The technique consists of air decking at the bottom of the blasthole in dry holes by means of a wooden spacer or a closed PVC pipe. Although, practice of air decking is not new thing in

blastholes, the concept of inserting bottom hole decking below the explosive column is relatively new. Explosives provide a very concentrated source of energy, which is often well in excess of that required to adequately fragment the surrounding rock material. Blast design, environmental requirements and production requirement limits the degree to which the explosive energy distribution within the blasthole can be significantly altered using variable loading techniques. Use of air-decks provide an increased flexibility in alteration and distribution of explosive charge in blast holes. The Russian scientists Mel'Nikov (1940) and Marchenko (1954), conducted air deck blasts which demonstrated the transfer of explosive energy to the overall burden was due to the repeated action of the products of detonation on the walls of the charge chamber. The conventional middle air decking has got some limitations and cannot be universally applicable to all types of rock mass and materials (Mead et al, 1993). Instead of middle air decking, insertion of decking at the top of the blast hole resulted in improvement of blast performance in terms of better fracturing (Chiapetta, 1987; Sastry, 2001). Attempts were made by Indian researchers to apply the air-decking technique for controlled blasting as well as production blasting to improve the blast fragmentation (Chakraborty and Jethwa, 1996; Jhanwar et al, 1999; Sastry, 2001; Ramulu et al, 2005). On the basis of the results of some of the early air deck tests, Chiapetta (2004) conducted experiments with bottom air-decking by means of a specially designed spacer and got good blast results of fragmentation, reduced vibration and toe. Chiappetta (2004) developed a device called 'Power Deck' which is used for facilitating bottom hole decking in the vertical blast holes of opencast mines.

The bottom hole air-decking was developed to avoid the general disadvantages of middle air decking and to simplify the complex charging procedure, associated with it. The design aspects of the technique are explained in the following sections. The bottom hole decking consists of air decking at the bottom of the hole in dry holes by means of a spacer or a closed PVC pipe, covered at the upper end. The fume characteristics of the spacer are to be tested before applying in underground coal mine. If blast holes are wet, water decking will be created at the bottom by means of a spacer with a weight attached to it for sinking to the bottom. The diameter of the spacer should be preferably one third of the blasthole diameter for easy lowering and not allowing the charge to go to bottom side while loading. The reported values of air-deck length was taken as basis for optimum bottom deck length which was about 10% of the hole depth (Mead et al, 1993). The hole contains explosive and stemming column as in conventional loading but with a spacer at the bottom. The principle of bottom hole air decking in achieving optimum explosive energy interaction on rock mass is given below:

- Reduced shock energy around the blast hole due to cushioning effect of air decking, which otherwise would result in crushing
- Explosive energy-rock interaction is more at the bottom due to relative relief zone existing at that zone.
- Effective toe breakage is due to striking and reflection of shock waves at the bottom face of hole

The procedure and sequence of blast hole loading and initiation for the bottom hole decking are given below:

- Inserting the spacer in to the hole bottom by stemming rod.
- Loading the primer explosive cartridge attached by delay detonator charging the column charge conventionally
- Stemming of the hole by proper stemming material, preferably by sand mixed clay cartridges or coarser sand cartridges.

The advantages of the bottom air decking technique in comparison to the conventional middle air decking are given below:

i) The highly confined toe is free of explosive charge but exposed to high concentration shock energy, resulting in good toe breakage and low vibration intensity.
ii) The reduced overall peak shock reduces the back break and damage.

Blast hole charge design for production blasts with bottom air-decking is Figure 2.

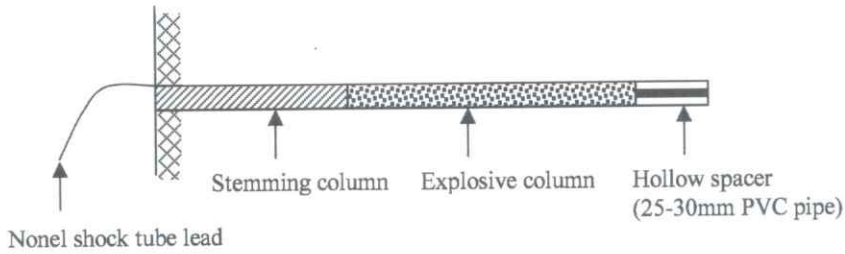


Fig. 2 Blast hole charge design for production blasts with bottom air-decking.

4. FIELD APPLICATION OF NEW BLASTING TECHNIQUES

In hole delay cut blasting technique using shock tubes of NONEL and bottom hole decking methods using plastic spacers were used at Head Race Tunnel (HRT) of LNPHEPP of M/s Patel Engineering. The details of the test site and general blasting practice are explained in the following sections.

4.1 General

LNPHPP is located in the Central Crystalline of Higher Himalayan Zone and situated in Uttarkashi District of Uttarakhand State about 230 km from Rishikesh on National Highway No.108. The Project of 600MW capacity is located on the right bank of Bhagirathi River. The location of the site falls at a Longitude of 78.53^0E and Latitude of 30.25^0N. This infrastructural project comprises of construction of 73.40 m wide Barrage across river Bhagirathi. The major underground structures under excavation include Head Race Tunnel (HRT), Power House and Tail Race Tunnel (TRT). The HRT is of 14 km long and 6.0 m diameter with horse-shoe shape on the right bank of river meant for water transmission to the Underground Power House.

5. GEOLOGICAL INFORMATION OF EXPERIMENTAL SITE

The LNPHPP falls in the Uttrakhand Himalayas and is located on the River Bhagirathii upstream of Uttarkashi district. The Uttarkahsi region is made up of two main tectonic units namely the Himalayan Central Crystallines and the Lesser Himalayan Formation. The slab of the Central Crystallines has been thrusted southward along the Main Central Thrust (MCT) over the quartzite and volcanic of Berinag Formation of the Lesser Himalayas or rock belonging to Garhwal Group. The Garhwal Group towards north is followed by the Central Crystallines which have been divided into three zones i.e. Upper Crystallines, Middle Crystallines and Lower Crystallines. Garhwal Group towards north is followed by the Central Crystallines which have been divided into three zones i.e. Upper Crystallines, Middle Crystallines and Lower Crystallines. The main rock type of powerhouse complex is schistose, gneiss and augen gneiss with abundance of mica and geotechnically the rock mass falls in "Fair Category" and it's having three sets

of prominent joints. The main two sets of joint intersecting at right angle tend to make wedge continuously. Some weak zone/clay filling, altered rock, sheared rock mass and excessive flow of water at places makes the rock poor in strength. In many places it is found that the regional trend of foliation is perpendicular to the tunnel alignment, and joint which intersects the foliation at right angle and creates wedge on roof. The strike of the foliation is going through along the tunnel alignment which is geologically not favorable because of probabilities of plane failure and wedge failure in the presence of heavy joint planes. The detailed geological information is given in the Table 1. The density of schistose/augen gneiss was 2.7 t/m^3 and Uniaxial compressive strength was 40-60 MPa.

6. DETAILS OF BLASTING

The tunnel was excavated with heading and benching simultaneously by using drilling and blasting method. Rocket boomer was used for drilling of blast holes of 45 mm diameter. Wedge cut blasting pattern was adopted with a maximum hole depth of 3.5m for the tunnels of $42m^2$ area of cross section. The specific charge was varied depending on the static and dynamic properties of rock. The explosive used was cartriged emulsion with 80% strength. Long delay detonators from 1 to 10 were used to fire various rows in different delays. The maximum charge per delay used in the blast round was 32 kg in the bottom holes and total charge per round was 224.8 kg. Total number of holes used was 96 which include 13 dummy holes at the Crown periphery of the tunnel line. The specific charge used for Schistose/Augen gneiss was 1.88 kg/m^3. The progress per round with this blast pattern was observed as 2.75 to 3.0m out of 4m effective depth of blast round. The in-hole delay cut pattern is shown in Figure 3 and the blast pattern practiced for the full face tunnel blasting at HRT is shown in Figure 4. The charge details of cut pattern are given in Table 2. The blast design and output parameters before optimization are given in Table 3.

Table 1 General geological information.

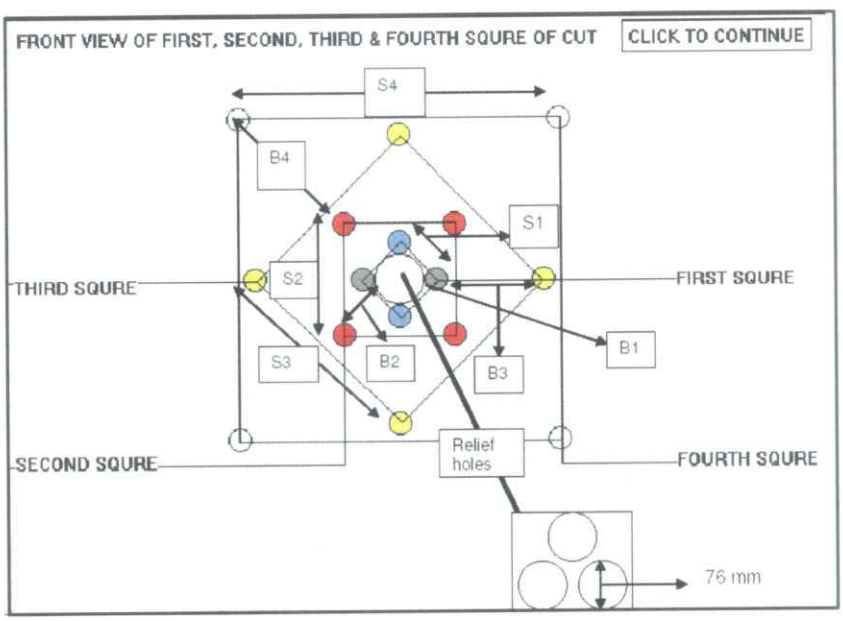
Location	**Crown to Spring level (Both Sides)**	**Below Spring level(Left-side)**	**Below Spring level (Right-side)**
Rock type	Schistose/Augen gneiss with alternative mica	Mica schist with alternative bands of quartz	Schistose/Augan gneiss with bands of mica and quartz
Critical joint angle	$50^0/52^0$, $210^0/50^0$	$095^0/55^0$, $175^0/45^0$	$095^0/55^0$, $175^0/45^0$
Seepage	Moderate	Continuous	Occasional
Wedge portion	Crown	None	Walls
Spacing	6-20, 20-60cm	6-20, 20-60cm	<6, 6-20cm
Opening	0.25-2.5mm	0.25-2.5mm	0.25-2.5mm
Joint Roughness	Rough, Planar& Undulating	Rough, Undulating	Smooth, Undulating
Joint Alteration	Altered joint, highly staining	Moderately altered walls	Moderately altered walls
Type of Filling	Mica, Quartz	Mica, Quartz	Quartz
Rock Strength	Weak-Medium strong (25-50MPa)	Weak-Medium strong (25-50MPa)	Weak (5-25 MPa)
Nos. of Joint Sets	Three joint sets + Random	Three joint sets + Random	Three joint sets + Random
Degree of Weathering	Slightly Weathered Rock	Moderately-Highly Weathered	Moderately Weathered

Location	Crown to Spring level (Both Sides)	Below Spring level(Left-side)	Below Spring level (Right-side)
Water Inflow	Dripping (Low)	Damp	Seepage at places
Rock mass quality-Q	1.53-3.04 Poor rock	0.86-1.14, Poor rock	1.15-3.04, Poor rock
Rock mass Rating (RMR)	46-49, Class III, Fair	37-44, Class IV, Poor	52-57, Class III, Fair

Test blasts were conducted to optimize the design parameters and improve the blasting productivity. The experiments were conducted under similar rock conditions and explosive parameters. Blast design parameters were modified to get maximum pull and minimum overbreak. Test blasts were conducted by applying the in-hole delay cut blasting in the first stage and the bottom hole decking in the second stage.

Table 2 Burden, spacing and charge configuration of the blast holes in the cut.

Short Delay No. (25 ms delay)	Name of square	Burden, m	Spacing, m	No. of holes	Charge/hole, kg	Total charge, kg
1	First	0.15	0.2	4	2.4	9.6
2/3	Second	0.2	0.4	4	4.8	19.2
4/5	Third	0.35	0.75	4	4.8	19.2
6/7	Fourth	0.45	1.2	4	4.8	19.2



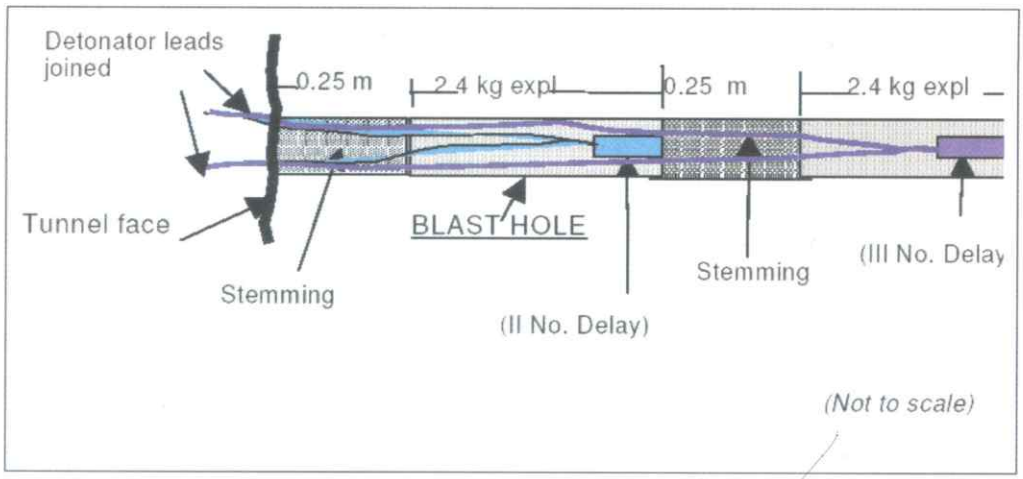


Fig. 3 In-hole delay cut blasting pattern.

Table 3 Blast design and output parameters before optimization at LNPHEPP.

Sl No.	Parameter	Value
1	Diameter of blast hole	45mm
2	Total no. of blast holes	96
3	No. of relief holes (Ø=89mm)	3
4	Charge per round	224.8kg
5	Maximum Charge per delay	40 kg
6	Velocity of detonation	4000 m/s
7	Specific charge	1.78 kg/m^3
8	Specific drilling	3.0m/m^3
9	Pull per round	2.7-3.0 m
10	Blast vibrations (at 30m)	7.6 mm/s $[V=1124(D/\sqrt[3]{Q})^{-2.3}]$
11	Overbreak	0.3-0.6m

7. TEST BLAST RESULTS

The test blasts on optimization by applying new controlled blasting techniques yielded encouraging results. The overall improvements in the blast performance are given in Table 4. The tunnel profile with visible half-casts resulted due to application of the above said innovative blasting techniques are shown in Figure 5 and 6.

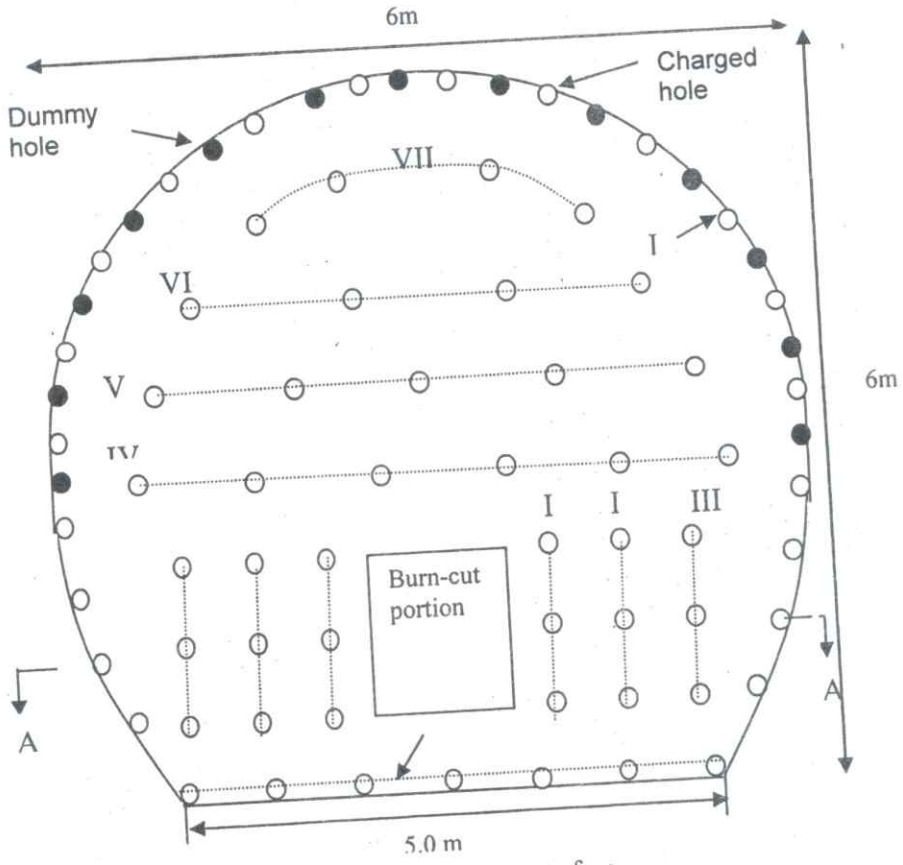


Fig. 4. Controlled blast design and blast hole geometry for HRT, LNPHEPP.

Table 4 Optimised blast design and output parameters at the dolostone mine.

Sl No.	Parameter	Value
1	Diameter of blast hole	45mm
2	Total no. of blast holes	96
3	No. of relief holes (Ø=89mm)	3
4	Charge per round	216.8kg
5	Maximum Charge per delay	32 kg
6	Velocity of detonation	4000 m/s
7	Specific charge	1.4 kg/m^3
8	Specific drilling	2.4m/m^3
9	Pull per round	3.75-3.9 m
10	Blast vibrations (at 30m)	5.4 mm/s [$V=950(D/\sqrt[3]{Q})^{-2.3}$]
11	Overbreak	0.1-0.25m

The following inferences are made from the outcome of test blasts:

i) In-hole delay cut blasting resulted in maximum pull of hole depth with pull to hole depth ratio of 0.94-0.98.

ii) Bottom hole decking with spacer of 0.30 m (PVC pipes) in periphery holes resulted in reduction of overbreak by 0.2-0.3m and substantial reduction in the intensity of ground vibrations.

iii) Application of the productive and controlled blasting techniques resulted in improvements in pull by 0.75-1.0m, decrease in Specific charge and specific drilling by 0.4 kg/m^3 and 0.6 m/m^3. There was substantial reduction in ground vibrations from 7.5mm/s to 5.4mm/s at 30m distance.

Fig. 5 Tunnel profile with minimum overbreak after application of new blasting techniques at LNPHEPP

Fig. 6 Tunnel profile with maximum half-cast factor after application of new blasting techniques at LNPHEPP

8. CONCLUSIONS

The in-hole delay cut blasting and bottom hole decking techniques were applied successfully at LNPHEPP using shock tube detonators and PVC spacers to optimise blasting productivity. The technique deploys multiple NONEL delay detonators in a hole, which adds time for the burden displacement, to partition the total charge and firing sequentially from collar to bottom in order to provide less confinement for the bottom charge to pull a greater depth. The improvements observed in all the blast performance indicators like pull, specific charge and specific drilling with 4m deep rounds. The pull/progress per round was improved by 30-33%, specific charge was improved by 20% and specific drilling was improved by 20%. There was an added advantage of reduction in ground vibration intensity by 30-40%, which obviously results in improving ground control and roof support aspects of underground mine. The overbreak/sidebreak was also reduced by 40-50% due to increase relief and reduced vibration intensity.

ACKNOWLEDGEMENTS

The authors thankfully acknowledge the Scientist-in-Charge, CIMFR Regional Centre, Nagpur and M/s Patel Engineering Ltd, Lohari-Nag Pala Hydroelectric Power Project for their cooperation during the studies. The authors owe the credit of the novel ideas explained in this paper to their mentor Late Dr. A.K.Chakraborty, former Scientist-in-Charge, CIMFR Regional Centre, Nagpur, who strived for the productivity improvement of mining and tunneling till his last breath. The views expressed in the paper are those of the authors and not necessarily of the organizations they represent.

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REFORMATION OF MINERAL REGULATION IN INDIA: NEED OF THE HOUR

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ABSTRACT

Survival of the fast growing population of India with increased per capita income demands a systematic and scientific development of mineral resources. Demands for metals is set to grow. The National Mineral Policy 1993 (NMP 1993) did not yield the desired results due to complex & lengthy licence granting procedures adopted by all the States in the country. Govt. of India is now trying to reform mineral regulation through enactment of a new MM (D&R) Bill 2011. However, the new Bill is not in tune with the spirit of the NMP-2008. This paper presents a critical review of the proposed Bill and suggests reforms to facilitate simplification of license granting procedures and other important related issues. Facilitation rather than too much regulation & control is the need of the hour. In the interest of placing the National, State and Rural Economies on a fast track mode, it is necessary for separating the proposed Act into two independent Acts, one for Exploration & Prospecting and the other for Mining. Mineral exploration is a stand-alone industry. The Mineral Exploration Act (MExA) should be dealt with by a centralized authority which could be a division of the Geological Survey of India (GSI) or Indian Bureau of Mines (IBM). Minerals being site specific, all known major mineral resource located within forests be declared as Mineral Corridors (MCs) and brought under the control of the Ministry of Mines. Regarding environmental clearance, MoEF may stipulate conditions to be followed by all clusters of Mining Lessees. Each mine-wise clearances should be done away with. Delays and inaction are depriving our villages and tribal areas the socio-economic benefits arising out of Accelerated Mineral Development.

Key Words: *National Mineral Policy, Mineral Exploration Act, Geological Survey of India, Indian Bureau of Mines, Environmental Clearance, MoEF*

INTRODUCTION

Mining and Quarrying are as important as agriculture and forestry for the very survival of our fast growing population. India, China & their neighbors now account for half of all Metal consumption and going through a process of Industrialization comparable to the US, 50-100 years ago, and post war Japan. With the increase in per capita income, the demand for all metals is set to grow at a rapid rate in the Country. Mining and Quarrying supply the most basic natural mineral raw materials necessary for the development of all kinds of industries, infrastructure, housing and power. However, Mining is a much maligned word today. Mining and Quarrying are being looked down upon as unfair and unpleasant professions and business. Miners and Quarry operators are being branded as looters and polluters. Illegal mining, transportation & care-less attitude towards environment go on despite the fact that the MM(D&R) Act is heavy on Regulation and Control with multiple Governmental authorities loaded with powers to act. It is not hard to imagine that mineral-related offences reflect cooperation, corruption and inaction on the part of some government functionaries. The offences could be drastically minimized, if not stopped, if only the Govt of the day adapts an investor-friendly law that provides for more of facilitation in the matter of speedy grant of licences, statutory clearances and less of Regulation & Control.

Govt. of India has been trying to enact a supposedly reformed MM(D&R) Bill-2011 which is expected to be investor friendly, at all levels, right from reconnaissance exploration to prospecting, feasibility studies and mining. At the same time the

New Bill, which is currently being reviewed by a Standing Committee of the Parliament, is expected to create significant revenue to the State and Central Governments and help in social and economic development of the communities affected by mining & quarrying. Alas! the Draft MMDR Bill is least investor-friendly, is more complex than the existing Act, very heavy on Regulation/ Control, heavy on taxes, fees, cess & compensations. It also demands an unreasonably high contribution to Mining Funds thus killing the very basis of Socio-economic development of affected communities.

The draft MMDR Bill-2011 was not framed by a Committee of Experts in exploration, mining, environment & rural economy. The MMDR Bill is not keeping with the spirit of the NMP 2008. It's focus is not on facilitation of exploration, discovery and speedy development of mines but is loaded with all ingredients to throttle the industry and is totally oblivious of immensely beneficial contributions of mining to the Rural Economy of our country. If implemented, without thoroughly reviewing, the Act will take us back not only to the Licence Raj but also kill any hope of industrialization of the country & rural employment generation.

The balance of payment issue arising out of the huge cost of importing of metals particularly gold, silver, platinum, nickel, copper etc will continue to worsen. The BoP is adding to the depreciation of the rupee and eating into the foreign exchange reserves of the country *(Ref. Editorial in the 8th Feb. 2012 issue of the Deccan Chronicle)*. Ultimately the mineral-based defence security of the country would also be in high risk.

We need to remain competitive. Current scenario is not conducive to attract neither FDI nor Indian private investment. On the other hand, Indian entrepreneurs are increasingly looking for investor-friendly mining policies outside India. Today the situation is such that Industrialists are forced to import coal and iron ore!! The delays and inaction are depriving our villages and tribal areas the socio-economic benefits arising out of Accelerated Mineral Development

CURRENT SCENARIO

- *India is largely under-explored especially for non-bulk metals such as gold, copper, PGMs, nickel, zinc, lead, silver, molybdenum, tin, tungsten, cobalt, antimony and Rare Earth Elements and import them at a very high cash export cost of over 50 billion dollars per annum.*
- *The Geological Survey of India and the private sector have demonstrated that the Geology of the country has the potential to deliver resources of these metals and minerals. However,* ***more than 50% of the 517,000 sq km area classified by the GSI as having "Obvious Geological Potential (OGP)"*** *is still to undergo detailed geological mapping, high-resolution geophysical surveys and basic geochemical surveys;*
- *Resources of about 600 tonnes of gold metal besides platinum and copper are known to exist but have not been converted into mineable Reserves due to delay in grant of Prospecting Licences.*
- *Indian exploration budget including (private investments) continues to a mere US$50 million which equates to* ***<0.5% of the global spend of about US$10.7 billion for the year*** *2010.*
- *Since the adoption of the so called* ***liberalized*** *National Mineral Policy in 1993 by the then Congress Govt. not a single new mine of any of the metals stated above has been established in the last 18 years.*
- *The GDP of the country has remained flat at ~2% in the last 15 years (E & Y Report, p. 34). Contribution of the mineral sector to the GDP of the country is today is ~ 2.3% as compared to 7.5% and 7.7% in Australia and South Africa as stated in the Ministry's* ***"Note for the Cabinet"*** *dt.30th August 2011. India has the geological settings to*

contribute on a similar scale to the ***GDP if only it*** *frees exploration and mining from file processing delays and lengthy mandatory clearances.*

- ***Five Year Plans of Mineral Development are rendered Meaningless due to*** *years of delay in grant of licences. That is the very reason why the 11th Five Year Plan for development of precious metals, nonferrous and ferrous metals in the country has passed without implementation of even a single recommendation contained in the Plan Document. The 12th Five Year Plan has again reiterated the urgent need for conversion of existing resources of gold, platinum, copper, zinc, iron, coal etc. into reserves and new mines.*
- *The mineral industry strongly suggests the need to* ***incentivize exploration*** *for the simple reason that mineral exploration by it's very nature is high risk until a discovered mineral deposit is proven feasible for mining. "India is the only mining country which does not allow tax benefits on exploration expenditure. It allows only that expenditure which is incurred "4 years prior to the year of commercial production which is not really helpful for the fact that the total period of exploration plus the mine construction approximate 8-10 years".*
- *The mineral industry asked for allowing* ***easy transferability of PLs and MLs.*** *Enabling easy transferability of licences and data for a profit, as in advanced mineral economies such as Canada and Australia, would help the country to attract high levels of investment into mineral exploration and mining. "An investment of US$ 1 in exploration is estimated to give a return of US$15" (Ernst and Young Rept.-2011, p. 34). Another independent study says, for every rupee of investment in coal mining there is an investment of Rs.12 in the downstream value chain and ancillary industries.*
- *The "Note for the Cabinet" referred to above also states that the* ***"main factors responsible for lack of adequate investments into the mineral sector were the procedural delays in processing of applications for mineral concessions".*** *It took 6 years for the grant of first set of Reconnaissance Permits after the National Mineral Policy was introduced in year 1993.* ***Thereafter, it took 7 to 8 years for grant of PLs having 3 years tenure! 46,885 applications are pending as at the end of 20th Sept. 2011*** *as per the proceedings of the quarterly meeting of the CEC held in New Delhi. These applications include 15,535 PL applications and 452 RP applications and 30,898 ML applications!!*
- *License for Exploration,* ***be it reconnaissance or prospecting,*** *is a simple permission as it* ***does not involve acquisition of land; does not cause damage to forest and no environmental pollution.***
- *Lack of* ***security of tenure*** *for progressing from reconnaissance exploration to prospecting licence to mining lease has been one of the major concerns of the private investors. Such concerns emanate from situations where by the State Governments take adhoc decisions to reserve areas held under application by a private investor and even those areas explored by the private, in favour of State PSUs.*
- *Mineral exploration is a multibillion dollar industry in the world today.* ***India requires investment of the order of about 300 to 500 million dollars per annum on exploration alone.*** *Because much of this investment is high risk, the Laws pertaining to mineral exploration should be seamless & easy on investors in terms of procedures of Grant, Agreements & Transfer of Licences, and pledging & hedging of mineral resources at the Exploration stage.*
- *Our population has grown to about 1.2 billion out of the global 6 billion.*

We are going to be 1.5 billion in the next 30 years. Our towns have become cities and cities are becoming megacities. There are plans afoot to Provide Urban amenities in Rural Areas. Production of food grains, their protection, preservation and transport to the extent of 350 million tonnes needed for the future require huge quantities of metals and minerals. Housing for millions; lakhs of kms of pipe lines; construction of thousands of kilometers of roads, flyovers, subways, railway lines; building of mega ships; thousands of passenger & defence aircrafts; energy independence; health services, clean water for all; millions of computers, TVs and millions of other electronic equipments-- all these needs are forcing greater and faster consumption of natural construction materials, iron, steel, aluminum, copper, zinc, nickel, platinum, palladium, chromium, titanium, vanadium, molybdenum, cobalt, cadmium, graphitic carbon, uranium, rare earth metals and variety of other rare but important metals used in telecommunication and the indispensible space technology. The demand for gold not only as a piece of ornament but also as a source of financial security has not diminished despite its high price.

- ***Huge investments in exploration has a great multiplier effect in terms of employment & development of ancillary industries, generation of far reaching flow-on benefits;*** *for eg., Exploration promotes India-specific R&D of geophysical, geochemical tools, equipments, related electronics and data processing softwares, chemical labs and geophysical service providers; development of deep drilling and multipurpose drilling machines, manufacturers of drilling accessories and service providers; Mineral processing related R&D and service providers; Development of data processing, resource estimation & modeling softwares; Application related academic research on Mineral deposits; Remote sensing satellite derived data acquisition, processing and interpretation; training of geologists, geophysicists, geochemists, metallurgists and GIS cartographers needed for the exploration industry and lastly financial institutions who understand exploration-related risks & rewards .*
- *Mineral exploration deserves incentives to encourage heavy investments and to make quick discoveries.* ***If successful, the facilitators i.e. the Governments at State, Centre and the local people will automatically share the revenue in terms of as much as 40% of all kinds of taxes, employment and compensatory benefits. Expenditure on mining and mineral processing, some times as much as 50%, will go into the local economy.***
- *Minerals Exploration should be treated as a stand-alone industry with peoples participation through stock exchanges like in Canada, Australia, USA, UK, China & South Africa.*

The existing Act as well as the new MM(D&R) Bill have failed to recognize that the stake holders in the mineral industry are not the Geological survey organizations of the State & Central Governments but private investors and PSUs; small and big, junior explorers and mega mining houses, be it Indian or foreign. The New Act aims to accommodate the concerns of all but, in so doing has ended up creating a series of hurdles for true stake holders – the private investors and the PSUs.

The contents of the new Act appear to favour a few private Indian major industrial houses that have the potential to monopolize the Indian mineral industry by garnering all mineral-bearing lands and mining leases through the auction process introduced in the Act. "Spectrum is not a natural resource", hence it's comparison with mineral prospects and not fully proven resources is untenable.

Instead of analyzing all these problems facing the stake holders in the country and accordingly framing a new Act, the MoM has drafted a complex and overly-regulated document topping it with a demand for sharing a significant proportion of the profit over and above a generous compensation to the land losers.

The demand for sharing a proportion of the miner's profit was the suggestion made by the GoM, hence it is a political agenda introduced as a Law into the Act. **This "super Tax" demand may not be tenable in terms of Article 14 and 19 of the Constitution of India for the fact that the right to minerals vest with the State Govt and the displaced person only has agricultural or traditional rights with no rights on minerals. Govt is entitled for a share of the mineral in the form of royalty, duty, cess besides Corporate tax or income tax but not any more than that.**

The profit sharing law is made mandatory selectively to the mining industry ignoring the fact that people lose much more land for many non-mining projects Eg. Formula-1 Circuit; buildings, highways, power projects, SEZs. It is rumored that the GoM have also ignored the suggestions of the Dy.Chairman of the Planning Commission to make a detailed study of the implications before introducing the profit sharing law into the Act. The Ministry has failed to note that the Black Economic Empowerment Act in South Africa, which may have been the inspiration for the proposed amendment, is uniformly applicable to all companies and sectors.

The Central Govt is introducing a new Companies Bill making it obligatory for the Companies to spend 2% of their net profit on CSR activities and also constitute a Corporate Social Responsibility Committee (CSRC) which shall recommend to the Board a CSR policy which should be placed on the Company's website.

The new Act has enough provision to **compensate the land loser** before commencement of mining **{Sn.43(6)}**, during mining by way of employment and allocation of a share per every affected person**{Sn.43(3 & 5}** and after completion of mining for the damaged land **{Sn.43(7)}. These compensations and sharing of profits become effective for all the mines granted w.e.f. 1.1.1997 as per Sn.43(11) of the new Act !!.**

Another Bill that is going to affect the Mining Industry is the **National Land Acquisition and Rehabilitation & Resettlement (LARR) Bill, 2011.** This bill is also meant for compensation to project affected persons. Therefore the draft Mining Bill needs to be aligned with the other Bills.

From all these angles the proposed Act is most likely to discourage any significant private investment into exploration of metals and minerals which are in great demand with in the country, hence entirely dependent on imports at huge cost. The mining industry, both in the private and public sectors, have been demand ing for thorough review of the proposed MMDR Bill-2011.

MAJOR DEFICIENCIES OF THE PROPOSED MM (D&R) BILL 2011:

- **Complex system of grant of licences for Reconnaissance exploration and Prospecting:**

For the fact that the new Act lays emphasis more on Regulation and Control than Development and Facilitation, it is a retrograde approach. Bulk of the Act deals with provisions to control & engage multiple govt agencies to check, verify, investigate and direct. Instead of a single Exploration Licence leading to mining, the New Act has introduced a complex system of 5 different methods for grant of licences. They are:

(a) Section 4(2) to be read with Section 23(1) for allotting areas for Government survey organizations;

(b) Section 13 for grant of Prospecting Licence through auctioning;
(c) Sections 19 & 20 for grant of non-exclusive Reconnaissance Licence (NERL);
(d) Sections 21 & 22 for grant of High Technology Reconnaissance cum Exploration Licence (HREL); and
(e) The same Sections 21 & 22 for grant Prospecting Licence (PL).

1) **Section 4(2) read with Sections 13 & 23(1) of the Act**: The Section 4(2) provides for reservation of areas for reconnaissance exploration by Govt. survey agencies, chiefly GSI, MECL and Directorate of Mines and Geology in all the States. This is not there in the existing Act. This was not the intention of reforms introduced in NMP-1993. This enables the Govt. Geological Survey organizations to spend tax payers money and compete for exploration lands with the private sector instead of acting as a facilitator for promoting exploration and prospecting by the private sector and PSUs.

The tenure of this reservation is 3 years for reconnaissance exploration and 6 years for prospecting, a total of 9 years, besides ear marking crores of rupees tax payers money for the said purpose. **Sn 4(2)** has been introduced on the basis of a firm belief that private investors and PSUs would commit to invest crores of rupees in prospecting and mining via the Auction route **u/s 13** of the Act and on the basis of reconnaissance data and mineral resource/reserves estimated by Government Geologists. The State Governments should be naïve to believe so because the quality standards of Govt estimated reserves will be viewed as not on par with the international codes followed by stock exchanges, institutional investors and even Banks in India. **Thus the question that naturally arises is whether there is any real need for the country to provide for reservation of large lands, block it for up to 3+6=9 years and allocate tax payer's money for reconnaissance and prospecting by Govt. Survey organizations?.**

2) **Section 13** is introduced in the Act for auctioning of mineral bearing lands already explored and relinquished by govt survey organizations- GSI, MECL & DGMs etc under Section **4(2)** and private agencies and PSUs under Sections **19 to 22. There was no need of introducing auctioning for grant of Prospecting Licence.** The existing system of grant of PL is working very well except for the enormous delay in disposing the applications. No stake holder has complained against the present system of grant of PL save for the lengthy procedures. FIMI, which is the industry representative has argued against introduction of auctioning. With the exception of a few captive mineral-based industries no other stake holder has favoured introduction of auctioning for grant of PLs.

Drawbacks of the system of Auctioning:

a) Areas explored in a reconnaissance way may, at best, reveal mineral/metal bearing areas, defined as anomalies by geological, geophysical and geochemical methods. Reconnaissance operations rarely reveal significant mineral resources. Therefore, valuation of such anomalous mineral-bearing grounds will be a subjective & speculative exercise on the part of State Governments, consequently the selection criteria for grant of PLs would be a highly questionable exercise leading to litigations.
b) After all, the GSIs total budget for the 12th Five Year Plan is a

megre **Rs.4,500 crores which accounts for about Rs.900 crores per annum** which is, infact, the money required for exploration of only one metal Eg. gold in the country per annum. Therefore, such provision for reservation is not in the interest of Mineral development in the country. **GSI, being a non-commercial Scientific organization, should be permitted to enter upon any land be it leased or otherwise to enable it to collect fundamental scientific data. Do not reduce it to the level of competing for land with the Pvt. sector & PSUs.**

c) The assumption of value realization through Auctioning {see the Explanation to **13(3) of the new Act**} encourages State governments to reserve large areas u/s **4(2)** in favour of State & Central Geological survey organizations for conducting reconnaissance and prospecting operations thus **blocking exploration ground for up to 9 years** and enabling these organizations to act as competitors than facilitators of exploration and prospecting by private sector and PSUs.

d) Reservation of thousands of sq kms of tracts for reconnaissance exploration is anti-reform; is not in the existing Act and is not in accord with NMP-2008.

e) The FIMI, the HODA Committee as well as the stake holders have favoured auctioning of **fully prospected blocks** for grant of Mining Lease, not for PL.

f) The auctioning system requires notification of large tracts of lands explored and relinquished by Govt. Survey organisations, private companies and PSUs **{Sn 13(1) & (11)}**. The process of Notification of lands, calling for bids and selection not only causes huge delays but it also has a great potential to trigger corruption and litigations.

g) Section **4(2) read with Section 23(1)** will only waste precious 9 years (Recce 3 yrs + 6 yrs for prospecting) because private companies would not totally trust the data and resources/ reserves generated by the Govt survey organizations.

h) Countries highly successful in discovering and developing their mineral resources have not adopted auctioning method for attracting risk investments.

i) Auction will only attract speculators and profiteers rather than serious players. Auctioning of mineral anomalies and resource blocks other than fully proven will also encourage monopolistic tendencies.

j) **Section 13(2)** – Empowers the State Government to call for competitive bids even on an area recognized by a stake holder and applied for PL. There are a series of 4 complex provisions following Section 13(2). In the interest of simplification this Sub-Section should be deleted.

k) **Section 13(3) - Section 13(3)(a) to (g)** – these conditions are prescribed as criteria for assigning weightages for selection of best bids for grant of PLs. *The conditions to be prescribed for grant of Mining Lease have been prescribed for grant of PLs. Hence, these selection criteria are untenable.*

l) **Section 13(3)(B)** – *This sub-section attempts to recover from the bidder a value "on the basis of market consideration to be based on a floor price set by the State Government on the available reconnaissance data".* This is really absurd. How could a value for the

mineral(s) be assessed even before prospecting is carried out and quantity and quality of minerals are discovered?

There are many other reasons against auctioning method of grant of Prospecting Licences. We, therefore, plead with the Hon'ble Members of the Parliament to suggest for getting rid of Sections 4(2) and 13, instead, recommend for utilizing the tax payers money for generating basic, fundamental, scientific, geological, geophysical and geochemical data for the country. This way the Govt. organizations can facilitate and fast track mineral exploration in the country rather than ending up as competitors to the private sector and PSUs.

3. Non-exclusive Reconnaissance Licence (NERL) (Sections 19 & 20):

Among the above 3 methods of grant of areas for reconnaissance exploration and prospecting it is best to retain the HREL for it's distinctive merits. HREL in a single licence allows for both reconnaissance and prospecting eventually leading to application for Mining Lease.

It is not clear to anyone except perhaps to the officials of Ministry of Mines why **NERL** has been introduced. The way the Rules are framed in the new Act gives the impression that NERL is an unworkable proposition for conducting reconnaissance. It is intended to create competition among stake holders but does not guarantee that the stake holder will eventually end up obtaining PL and ML. Look at the following sections which makes NERL an impractical proposition;

(a) NERL is intended to encourage exploration by more than one person on the same block of land. However, each later applicant has to submit a Reconnaissance Plan different from the earlier one (**see provision 2 19(1)(b) and the follow up explanation**). The plan has to be for every quarter which should accompany detailed projection of proposed expenditure **{19(1)(b)(v)}**. Added to these unworkable stipulations, the plan of operations can only be modified with prior approval of the State Directorate. Further, the State Directorate or the Central Govt. may direct the licencee to modify the plan of operations if it is in conflict with the earlier applicant for NERL. These conditions and several others reviewed in the following are stipulated with very little knowledge of how reconnaissance mineral exploration operates.

i) NERL is meant for reconnaissance only within a very short period of 1 to 3 years over a large area of 10,000 sq km (minimum has not been fixed in the Act) {**see Sn 7(1)**}.

ii) Any mineral exploration programme is a dynamic process which may keep changing on a weekly basis depending upon results of previous exploration; change in the concepts of the team incharge of exploration, changes in the market price of metals sought, changes that might happen in the land use patterns and access to land during the course of exploration of as large an area as 10,000 sq km. Therefore, **there should be enough freedom for the explorer to operate**. The law should not prescribe impractical conditions that makes every applicant to submit different Reconnaissance Plans {provision to **Sn 19(1)(b)**} and detailed quarterly projection of expenditure on operations **{19(1)(b)(v)}**. How can anyone predict detailed expenditure on a quarterly basis without even carryout reconnaissance?

iii) How can anyone submit Quarterly Plan of operations containing "particulars of the machines, instruments, nature of the data proposed to be collected **{19(1)(b)(iii)}**". GSI, IBM, DMG well know the nature of the data collected during Reconnaissance mineral exploration. The Act does not stipulate Government Survey

organizations to submit Quarterly Plan of operations and detailed expenditures. There is also no law for GSI, DMG etc. to modify their plans with the approval of the State/Central Government. Why should such impractical conditions be prescribed to the private players and PSUs?

iv) Added to the above, HREL, PL and MLs can be granted over a granted NERL **{see Sections 9(1)}.** As per 22(6) & (7) a first-in-time PL from someone else over NERL has the preference for grant. As per 25(3) ML grant is subject to eligibility criteria. Therefore, an NERL licencee cannot entertain any hope of receiving PL or ML grants.

As at the end of 20th Sept. 2011 *as per the proceedings of the quarterly meeting of the CEC held in New Delhi,* ***452 RP applications*** *are pending in different States.* As per **Sn 4(6)(c)** read with explanation to **Sn 137(1)(iii)** (transitory provisions) applications currently pending for Reconnaissance Permit shall get granted as NERL.

Where is the need for NERL when HREL can deliver results much faster, smoother with least possibility for litigations? The only demand of the stake holders is to reduce the prospecting fee and security deposits from the proposed **Rs.2.5 crores per annum for 5,000 sq km area {Sn 21(1)(g) & Sn 21(4)}** as per **Sn 4(6)(c) & Sn 137(1)(iii).**

On all the above grounds the NERL is an unworkable proposition. Therefore, we suggest that it is best to delete it from the Act. As it stands now, NERL does little to promote exploration in the country.

4. High Technology Reconnaissance cum Exploration Licence (HREL) and Prospecting Licence (PL) (Sects.21 & 22): Discovery & Development should be the focus of the Act; too much of regulation & as many as 5 regulatory organizations have completely curtailed the freedom for scientific exploration{Sn 21(1)(b)}:

a) The tenure for HREL is 3 to 6 years + 2 years and 2 to 3 years for PL **{Sn 7(2) & (3)}**.This provides for discretion on the part of the granting authority. It is necessary to explain when 3 years is applicable lest the State Governments at its discretion may prescribe 3 years even for 5,000 sq km of HREL and 2 years for 500 sq km of PL.

b) Selection criteria commonly prescribed for grant of ML have been stipulated for grant of PLs {**Sn 13(3)(c) to (g)**}. Selection criteria for PL should be a good track record of successful exploration and financial capability. **Sn13(3)(c) to (g)** have the potential to keep out technically highly capable junior companies and even individuals.

c) **As per Sn 20(1)(g)(i)** HREL is restricted to non-bulk minerals. But why? By so doing, the Act will restrict the possibility of discovering subsurface bulk mineral deposits such as, chromite, magnesite, manganese, haematite, magnetite including titaniferous magnetite seams etc.?

d) **As per Section 21(1)(b)(iii)** an Exploration Plan(EP) has to be submitted every 6 months. An annual EP together with a forecast of gross expenditure commitment would be a more meaningful condition. As per **Sn 21(1)(c)** a licencee is not free to change the plan without a direction from IBM or State Directorate or Central Govt.. *Such directions may not be in line with the concepts and scientific approach, hence not acceptable to a licensed explorer.* A licencee should free to change his plans and programmes to achieve the ultimate goal of discovering mineral deposits.

e) Any mineral exploration programme is a dynamic process which may keep changing on a weekly basis depending upon results of previous exploration; it may change with the changing concepts of an exploration team; changes may occur due to non availability of equipments or service providers; due to inordinate delay in granting certain clearances from the Government and local people may prevent access to land etc. thus affecting schedules and before even starting reconnaissance operations under HREL, it is unreasonable to demand the licencee to spell out the number of pits, trenches, boreholes, number of samples to be drawn, particulars of machines to be used and also to predict the details of exploratory mining to be undertaken. Therefore, **there should be enough freedom for the explorer to operate**.

f) As per **21(1)(b)(iv)&(v)** baseline information on environmental conditions to be provided together with EMP well before commencing reconnaissance and prospecting operations. This demand is harsh on the licencee for the fact that there are no instances of serious adverse effect of reconnaissance and prospecting operations on environment. **However, the Act may specify conditions for a licencee having a programme of exploratory MINING to provide environmental baseline data and measures for environmental protection.** Likewise drilling programmes proposed within forest blocks should carry similar conditions. Similar conditions have not been made applicable to GSI and State Directorates. In any case **Sns 46, 47 & 48** incorporate all powers to issue directions under National Sustainable Development Frame Work and State Sustainable Development Frame Work.

g) **As per 21(1)(d) a Licencee has to submit reports to GSI, IBM & State DGMs**: Reporting to two Govt. Departments like the State Directorates and the GSI should be enough. GSI should share the data with the IBM.

h) Under the New Act, PL can be granted only to a NERL licencee or through the bidding process under **Section 13** of the Act. As per **Sn 22(6)** a PL application will have preference over NERL and HREL. As per **Sn 9(1)** HREL and PL will have preference over NERL. As per **Sn 13(3)** bids should be called even on direct PL applied areas and grant it through a complex process of "Swiss Challenge". All these involve constant vigil on the part of lower bureaucracy, identification of areas and issuing of notifications from time to time from an alert bureaucracy calling for applications or bids for granting PLs {**see Sns 13(1) &** more complicated procedures **under 13(11)**}. Hence, the entire process is too complex to follow. **Many applicants will end up in Tribunals and Courts instead of exploring for minerals.**

For the many good reasons cited at para 2, 3 & 4 above, I suggest for deletion of the auction route and NERL (Sns 13 & 19). The Act should be amended to retain only HREL with area stipulation from a minimum of 1 sq km and max. 5,000 sq km with tenure from 3 years to 6 + 2 years. If this is done, the Act is simplified and removes the complex process of granting NERL, PL and Auctioning. It will expedite the time it takes to reach the mining stage which is the ultimate goal of any mining Act.

5. TAX REGIME INCLUDING COMPENSATION FOR LAND OWNERS:

The current and proposed taxation including the super tax suggested by the GoM is a major deterrent for private sector participation in India including FDI. If the proposed Act is implemented, the tax contribution of the exploration mining industry would include the following:

High fee for doing exploration and super tax for doing mining in the country!!

i. **Section 19(1)(j) Annual fee for NERL (Non Exclusive Exploration Licence):** Rs.50 to Rs.500 per sq km per year. When a range of fee is fixed the States always charge the maximum limit (Rs.500/- in this case) as has been the practice in the past. This amounts to Rs.50 lakhs per year for 10,000 sq km area prescribed under Section 6(1)(a) of the Act. **No minimum area is fixed for NERL.**

ii. **Section 19(4) Security Deposit:** This is equal to the NERL. Rs.50 lakhs payable by the licencee for the first year.

iii. **Section 21:** Application Fee and earnest money for NERL will be prescribed by the Central Government.

iv. **Section 21(1)(g):** Annual fee for HREL (High Technology Reconnaissance cum Exploration Licence) of Rs.50 per hectare. It amounts to **Rs.2.5 crores** per year for 5000 sq km which is the maximum limit prescribed as per Section 6(1)(b) of the Act. **For 3 years Rs.7.5 crores and Rs.15 crores for 6 years which is the maximum limit as per Section 7(2) of the Act.**

v. **Section 21(4):** HREL Security deposit of **Rs.2.5 crores** for the first year.

vi. **Section 21(1)(g):** PL fee Rs.50 per hectare. It amounts to **Rs.25 lakhs** per year for 500 sq km which is the maximum limit prescribed as per Section 6(1)(c) of the Act. **For 3 years Rs.75 lakhs fixed as per Section 7(1)(3) of the Act.**

vii. **Section 21(4):** PL Security deposit of Rs.25 lakhs for the first year.

viii. **Section 17(6):** NERL, HREL & PL Transfer fee - as may be prescribed by the Central Government.

ix. **Section 18(3)(b) & first provision to 3(b):** ML Transfer fee and additional fee.

x. **Section 24(1)(e):** Surface rent and water tax to be prescribed by the State Government.

xi. **Section 24(1)(n):** Security deposit on Mining Lease @ Rs.1 lakh per hectare. This amounts to Rs.1 crore per 1 sq km. The amount is payable an equal installments over the approved mining plan period.

xii. **Section 43(1):** Annual compensation payable by NERL, HREL and PL holders to every person holding "**surface rights of the land over which the licence has been granted**". **This imposition will strangle the exploration industry if compensation has to be paid in advance each year to every person holding surface rights over the entire area of the licence.** The manner of payment of the compensation amount will be prescribed by the State Government. **Is it ever possible to collect land holder data over the entire area of 10,000 sq km of a NERL, 5,000 sq km of a HREL and 500 sq km of a PL? This Section has to be reworded for clarity for the fact that a licencee is liable to pay crop compensation only to the owners of the land that he is going to use for conducting prospecting operations.**

xiii. **Section 43(7):** payable by all exploration and prospecting

licence holders and mining lessees to compensate the land owners for the damage done after completion of reconnaissance or prospecting or mining. This compensation will be assessed and/or approved by the State Government.

Comment: A licencee would have already paid appropriate compensation each year in advance for the land utilized for purpose of prospecting and exploration, as per Section 43(1) of the Act. This being so, why should there arise payment of another round of compensation by exploration and prospecting licence holders at the end of the operations as prescribed in Section 43(7) of the Act?.

xiv. **Section 43(2)(a):** a mining lessee, other than coal and lignite, shall pay an amount equivalent to the royalty paid in a financial year to the District Mineral Foundation (DMF) constituted as per **Section 56(1)** of the Act.

xv. **Section 43(2)(b):** a lessee holding mining lease for coal and lignite shall pay an amount equivalent to 26% of the profit after deduction of tax of the immediately preceding financial year to the DMF.

xvi. **Section 43(6):** compensation payable to the land owners at market price for purchase or lease.

xvii. **Section 43(3)** – allocate one share for every person affected by mining

xviii. **Section 43(5):** provide employment or assistance to land owners in accordance with the rehabilitation and resettlement policy of the respective State Governments.

xix. **Section 43(11):** compensation to the affected families applicable retrospectively from **1.1.1997**

xx. Fee towards mine closure plan.

xxi. **Section 41 Royalty:** mostly payable on ad valorem basis.

xxii. **Section 42: Dead rent**

xxiii. **Corporate income tax: 33%**

xxiv. **Corporate social responsibility mandatory tax of 2%** of the net profit as per the new Companies Bill.

xxv. **Section 44(1)(b):** 2½% of excise duty as CESS which goes into National Mineral Fund (NMF) constituted as per **Section 50(2)** of the Act. NMF contributes to NMRA (**Sections 58 to 61**) and NMT (**Sections 75 to 88**).

xxvi. **Section 45(1):** CESS at 10% of which goes into State Mineral Fund (SMF) constituted as per **Section 53(2)** of the Act. SMF contributes to SMRA (**Sections 70 to 74**) and SMT (**Sections 89 to 100**). This is for minor minerals only.

xxvii. **Education cess:** 2% surcharge

xxviii. **Environment levies:** for coal, it is Rupees 50 per tonne of raw coal mined

The tax regimes, including royalty, dead rent and other levies from both the State and Union governments must be rationalized and stabilised. If the proposed sharing of profits as per Section 43 of the Act is implemented it will have adverse impact on investments flowing into new projects *(see Dipesh Dipu, MEJ, Vol.13, No.1, August 2011, p. 14).* Typically, a project with internal rate of returns in the range of 13-15% would witness a reduction to about 9-12% due to the additional cash outflow. For existing projects, the additional outflow will hamper expansion plans and profitability will be severely impacted. **The net result is that investments will be directed to foreign mineral ventures depriving the country of the benefits to the local people and to the nation.**

The Fraser Institute, an independent Canadian research organization conducts an annual survey of mining companies to assess how public policy affects exploration investment. They prepare a Policy Potential Index (PPI) which is a report card on the attractiveness of the Governments mining policies. According to the Fraser Institutes 2010-11 survey India ranked low at 74 with a PPI of only 10.6 among 79 provinces/countries as against Canada with a PPI score of 90. **This fact should alert the Government on the need to thoroughly review the Act before passing it in the next session of the Parliament.**

6. The Security of Tenure is still a major problem (see Sections 9(1) & 25(3):

As per **Sn 9(1)** HREL and PL will have preference over NREL and more dangerous is **Sn 25(3)** which says that grant of ML is subject to **eligibility criteria** which allows for use of discretion, judgment, assessment of fulfillment of general conditions and special conditions than seamlessness.

7. Transfer of exploration licences and MLs in the New Act are made more complex{see Sn 17(1) & 18(2)}:

As per Section 17(1) (Prov.i) an existing PL holder should transfer, after giving 90 days notice to State Government, *only to a person holding a PL or ML in the adjoining area.* Why this restriction? What purpose does it serve? Though mineral prospecting is a high risk activity is also a standalone economic activity where in the explorer would like to profit from his risk investments at the end of the day. If such conditions are imposed it discourages investors.

The 3rd Provision to **Sn 17(1)** says that the Govt. may disapprove the transfer on the grounds that the transferee is not eligible as per the Act. This is sure to lead to litigations as it provides for use of judgment, discretion and bias on the part of the authority commenting on the eligibility of the transferee. Why should Government charge a fee for PL transfers? {**Sn 17(6)**}.

Regarding ML transfer, it is understandable that approval of the State Government is necessary for transfer of ML and the transferor has intimated the amount realised for such transfer and also the mode of transfer. But why should it be based on a judgment whether the amount received is adequate or not as long as the transaction is as per the law of the land? {**Sn 18(2)**}. The proposed provision enables the authorities to question every transfer-transaction, hence, provides for Government interference and opportunities for corrupt practices.

8. Allow the Indian Public to invest into exploration through the BSE.

The result of this type of investment is well understood by the Secretaries of the Ministry of Mines who have visited Australia and Canada on numerous occasions. The Australian Stock Exchange has listed some 800 Exploration and Mining Companies that operate not only in Australia but also all over the world. Middle class India with the right type of incentives can easily finance a complete renascence of the mineral Industry as has happened in Australia, Canada, China, Chile, Ghana, Tanzania to name a few.

NEED OF THE HOUR:

- In the interest of placing the National, State and Rural Economies on a fast track mode, it is necessary **for separating the proposed Act into two independent Acts, one for Exploration & Prospecting and the other for Mining.** Grant of licences for reconnaissance exploration and prospecting should not be left to the States as they have completely failed to implement the spirit of the National Mineral Policy in the last 18 years. The New Act, which empowers the States to grant

licences for exploration will serve no purpose due to the complex & lengthy procedures that the States have been following and will continue to follow and will continue delay the process of granting of licenses. This statement is fully supported by the fact that the proposed Act does not contain any solution to the serious problem of delay in the grant of licences except making the investors to approach the Central Tribunal. Let the States enjoy the power of granting MLs as proposed in the New Act.

- **The Mineral Exploration Act (MEx Act) should be dealt with by a centralized authority which could be a division of the GSI or IBM** for the fact that the Nation's geological programming for exploration and scientific data collection is in the hands of the Central Geological Programming Board which also takes care of the concerns of the State Geological Programming Boards.

- **Mineral Corridors:** Intention to declare mineral corridors is now over 20 years old. Minerals being site specific, all known major mineral resource located within forests be declared as mineral corridors and brought under the control of the Ministry of Mines. GSI and IBM would help in declaration of such Mineral Corridors. This will save the mineral industry from obtaining clearance from the Forest Dept and MoEF.

- **Mine-wise environmental clearance:** Regarding environmental clearance, MoEF may stipulate conditions to be followed by all Mining Lessees. Each mine-wise clearances should be done away with.

An Investor-friendly Act is a means for Development of Rural Economy:

Minerals are site-specific. Almost all mineral exploration and mining activities happen in rural areas. Modern mineral exploration is a stand-alone economic activity. Exploration, mining and quarrying create plenty of job opportunities, both direct and indirect, for the rural youth thus taking off pressure on the Government to provide employment opportunities. For eg. for every tonne of gold produced in the country, about Rs.80 to 120 crores get into the local rural economy. This is besides the 33% corporate tax and royalty etc. paid by mining entrepreneurs. In a sense, by facilitating grant of PLs and MLs, the Central and State Governments will automatically become share holders of a mining enterprise at the same time enabling the rural youth to learn technical skills and earn their livelihood.

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GEOGENIC HAZARDS IN COASTAL ODISHA : WITH SPECIAL EMPHASIS ON COASTAL EROSION

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ABSTRACT

Odisha is a coastal state in eastern India, situated along the Bay of Bengal. It's uneven coastline extends for a length of 476.4 kilometers. The coastal belt is being ravaged by geogenic hazards like severe coastal erosion and consequent environmental problems. This is causing significant economic loss, ecological damage and societal problems in the state.

The cluster of human settlements and the eco-sensitive valuable natural habitats nearing the sea have been the worst affected due to the advancing sea.

Several factors are contributing to the increased pressure in the coastal zone. The cause of coastal erosion could be due to wave generated winds, storms and unusual weather conditions. Besides, the effect of active neotectonism along the coast may not be ruled out to be the possible cause of the coastal erosion. The erosion rate depends upon the tidal range, geomorphological and tectonic settings, groundwater fluctuations and climatic/meteorological factors.

Sustainable management of coastal and marine resources is essential for long term economic growth and to ensure the equilibrium between economic development and the protection of the environment.

Key words: Geogenic Hazards, Neotectonism, Coastal Erosion

INTRODUCTION

Odisha is a coastal state in eastern India situated along the Bay of Bengal. The uneven coastline of the state is 476.4 km long. It stretches from Chandaneshwar ($21^0$36'36": $87^0$29' 05") in the northeast in Baleshwar district to Sonnapura ($19^0$07'07":$84^0$47'31") in the southwest in Ganjam district. The districts of the state lying along the coast are Baleshwar, Bhadrak, Kendrapara, Jagatsinghpur, Puri and Ganjam. The coastal belt is thickly populated and pristine with a number of major eco-sensitive natural habitats.

The coastal belt is being ravaged by geogenic hazards like coastal erosion which is causing significant economic loss, ecological damage and societal problems to the state. The cluster of human settlements and the eco-sensitive valuable natural habitats near the sea have been the worst affected due to the advancing sea.

CLIMATE

The coastal Odisha is falling under the tropical monsoon climate with mean annual temperature of 27°C which varies between 37° C to 13° C. It is moist sub-humid or dry sub-humid type and mega-thermal in nature. The mean monthly rainfall is 120 mm. (Source : IMD).

HUMAN SETTLEMENTS AND NATURAL HABITATS

A large number of densely populated human settlements have been clustered along the coastal tract of Odisha since time immemorial. While the major urban conglomerations are Puri, Paradip, Dhamra, Gopalpur and Chandipur are present on the coastline, Baleswar, Chhatrapur and Ganjam are lying close to the coast. Besides, the eco-sensitive valuable natural habitats present along the coast are: the World's largest rookeries for Olive Ridley sea turtles in the extensive sandy beach of Gahirmatha, India's second

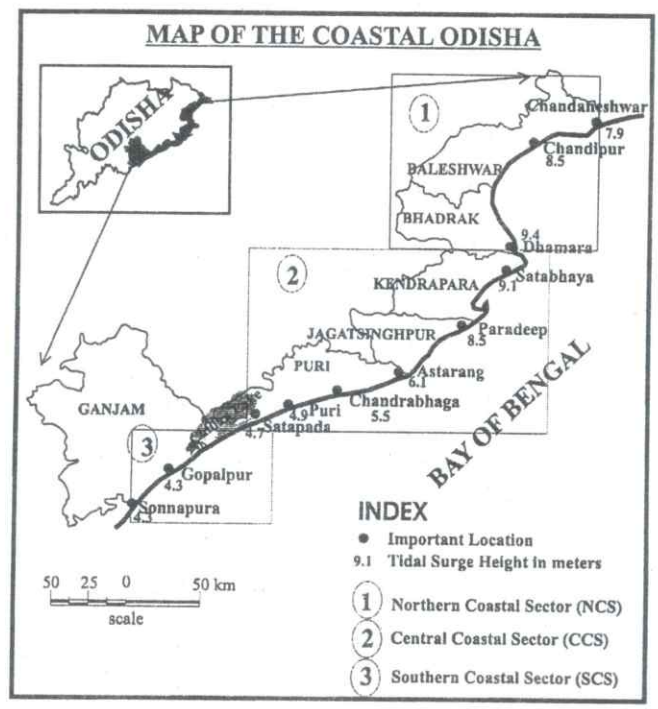
largest mangrove cover in Bhitarkanika - the habitat for the highly threatened estuarine crocodile, and Asia's largest brackish water lagoon the Chilika lake that supports country's largest congregation of migratory birds and having World's one of the largest habitat of Irrawady Dolphins.

DRAINAGE

The major rivers meeting the sea along the coastline of Odisha are Subarnarekha, Budhabalanga, Baitarani, Brahmani, Mahanadi, Rushikulya and Bahuda. Major part of the coastal tract is dominated by the distributaries of Mahanadi-Brahmani-Baitarani River System (about 60 %). The drainage is consequent in nature, parallel to sub-parallel in pattern in the west but gradually changes to arcuate and anastomatic towards east and ultimately to dendritic type drainage near the mouths.

COASTAL SECTOR

The coastal belt of Odisha, may be divided in to three sectors (see plate) on the basis of their linear dispositions, viz. (1) the Northern Coastal Sector (NCS) - from Chandaneshwar to Chandbali, stretching for a length of 136.85km in Baleshwar and Bhadrak districts, (2) the Central Coastal Sector (CCS) - from Dhamra to Satapada (Chilika lake), stretching for a length of about 285.4 km, in Kendrapara, Jagatsinghpur and Puri districts, and (3) the Southern Coastal Sector (SCS) - from Ganjam to Sonnapura, stretching for a length of about 53.15 km in Ganjam district. While the coastline in the NCS is disposed in an arcuate shape with concavity towards inland and includes Subarnarekha and Budhabalanga rivers, the CCS forms a very wide arc with an overall concavity towards the sea and includes Mahanadi, Brahmani and Baitarani Rivers and their distributaries and the SCS forming a straight coast includes Rushikulya and Bahuda rivers.



CONTINENTAL SHELF

The present day shelf is narrow in the southern part of the coast whereas it has an extended continental shelf in the north Odisha coast. The width of the continental shelf vary at different places off the coast with a maximum width of about 90 km in the north (off-NCS), 50 km in the south (off-SCS), and only about 60 km in central coast (off-CCS). On an average the slope gradients of the continental shelf is about 3

m per km for a distance of 50 km from the coastline. The depth at the shelf edge is around 150m.

TIDAL REGIME

Tidal currents are a highly dynamic phenomenon that varies not only with the seasons of the year but also change throughout the years resulting in an ever changing geography in beaches. The coast is micro- to meso-tidal in nature and the wave characteristics having wave height 1.0-2.6 m, wave period 5-14 Seconds and the current direction is NE during most part of the year. The Gross Littoral Drift is 1.5-2.0 million m^3 /year.

GEOMORPHOLOGY

The coastal stretch exhibits varied geomorphologic signatures evolved out of dynamic and varied interaction of Quaternary processes viz. fluvial, marine (both waves and tides) and aeolian.
Along the coastal tract of Odisha, both fluvial and marine processes operate but the activity of the later predominates over the former as the sea approaches. Wind energy along with fluvial and marine processes is responsible for producing inland and coastal sand dunes and beaches.

The geomorphic units are in turn, grouped into geological units and the morpho-stratigraphic sequence of the area has been established based on the spatial distribution and relation of the different terrain unit/geomorphic units supported by sedimentological and palaeontological analyses and 14C age dating which ranged from 5760 ± 140 YBP to 2920 ± 160 YBP (Mukhopadhyay, et al 2011).

The morpho-stratigraphic sequence of the Quaternary formation in the coastal tract of Odisha is: (i) Recent Beach (bounded by the high water line and low water line), (ii) Mud flat/Tidal flat, (iii) Younger beach ridge (1^{st} set), (iv) Interdunal flats, (v) Older Beach Ridge / Dune (2^{nd} set), (vi) Interdunal flat, (vii) Oldest Beach Ridge/Dune (3^{rd} set), (viii) Lower Deltaic Plain and (ix) Upper Deltai Plain.

The Recent Beach is bounded by the high water line (HWL) and low water line (LWL). The width of the beach varies from 2 km to 4km in the NCS, from 25 m to 80m in CCS and from 40m to 120 m in the SCS. The relief of the surfaces varies from 2 m to 5 m. The beach face dips 4^0 to 10^0. The Mud flat is extensively present in the NCS as a low lying flat plain with very low relief attaining a maximum width of 22 km. In the Brahmagiri area of CCS, close to the Chilika lagoon, a beach dune mud flat complex is present (Chakraborti & Chattopadhyay, 1989). The Younger beach ridge/dunes (1^{st} set) in the CCS occur bordering the beach surface and attain a height of 5-10 m. The width of this zone varies from 500m to 1200 m presenting a highly undulating topography. In the NCS, the dunal surface is in the form of a chain of coastal sand and dunes are disposed parallel to the coastline with maximum height of 5m. In SCS, the beach is fringed inland by beach ridge/dune complex which varies from 600 m to 2 km with height varying from 3m to 15m. The Interdunal flat after the 1^{st} set of younger ridge/dunes varies in width from 1150 m to 2500 m in the CCS. The tidal flat in the NCS has two distinct morphometric facets like a sandy sloping (average 6°) shoreward zone with an average width of 30 m, and a wide silty flat matted with ripples, having an average width of 1.5 km. In the extreme southern part of the NCS, these dunes are usually disposed in north-south and occur up to about 25 km away from the coast. The Older Beach Ridge / Dune (2^{nd} set) occur as a flat to undulating terrain with width varying from 100 m to 1200 m and height varying from 2 m to 10 m in the CCS. In the NCS, the older dune sands with thick soil cover are located about 10 km from the coast. The Interdunal flat after the older ridges in the CCS is a flat terrain with width varying from 520 m to 1600 m. The Oldest Beach Ridge/Dune (3^{rd} set) occur as isolated dunes with height varying from 4 m to 7 meters in the CCS. The lower deltaic plain occurs at the end of the dune complex and the contact is often marked by water-logged patches or marshes. The process of formation involved is mixed environment.

The average width of the lower deltaic plain varies from 2.5 km to 10 km in the CCS. The lower deltaic plain has gradational contact with the Upper deltaic plain and could be marked by the general absence of marshes and water logging.

GEOLOGY

Recent to sub-recent unconsolidated rock particles/sediment of marine, lagoonal, deltaic and fluviatile facies have been deposited under fluvial and marine conditions in the coastal tract. The fluvial components of the Present Day Formation is made up of bed loads, channel bars, point bars and flood plains in major rivers showing coarse to fine and loose, poorly sorted sand and clay. The marine equivalent is represented by pale yellow to off-white, medium to coarse grained sand, including shells of living fossils; deposited with a coast-parallel configuration, associated with sand dunes. The lagoonal facies of the formation is characterized by sandy or muddy clay pile, with loose-bonded sandy particles with clay (Pradhan, 1998).

The beach consists of fine to medium grained grayish white fresh sand. Black sand concentrates found in places are patchy and thin in occurrence. The beach ridge/dune complex shows different degree of oxidation of the constituent sand. The sand is relatively matured/oxidised in order of antiquities. The first set or the Younger ridge/dune sand found very close to the beach is unoxidised and devoid of soil and vegetation. The second set or the Older ridge/dune sand is mildly oxidized where thin soil cover with scanty vegetation is observed. The 3rd set or the Oldest ridge/dune sand is relatively more oxidized with fairly developed soil cover supporting good vegetation. While the Interdunal flat between the Younger and Older beach ridges/dunes is formed under fluvio-marine and Aeolian processes and possess incipient soil growths with scanty grass, the Interdunal flat between the Older and Oldest beach ridge/dune involved fluvial and aeolian action. The lower deltaic plain has gradational contact with the upper deltaic plain.

In the NCS, the Beach surface consists of fine grey coloured sand with minor silt. The Mud flat (Basudevpur Surface) formation mainly comprises grey to black clay with minor silt and fine sand and a thin surface soil. The Dunal surface is partially oxidized and has no soil cover. Patches of highly oxidized Older Dune Sands with thick soil cover are traced. The mesotidal NCS plain is characterised by the presence of a broad expanse of fluvial, fluvio-tidal and marine coastal sediments like, 'Caliche' bearing soil and clay. (Mishra, *et al*, 1989).

In the CCS, around Paradip region, the Beach is having medium to grey white coloured sand. It has no soil cover. The Younger beach ridge (1st set), is composed of fine unoxidised sand. The unit does not have soil cover. The first phase of Interdunal flat consists of fine to medium grained sand. The Older Beach Ridge / Dune (2nd set), has yellowish brown sand, mildly oxidized. Thin veneer of soil is found. Coastal process involved is remobilization of sand. The second phase of Interdunal flat consists of feebly oxidized medium sand. The Oldest Beach Ridge/Dune (Third set) is having deep brown oxidized fine to medium grained sand. The terrain possesses fairly developed soil. Processes involved are remobilization of sand by strong wind (Mohanty & Pattnaik, 1999). The Kendrapara Surface is a fluvio-tidal deposit with plastic clay and occasional fine sand. It lies beyond the present beach sediments on sea-ward side. The Rajkanika Surface is composed of loose, coarse to medium grained, straw yellow sand (Chakraborti, *et al*, 1989). The test result of a 20 m pit in Paradip area show alternate sand bands (around 2 m) and clay partings (<1 m) (Mohapatra, *et al*, 1995). In the area between Paradip and Kusabhadra river, the present beach consists of fine sand. The younger dunes/ridges consist of fine to medium grained unoxidised white to yellow grey coloured sand devoid of any soil. The

Older beach ridges/dunes consist of feebly oxidized yellowish grey fine sand. The Oldest set of ridges/dunes consist of relatively more oxidized sand with fairly well developed soil horizon. To the north of Devi river, the dunes are covered by clay/silt and appear to have been merged with lower deltaic plain. In Ersama-Paradip region, the landform unit commences from the end of first set of dunes with beach ridges/dunes of differing antiquities interspaced. In Konark region, the interdunal spaces in Konark area are invariably sandy and the lower deltaic plain land consists of clay and clayey silt (Mohapatra, *et al*, 1996). The Beach between Kushabhara river and Chilika mouths comprise fine to medium grained grayish white sand. Black sand concentrates found at places are patchy and thin in occurrence. The Lower deltaic plain consists of silt and clay. (Sarangi, *et al*, 1997).

In the SCS, the area between Satapara and Sonapurapeta, the beach is fringed inland by beach ridge dune complex. Beach sand comprises ill-sorted yellowish white sand with quartz, feldspar, garnet, shell fragments and black sand (rutile, ilmenite, sillimanite, monazite, garnet and zircon). Beach ridge dunes comprise fine sand consisting of quartz, feldspar and black coloured heavies. Black heavy constituents gradually decrease and oxidation increases from coast to inland. Fluvio-lacustrine marine deposits mainly comprise sand, silt, while clay occurs predominantly in the lagoon/estuarine and deltaic regions. Tidal flats are constituted of mud and silt (Sarangi & Mohapatra, 1999). Black and brown clay are observed in the Ganjam Formation. The brown sandy clay has got an extensive aerial coverage. The marine black clay with shells (Govindpur Surface) and beach sands (Rushikulya/Gopalpur Surface) were deposited along the coast under marine conditions. Beach sands are represented by coarse sands. The Rare earth placer deposit at Gopalpur pinches southwesterly along the coast towards Ichhapur (Mohanty & Devdas, 1989).

TECTONICS

A number of faults/lineaments trending along NE-SW, E-W and NW-SE directions are disposed in a curvilinear pattern below the surface in the coastal tract of Odisha. Majority of the faults are basement controlled and are parallel to sub-parallel to the general NE-SW structural trend. The strata dip uniformly due SE and the sequence shows gradual thickening towards the sea. The East Coast Lineament is possibly a fault with down throw to its east which has given rise the coastal graben trending in NE-SW direction along which the coastal plain has been developed. The Mahanadi-Brahmani-Baitarani compound delta is formed along the NW-SE trending Mahanadi graben (Mahalik, 1998). Due to the horst and graben structure, the basement is lying below 1500 m at Pipli, 2500m at Chandanpur-Gop and 2000 m in Puri-Konark below the surface under the thick pile of Quaternary sediments. In Baleshwar off-shore, a major graben has been marked possibly extending towards on-shore Mahanadi deltaic area (Bharali, *et al,* 1998).

The deltaic plain is characterized by a number of ENE–WSW trending basement faults which were reactivated during Tertiary and Quaternary periods. The active deltaic distributaries in the Mahanadi inter-distributary plain align along the directions of NE–SW lineaments. In the Lower Deltaic Plain of Chandbali depression the N–S trend dominates. Two sets of lineaments, NE–SW and NW–SE, control the coast in the Chandbali depression. Many of the NW–SE trending beach ridges seem to be displaced by NE–SW trending lineaments, indicating reactivation in recent times. The orientation of the Dhamra river mouth is controlled by E–W trending lineament, along which a linear channel bar has been developed. The compression of meanders is controlled by these lineaments. The trend of lineament north of the Mahanadi river is NE–SW in the northern region and NW–SE in the southern region. The NE–SW trend corresponds to the Precambrian

trend, whereas the NW–SE trend corresponds to the Mahanadi graben trend. The NE–SW trending lineament controls the growth of spit near the Devi river mouth. Most of the depositional activities within the Devi river, especially the estuarine islands are controlled by this lineament trends. The configuration of the coast is straight near the Chandbali depression, wavy near the Paradip depression and wavy-to-straight near the Puri–Konark depression. The abandoned deltaic plain lies south of the Devi river and the delta-building activity is seen towards the north, especially in the Chandbali and Paradip depressions. The three tectonic depressions controlled the sedimentation pattern in the Lower Deltaic Plain (Kumar & Bhattacharya 2003).

SEA LEVEL FLUCTUATION

The coast constitutes one of the most dynamic parts of the earth surface and it is continuously undergoing both gradual and sudden changes with geological, physical and chemical processes. These changes occur over both long and short terms and involve hydrodynamic, geomorphic, tectonic and climatic forces. During the Quaternary period, about 30 thousand years before present, due to the formation and melt down process of snow, the sea level had fluctuated for a number of times. Between 20 and 17 thousand years ago, the sea level was 120 meters below the present level (Lambeck & Chappell, 2001 By about 14000 years B.P. the sea level started to rise till about 6000 years B.P. when the sea reached its present level. Subsequently, the sea level was about 2 to 3 meters above the present level.

COASTAL EVOLUTION

The main deltaic evolution was initiated after a major regression in Early Miocene and has been continuing till Recent with minor fluctuations. Prior to that, minor delta building took place during the Late Paleocene, later interrupted by extensive carbonate deposition (Bharali et al., 1991). The Oldest beach ridge/ strandline in the Mahanadi deltaic area has been dated to be ± 6000 yrs. B.P. (Sambasiva Rao, *et al.* 1978).

Chilika lake was formed during the regression period with the formation of beach ridges and spits enclosing a body of sea water around 3750 years ago (Nageswar Rao, *et al* 1995). The borehole sediments of Chilika lake demarcated the Tertiary and Quaternary boundary at a depth of 109.25m, on the basis of the last appearance of the foraminiferal form Lackharita. The sedimentary sequence has been differentiated into lower limestone-clay facies belonging to Early to Middle Tertiary Age and the upper clay-sand facies has been assigned a Quaternary age. (Bandopadhyay & Bose, 1992). A considerable thickness of Tertiary and Quaternary formations also occurs as subsurface deposits in the offshore areas. The thick sequence of Tertiary sediments is sandwiched between Cretaceous and Recent sediments (Bharali, *et al*, 1998).

LANDUSE PATTERN

The land-use practices in the coastal tract of Odisha have broadly been compatible with the geologic-geomorphic situation. Land use in the coastal plain is basically for paddy fields, cultivated croplands, irrigation canals, salt pans, aquaculture, settlement and tourist resorts. As per the land-use practices, the beaches at a number of sites as tourist resorts, the river mouths as natural ports and fishing centres, the mud flats as mangrove forests, the younger and older beach ridges/dunes as casurina, cashewnut and eucalyptus plantations, the younger interdunal flats as casurina forests, the older interdunal flats as village plantations and horticultue, the oldest beach ridge/dune as palm plantation, the lower deltaic plain as occasional pisciculture and the upper deltaic plains as paddy cultivation and dunal surfaces as human settlements being utilised.

NATURAL HAZARDS

The coastal regions of Odisha are under severe stress influenced by different geogenic and anthropogenic activities in

addition to natural hazards. The major environmental problems afflicting the area are flood, cyclone, storm surge, water-logging, salinity of soil and groundwater, wind blast, sand migration and of course the coastal erosion. All these problems though site specific and natural are aggravated when triggered by anthropogenic interference like deforestation, pollution and unplanned landuse practice.

Flood: Due to heavy rainfall during the southwest monsoon period, damaging flood situations occur and a large area in the coastal region is inundated causing heavy loss of life and property. A statistics reveals that, during years between 1834 and 1926 flood situation occurred at an interval of 4 years. After 1926 the flood situation occurred at an interval of 2 years and this has become an annual phenomenon after 2001.

Cyclone: Cyclonic depressions are generated in the Bay of Bengal and enter the coast of Odisha. Two peak periods are marked for the tropical storms, one during the pre-monsoon and the other during the Post-monsoon period. During the period, severe storms with wind speeds of 80-100 km/hour hit the coast. At times the wind speeds exceed and bring havoc to the parts of the coastal Odisha. The severest storm recorded during September 1885 and in October 1999 when storm velocity mounted up to 250-300 km/hr battered the coast near Paradip.

Storm Surge : During the post-monsoon period the storm-surge-generating cyclones are developed in the Bay of Bengal with surge heights 6 to 7 meters. At times it is raised even up to 10-12 m, as witnessed during the Super Cyclone of 1999. Fluvial and storm-surge flooding eventually coinciding with spring tide situation. The storm surge rushing through the inlet/ mouth of Chilika lake endangers populated islands and the lake margin.

Water-logging: Water-logging hazards are observed in the low-lying lower deltaic plains of coastal Odisha. In the low-lying coastal tract, sea water spreads to tens of kilometers inland and the surging sea waters transgresses into marshes swamps creating vast open expanse of water bodies, where waves generated by wind action may further transport greater amount of saline water inland and take time to return to the sea.

Salinity: Certain natural phenomena including salinity hazards in the near surface aquifers, salinity induced in soil through ingress of tidal water, periodic cyclones, non-availibiliy of adequate surface or groundwater for agriculture and also some man-made actions by way of construction of artificial barriers have created some adverse situations in the coastal belt. Soil and Groundwater salinity have been affecting the area up to 5 to 6 km (approx) inland from the coastline within the SCS. The intrusions of saline water in wells up to a distance of 1 km from coastline in sandy areas and up to 500 meters from the tidal tract of estuaries in alluvial areas are observed. The coastal alluvial aquifers are highly permeable and are in hydraulic continuity with sea/ estuarine water. Therefore, indiscriminate pumping from wells here leads to salinity intrusion.

Sand Migration: Due to strong wind, the process of dune migration is active in the Younger Beach Ridge / Dunes (1st set) and the unit is prone to erosion. In the Older Beach Ridge / Dune (2nd set) the coastal process involved is remobilization of sand and wind-born erosion is prevalent. In the Oldest Beach Ridge/Dune (3rd set) the processess involved are remobilization of sand by strong wind.

Tsunami: Though so far the coastal Odisha has never experienced any recorded tsunami run-up, the risk is not totally ruled out. About 121 km of coastline has a high risk rating, recording tsunami run-up of more than 2.0 m along the coastal stretches of Ganjam, Chilika and southern Puri. About 327 km of coastline has a medium risk rating with tsunami run-up between 1.0 to 2.0 m along most of the coastal stretches of

Jagatsinghpur, Kendraparha, Bhadrak, and Balasore districts. About 31 km of coastline that has recorded tsunami run-up between 0 and 1.0 m was accorded a low risk rating along the mid-Balasore coast (Kumar et al, 2010).

Earthquake: The entire coastal tract of Odisha falls within Seismic Risk Zone-III, where mild earthquake tremors are experienced, with magnitude of 3 to 4.5 in Richter's scale. Though this is a medium risk zone and not hazardous, the tremors may be aggravating the neotectonism.

Pollution: The geologic-geomorphic situation of a coastal area points to the possibility of contamination of both surface and groundwater sources through long distance migration of pollutants from the industrial units mostly located in the upland areas away from the coast.

COASTAL EROSION

Coastal Odisha has been subjected to accelerated erosion at several locations. The Integrated Coastal Zone Management Project (ICZMP) has assessed that, about 187 km of Odisha's coastline has been exposed to erosion. While 39.3 km (8.2 %) was identified as high erosion zone, 51.96 km (10.82 %) fell under medium erosion zone.

The Coastline Change Rate (CCR) study reveals that, about 55 km of the coastline has a high risk rating, with the erosion rates of more than 10 m/y along the coastal stretches north of Puri, central Kendrapara, and south of Bhadrak. Besides, about 194 km of coastline has a medium risk rating with erosion rates between 0 and 10.0 m/y along the coastal stretches near Chilika Lake, north of Kendrapara, and north of Bhadrak. (Kumar et al 2010).

Zones of Erosion : In the Central Coastal Sector, the coastline bearing the brunt of erosion is more pronounced at Puri beach, Konark-Chandrabhaga-Ramchandi beach, Astaranga towards Devi river mouth, Paradip-Jatadhar Muhan and south of Dhamra (Pentha/Satabhaya). Erosion seems to be rampant on the Puri beach where tidal waves have washed away not only a part of the beach but also the adjoining road. The area lying to the north of Paradip Port up to the Mahanadi mouth has come under active erosion and the continued buffeting of the coast by the waves along this stretch had resulted the coastline receding landwards by 200 to 300 meters. From the southwest of Paradip up to northeast of Dhenkia (near Jatadhar) the erosion zone of 280 m to 300 m has been tracked. The worst effected zone of coastal erosion is the Satabhaya/Pentha region in the CCS. Between Satbhaya and Gahirmatha the entire coast is facing severe erosion at the rate of nearly 80 to 100 m/year at certain stretches. In Satabhaya-Pentha area, Gobindapur and Kanhupur villages have been completely washed away and original Satabhaya village has been partially submerged due to inundation by the sea. The landward migration of the coastline by about 400 to 750 m in Pentha-Chinchiri area and 400 to 500 m in Kanhupur-Satabhaya area from the 1967 position indicate marine transgression and coastal erosion. An area of 4.95 sq. km along 8 km tract of Pentha-Chinchiri area and 2.5 sq. km along a 6 km tract of Gobindapur-Satabhaya area has been eroded. (Dash & Srinivasan 2009). In the SCS, the recent trend of beach erosion is marked at Gopalpur and north of Prayagi, besides the dune migration of the barren dune belt south of Paluru between Prayagi and Kontiagar and southwest of Bara Aryapalli is active (Sarangi & Mohapatra, 1999). In the NCS, the zone of erosion has been marked to the east of Aduan in Baleshwar district (Sarkar, 1991).

Causes of Erosion: The coast constitutes one of the most dynamic parts of the earth surface and it is continuously undergoing both gradual and sudden changes with various physical processes. These changes occur over both long and short terms and involve hydrodynamic, geomorphic, tectonic and climatic forces.

Some believe that the cause of the current problem may be due to rise in the mean sea-level, particularly in the Bay of Bengal and meteorological factors. Besides, several factors like the depletion of mangrove and other coastal vegetation have also been cited as the reason for sea turning violent High erosion has been observed to the north of river mouths along the coast and on the southern part of the breakwaters of ports.

The erosion process of the coast in Odisha activated since 1930s with the opening of a new path and channeling of the Nuanai to drain the water from Sar lake into the sea. Consequently damage to the coastline along Puri-Konark beach aggravated at its mouth. Then with the coming up of the major port at Paradip during 1960s, massive erosion across coastline up north started. The damage to the Puri beach aggravated when the water-logged area of Samagarapata, near Puri town was dredged into the sea through a new path of Mangalanai during the 1980s. A similar situation also occurred after the opening of new mouth of Chilka lake since 2000.

Erosion has been obvious and more pronounced to the north of the ports such as Gopalpur Port, Paradip Port and to the south of Dhamra Ports with the sea threatening to erode larger tracts of coastline. It's a sort of warning bells against the unregulated spurt in human interference and construction activity like port building along Odisha's coastline. Proposed captive port at Jatadhar Muhan creek may also aggravate the erosion process further northwards and the future of Paradip Port will shortly be at stake.

Besides all other causes, the phenomenon of the coastal erosion could have been aggravated due to the effect of active neotectonism along the coast (on-shore and off-shore) may not be ruled out (see photo).

Remedial Measures: The coastal erosion problem should be addressed at its source. Geomorphological setting, tectonic conditions, tidal ranges, groundwater fluctuations and climatic/meteorological factors need to be considered while taking up any remedial measure. A sustainable solution to coastal erosion problems should be based on an understanding of the sediment dynamics.

Creation of artificial dune belts along the back shore area of the beach, construction of sea wall/breaker and plantation of highly salt water resistant species may help to curb the coastal erosion to a greater extent.

CONCLUSION

Though the coastal Odisha is endowed with vast natural resources and large biodiversity, absence of reliable and updated information and data, its conservation values and socioeconomic importance has greatly hampered development. Sustainable management of coastal and marine resources is essential for long term economic growth and to ensure the equilibrium between economic development and the protection of the environment. The wetland ecosystem being integral part of cultural and biodiversity landscape of coastal Odisha, particular attention should be placed on effective land, water, forest and beach management.

Above all, the words of Will Durant, **"Civilization exists by geological consent, subject to change without notice"**, must be kept in mind during all times to come.

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ROLE OF DEXTRIN IN THE SELECTIVE FLOTATION OF FLUORITE

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ABSTRACT

Dextrin and related polysaccharides are generally used as depressants / dispersants in various mineral processing operations. Interaction of dextrin on calcium minerals both in the presence and absence of oleate was studied in the present investigation. The mechanism of dextrin adsorption at mineral / water interface was investigated by adsorption, contact angle and zeta potential measurements. The role of dextrin in the separation of fluorite by flotation has been discussed.

INTRODUCTION

Sparingly soluble calcium minerals such as fluorite, calcite, apatite and scheelite are important raw materials for chemical, cement, fertilizer and metallurgical industries. Generally these minerals are beneficiated by flotation using oleic acid or sodium oleate as collector. Considering the complexity of events that occur under practical flotation conditions, oleate collector alone is not sufficient to obtain desired selectivity. Hence other modifying agents are necessarily employed to achieve selective separation. Variety of tannins and starches are used to suppress the floatability of apatite and calcite. In recent years, the use of polysaccharides in mineral processing operations has attained significance as these compounds are biodegradable and environment friendly.

The mechanism of adsorption of oleate on calcium minerals was extensively studied and comprehensive review of the subject was published [1-2]. However, the interaction of tannins and starches on calcium minerals was neglected in spite of their vital role in different mineral processing operations. Recent publications of Laskowski on the above subject are most significant. It was observed that metal hydroxy sites play a vital role in dextrin adsorption [3-4]. Depending on the nature of mineral surface, dextrin was found to interact by three different mechanisms viz. chemical, electrostatic and hydrophobic [5-6]. Maximum adsorption of dextrin was noticed around the pH where mineral surface is highly hydroxylated. Adsorption of dextrin on such hydroxylated sites was found to proceed via chemical complexation.

Most of the investigators have studied the adsorption of dextrin on a single mineral in the absence of other reagents that too on sulphides and iron ores. Somasundaran has studied the adsorption of starch and oleate on calcite in aqueous solutions [7]. Co-adsorption of starch and oleate was interpreted in terms of a clathrate formation between starch in its helical form and oleate held inside the starch helix. The present investigation is aimed to have better understanding on the adsorption of dextrin at fluorite/water interface in the presence of oleate and it's role in the selective separation of fluorite from other calcium minerals.

EXPERIMENTAL

Materials: Details such as purity, source and surface area of the mineral samples used in this study are given in Table 1.

Table 1: Details of Mineral Samples

Mineral	Purity (%)	Surface area (m^2/g)	Source
Fluorite	98.30	0.917	Fluorspar mines, Kadipani, India
Fluorapatite	97.00	1.508	Gregory Bottley & Lloyd, London
Calcite	99.25	4.031	Svenska Minerals AB, Sweden

Dextrin and sodium oleate were obtained from Aldrich Chemical Co. Ltd. and BDH respectively. Other chemicals were of analytical grade with a purity of 99% except the solvents cyclohexane and isobutanol which were of spectroscopic grade. Dextrin solution was prepared by dissolving a known weight in de-ionized water and boiling the same at 100°C. The solutions were then cooled to room temperature in a water bath and diluted to required volume. Fresh solutions were prepared each day to avoid the effect of microbiological degradation and decomposition.

Methods: 0.5 gm of mineral sample was taken in 50 ml of dextrin solution and equilibrated for 30 minutes. In a system where a mixture of dextrin and oleate are involved, oleate solution was added in the second stage and equilibrated for further 30 minutes. pH of the solutions were adjusted by using dilute HCl and NaOH. After equilibration, the suspensions were centrifuged at 4000 rpm for 10 minutes and the clear supernatant solutions were analyzed for oleate and dextrin. Preliminary tests were conducted to check the sedimentation of dextrin and found negative even at 10000 rpm. The estimation of dextrin and oleate was followed by spectrophotometric methods established by earlier investigators [8-9]. In order to check the interference of oleate, different concentrations of oleate ranging from 10-100 micro grams/ml were added to dextrin solutions and the absorbence was measured. The results shown in Table 2 clearly indicate that there is no interference due to the presence of oleate in dextrin. However dextrin was found to interfere in the analysis of oleate.

Table 2: Calibration of Dextrin in the presence of Oleate

Sl No	Dextrin (µg/ml)	Oleate (µg/ml)	Absorbance
1	20	Nil	0.201
2	20	10	0.201
3	20	20	0.202
4	20	30	0.200
5	20	40	0.202
6	40	10	0.410
7	40	20	0.407
8	40	30	0.409
9	40	40	0.411
10	40	100	0.412

Calibration curves for oleate both in the presence and absence of dextrin were shown in Fig. 1. It may be noted that there is a slight increase in the intensity of the colour (absorbance) in the presence of dextrin. Hence a blank run (after estimating the concentration of dextrin) was performed by keeping same concentration of dextrin present in the solution. The actual concentration of oleate was arrived by subtracting the blank value from the total absorbance value of oleate in original solution.

After the adsorption experiments the material was dried at 60°C and a thin flat

disk with a dia of 1 cm was prepared out of this material. Wettability of these samples was investigated by contact angle measurements by sessile drop technique described elsewhere [10]. Contact angles were calculated by using Axi-symmetric Drop Shape Analysis - Contact Diameter (ADSA-CD) inbuilt computer software.

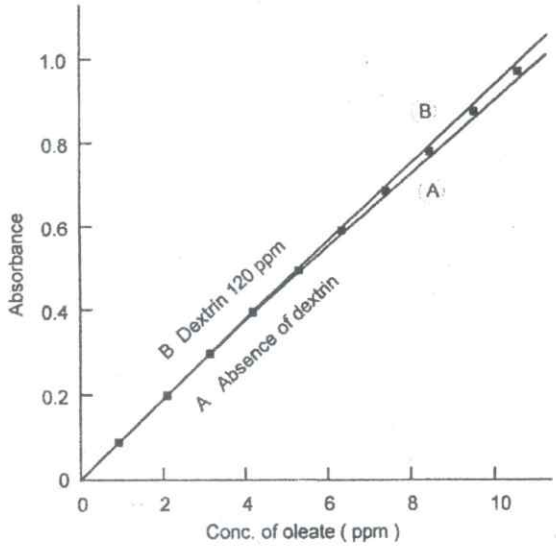
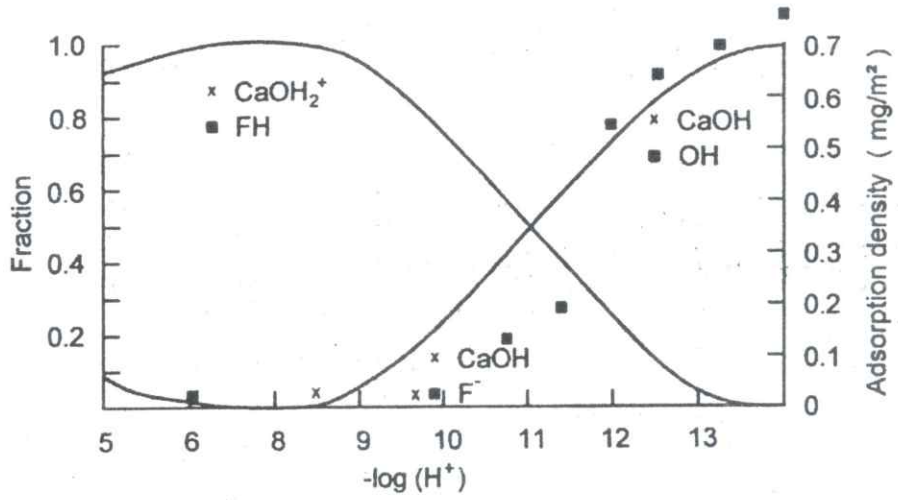


Fig. 1: Calibration curve of oleate

RESULTS AND DISCUSSION

Adsorption of dextrin at fluorite/water interface in the absence of oleate was illustrated as a function of pH. In order to have better visualisation, distribution diagram of surface species as a function of - log [H+] was constructed by using computer software, SOLGASWATER [11]. Surface equilibrium reactions of fluorite and their equilibrium constants established by earlier investigators [12] are used to construct speciation diagrams. Although bulk reactions by dissolved ions were considered, species that arise from bulk reactions were not included in the distribution diagrams as their contribution was found to be very negligible compared to surface reactions. Adsorption density of dextrin (represented as dots) along with fraction of surface species plotted against - log H^+ are shown in Fig 2. It is interesting to note that the adsorption of dextrin follow the path of surface metal hydroxylation and attains maximum in the vicinity of the pH where surface is highly hydroxylated. In other words, metal hydroxy sites on the surface play an important role on the adsorption of dextrin at mineral/water interface. Zeta potential measurements with respect to pH were also recorded to find out surface charge and thereby interaction mechanism of dextrin. The results of the same are plotted in Fig. 3. The surface charge of these minerals was found to be positive in the acidic region and negative throughout the basic. The i.e.p values 8.5, 5.5 and 5.2 of fluorite, appetite and calcite obtained in the present investigation are comparable to the values already reported in the literature [13].



Initial conc. of Dextrin = 24.0 ppm
TC mM for F^- = 0.600
TC mM for Ca^{2+} = 0.300
TC mM for CaF_2 = 0.200

Fig 2: Adsorption pattern of Dextrin on fluorite surface as a function of pH

It is apparent that the adsorption density of dextrin is high around pH 11.0 where both dextrin and mineral are negatively charged. It may be noted that colloidal dextrin is negatively charged from pH 3.5 onwards [14]. Adsorption results in combination with zeta potential measurements clearly suggest chemical interaction between dextrin and hydroxylated mineral surface. The model of chemical complexation via condensation was disscussed by Bhaskar Raju et al.[6]. It was also observed that the positive charge in the acidic region was shifted to near neutral in the presence of dextrin. The adsorption of negatively charged dextrin on to a positively charged surface was attributed to electrostatic attraction. Though it is not as pronounced as the one at pH of hydroxylation, a weak interaction could be seen where mineral surface and dextrin are oppositely charged. Thus dextrin was found to interact by different mechanisms depending on the nature of mineral surface. A similar phenomena discussed above was noticed in the case of apatite and calcite also.

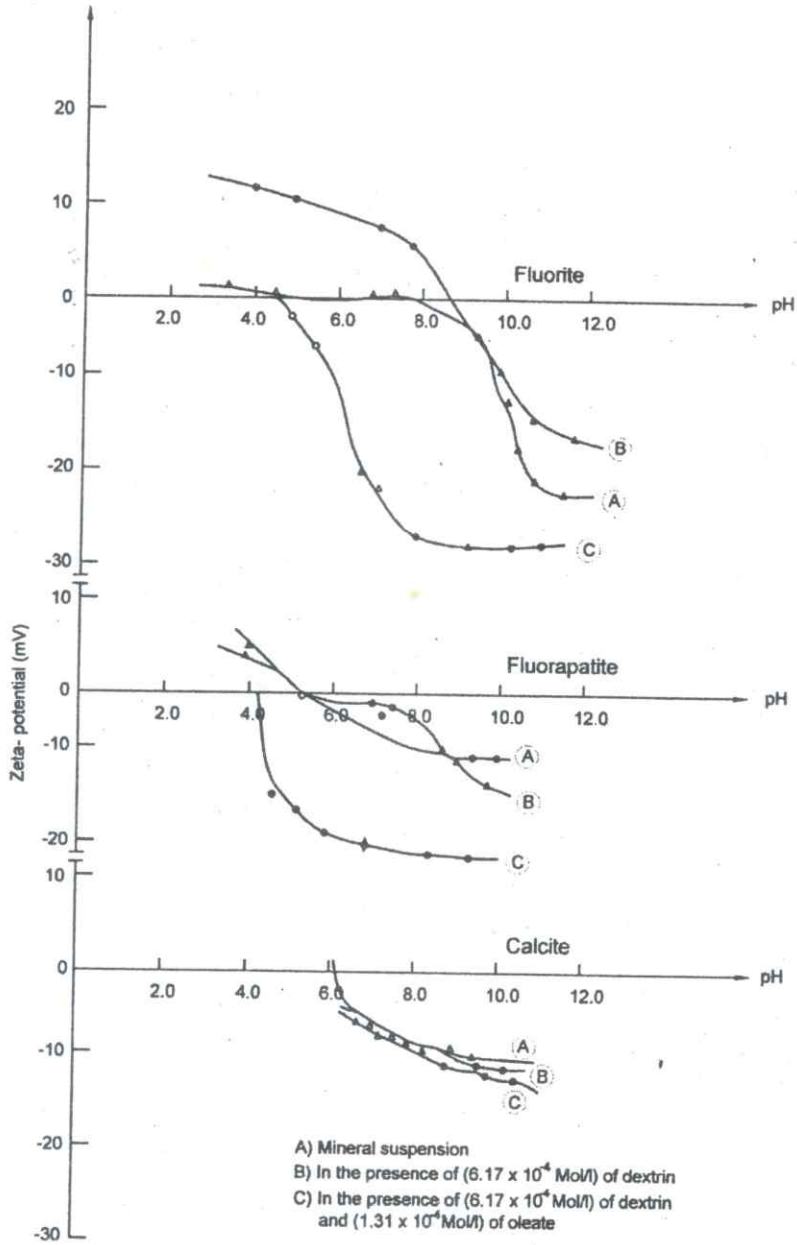


Fig 3: Zeta potential of Fluorite, Fluorapatite and Calcite in the presence of dextrin and oleate

Interaction of dextrin in the presence of oleate

Generally, flotation response of fluorite is optimum around pH 8.0. The significance of this pH while using oleic acid was explained in terms of solution chemistry of oleate [15]. The activity of acid soap (R.COOH.RCOO) which is extremely surface active is maximum around pH 8.0. Significant increase in flotation at pH 8.0 was attributed to the adsorption of such species on mineral surface. Hence most of the experiments were planned around pH 8.0 and above.

In order to evaluate the adsorption behaviour of dextrin in the presence of oleate, a fixed quantity (88 mg/L) of dextrin was added to 0.5 gm of fluorite in aqueous solution at pH 8.0 and equilibrated at different concentrations of oleate whose pH was pre-adjusted to 8.0. The results of adsorption densities of both dextrin and oleate along with contact angle measurements as a function of initial concentration of oleate are shown in Fig. 4. It is interesting to note that the adsorption of dextrin increases with oleate and reaches plateau around 1.75 mg / m^2. It clearly suggests that the adsorption of dextrin on mineral surface depends on oleate adsorption. Monolayer coverage of oleate is expected either at 5 or at 8 micro mol/m^2 depending on the state of the oleate molecule in the adsorbed region. The cross sectional area of oleate in a vertical orientation was reported to be 20.5 $Å^2$ whereas the alkyl chain in the condensed state (liquid crystal) corresponding to the lamellar as 33$Å^2$ [16]. If the oleate is assumed to be in a liquid crystal state, the monolayer coverage corresponds to 5 micro mol / m^2. In the present investigation, oleate adsorption density corresponding to the plateau value was observed to be 6 micro mol / m^2. However, cross sectional area of 20.5 A^2 was considered for the purpose of surface coverage (θ) calculations. Adsorption of dextrin on fluorite is supposed to be negligible around pH 8.0 since the surface is not hydroxylated at that pH (Fig. 2). The possibility of electrostatic attraction is also remote as the mineral surface is neutral. Hence the dextrin adsorption in the presence of oleate could be attributed to hydrophobic-hydrophobic interaction.

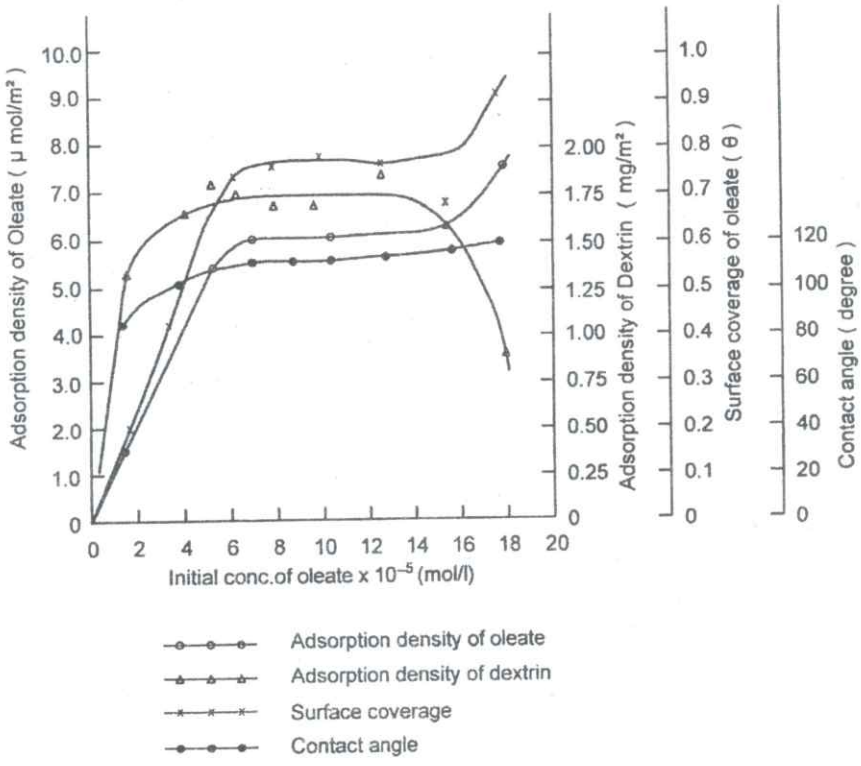
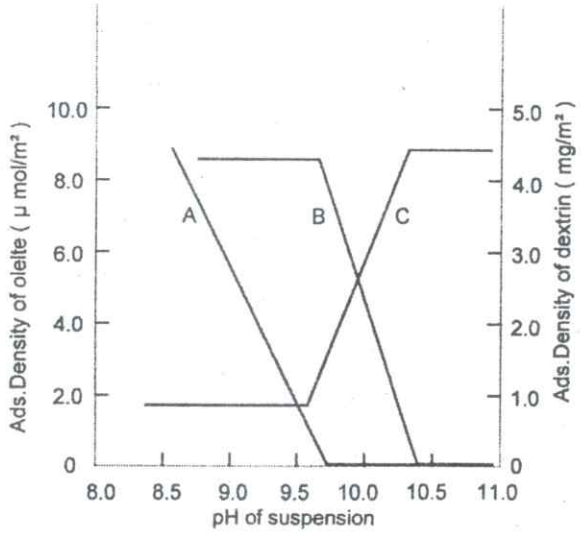


Fig 4: Adsorption behavior of dextrin and oleate on Fluorite (Initial Conc. Dextrin: 88 ppm, Slurry pH: 8.00

After initial adsorption of oleate, surface is covered with a layer of oleate and in turn becomes hydrophobic. Once the mineral surface becomes hydrophobic, dextrin molecule was found to adsorb on the surface through hydrophobic - hydrophobic interaction [4]. A sharp decrease in the adsorption density of dextrin was observed from the point where the adsorption density of oleate exceeds beyond monolayer. The displacement of adsorbed dextrin by the second layer of oleate or micellar aggregates could be explained by hydrophobic forces. The hydrophobic-hydrophobic interaction between two oleate hydrocarbon groups may be more stable and stronger than that existed between oleate and dextrin.

Adsorption of oleate and dextrin with reference to pH of the suspension was studied and the results of the same are shown in Fig.5.



A) Adsorption of oleate in the presence of dextrin
B) Adsorption of oleate in the absence of dextrin
C) Adsorption of dextrin in the presence of oleate

Fig 5: Adsorption of dextrin and oleate on fluorite with pH

It is interesting to note that there is a drastic decrease in the adsorption of oleate above pH 9.5. The chemisorption of negatively charged oleate ions by ion exchange mechanism was restricted possibly due to the competition between hydroxyl and oleate ions. On the other hand, a sharp increase in the adsorption density of dextrin was noticed from pH 9.5 onwards. More and more Ca-OH sites built up on the surface as the concentration of OH^- increases, once the surface sites are hydroxylated, dextrin can react with such surfaces and forms calcium-dextrin complex via condensation mechanism. The contact angles measured under such conditions were found to be below 45°. Apparently mineral will be depressed above pH 9.5. It is very clear from the above results that below pH 9.5 adsorption of oleate is predominant where as adsorption of dextrin will dominate above pH 9.5. The adsorption behaviour of dextrin and oleate on apatite and calcite is expected to be more or less similar to that of fluorite.

Contact angles were measured after conditioning the mineral samples with oleate and the results are shown in Fig. 6.

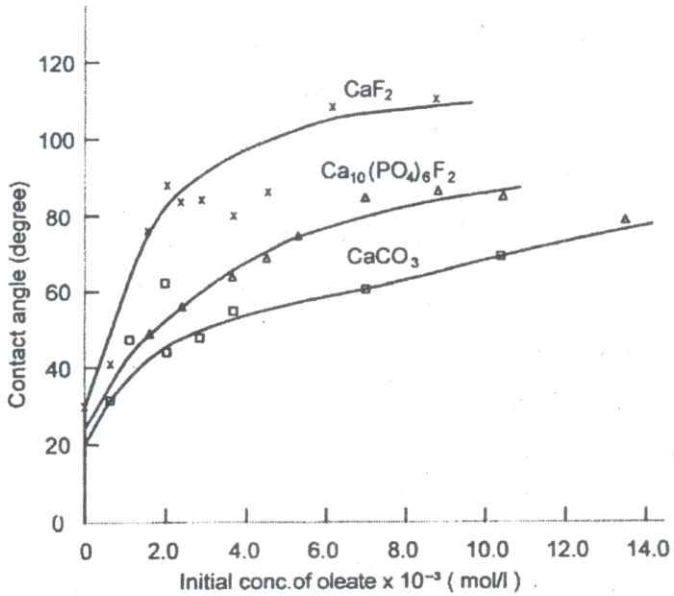


Fig 6: Effect of oleate concentration on wettability of calcium minerals

It is evident that at any specified concentration, fluorite particles exhibit high hydrophobicity compared to that of apatite and calcite. Fluorite could become sufficiently hydrophobic even at very low concentration i.e $2x10^{-5}$ mol/L of oleate whereas apatite and calcite need high concentrations of oleate to aquire similar degree of hydrophobicity. During actual flotation, it is difficult to maintain exact dosage of oleate due to recirculation of slurry. Further, other gangue minerals also aquire certain degree of hydrophobicity due to non-selective adsorption of oleate. Under such conditions, gangue particles may adhere with valuable particles through hydrophobic interaction which inturn will affect the quality of the concentrate. To avoid such aggregation of fluorite with calcite and apatite the slurry should be well dispersed. A few flotation tests were conducted on fluorite ore where calcite and apatite are present as gangue. The results of the same are presented in Table 3. It is apparent that in the presence of dextrin the quality of the concentrates was significantly improved without affecting the recovery. It may be noted that contact angles remain more or less same even in the presence of dextrin. From the above results it is suggested that dextrin might act as dispersant at pH 8.0 where fluorite is floated.

Table 3: Flotation results under the conditions of % solids: 30, Oleate Conc: 1.0 kg/t, Sodium silicate: 1.5 kg/t, Slurry pH: 8.00

Dextrin (kg/t)	Sample	Chemical Assay (%)				Recovery (%)
		CaF_2	$CaCO_3$	P_2O_5	SiO_2	
0.00	Feed	29.05	7.52	1.52	51.20	-
0.00	Conc.	65.24	7.62	2.14	15.92	83
0.3	Conc.	74.56	5.24	1.42	13.29	81
0.5	Conc.	78.24	4.24	1.40	14.52	80
0.6	Conc.	77.84	4.62	1.35	13.84	78
0.7	Conc.	80.20	3.82	1.40	12.46	79

It is known that stable dispersion can be achieved if the particles are hydrated with water molecules and *I* or covered with hydrophilic moiety. The attractive primary minimum for hydrophobic surfaces which could lead to aggregation may be reduced by adsorbing dextrin having hydrophilic moiety. The stable dispersion of magnetite and dolomite particles was attributed to repulsive character of hydrophilic structural force and their aggregation to attractive hydrophobic structural force in the presence of sodium oleate [17]. Though the oleate is adsorbed somewhat preferentially on fluorite, other calcium minerals also will attain certain degree of hydrophobicity due to non-selective adsorption. Under the conditions where both gangue minerals and valuable minerals are hydrophobic the aggregation of valuable fluorite particles with gangue particles like apatite and calcite could perhaps be prevented by dispersing the system with dextrin.

However, surface force measurement studies are essential for thorough understanding. Thus, depending on pH of the suspension, dextrin can act either as dispersant or as depressant.

CONCLUSIONS

Adsorption of dextrin on fluorite in the absence and presence of oleate was studied. Depending on the nature of mineral surface, dextrin was found to interact by three different mechanisms viz chemical, electrostatic and hydrophobic-hydrophobic interaction. Maximum adsorption of dextrin was noticed around the pH where mineral surface was highly hydroxylated. The mechanism of dextrin adsorption with such metal hydroxy sites was found to proceed via chemical complexation. Zeta potential measurements have indicated the possibility of dextrin adsorption by electrostatic attraction under the conditions where mineral surface and dextrin are oppositely charged. At the point of zero charge the adsorption of dextrin was found to be minimum/ negligible. Where both dextrin and oleate are present, pH of the mineral suspension was found to play a vital role. Below pH 9.5 adsorption of oleate is dominated whereas above pH 9.5, dextrin adsorption is high. Furthermore, dextrin adsorption on the mineral surface already coated with oleate was explained by hydrophobic interaction. At pH 8.0 where fluorite is generally floated from other minerals, it is presumed that dextrin will act as a dispersant.

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SHOWCASE OF MODERN TECHNOLOGY BACKED BY INNOVATIVE SYSTEMS AND APPROACH

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Bench Mark Mining Industry

INTRODUCTION

Scientific Mining and Coal beneficiation in India was introduced by Tata Steel with mining that started at West Bokaro in 1947 and the first coal washery of India was established in 1951 in West Bokaro. Beginning with production of 0.4 MTPA at 18% ash from year 1972 the unit at present it is producing 5.67 MT of Raw Coal and 2.1 MT of Clean Coal with 15 % ash.

The journey started from underground mines of 0.4 MT that went up to develop modern opencast mines of 6MT. Washeries processing coal through chance cones was developed to a modern washeries using Low Ep dense medium cyclones, U bottom flotation cells, vacuum bed filters and a myriad of other latest technology equipments, control systems were added to the unit for processing of coal.

MINING INDUSTRY WITH NEW MANAGEMENT INITIATIVES

It was a myth that modern technology, modern mind with innovative ideas and techniques cannot be a part of mining Industry but Tata Steel Bokaro has created a Blue Ocean for itself by adding new technology, Partnering world's best HEMM company, using TQM, TPM and TOC Techniques for overall growth backed by Lean Initiatives for reduction of wastages was established for manufacturing industry.

Total steel identifies the variance and put action plan together. The Cat 95 tonnes truck is connected through GPS and data is reported through the mine information system and it is evaluated to look for events that take trucks down , performance feedback to operators , haul road constructions and maintenance , shift changes, fuelling time and all such things that could make a difference in equipment utilization.

MAKING THE FLEET RUN

Manpower was a huge factor in getting most out of mining equipment. Besides, shift change over timing, staged shut down at different places and at different times with staggered operators taking the trucks immediately, fueling at shift change or during daily maintenance make the fleet run without interruption.

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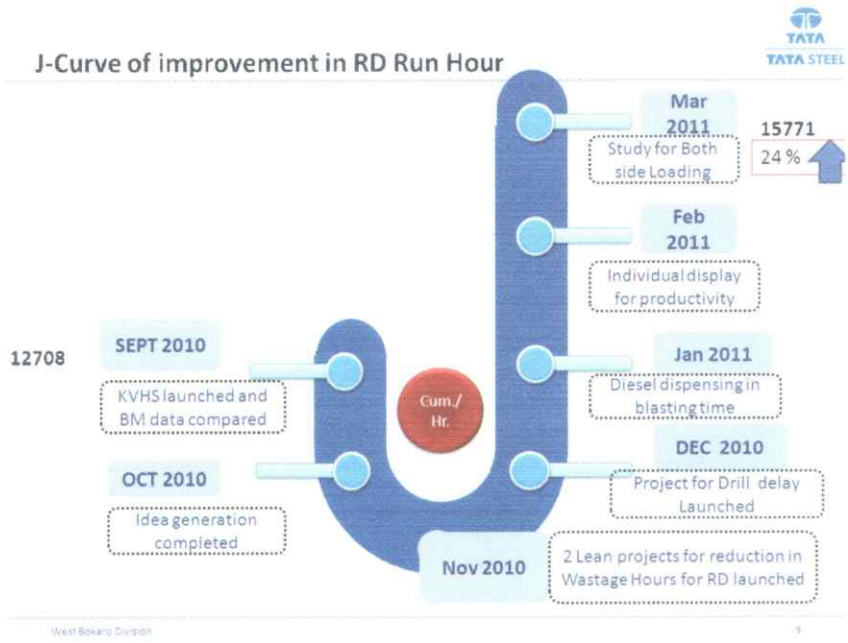
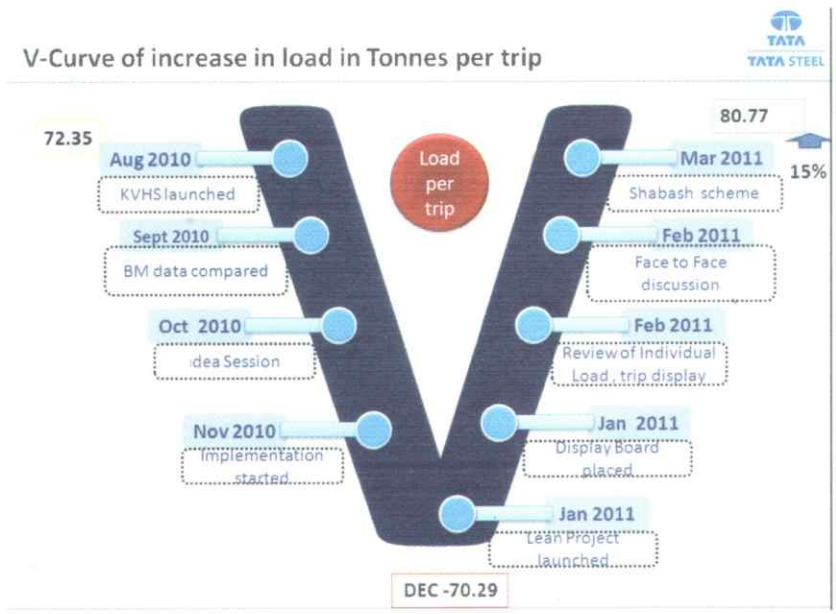


FOCUSING ON PRODUCTIVITY

The unit is looking at every possible way to be productive as possible, by introducing new techniques, new equipment, and better mining methods-.



It may be mentioned here that, operator training, performance feedback, incentives and culture of workforce also affect how the trucks and shovel work. The system takes care to ensure that each operator too gets report for waiting time, average payload, run hours and other performance indicators. Incentive program has been based on safety, productivity and run hours, to make it effective.

How to sustain with a competitive edge

A. Management of Control through Technology
B. Management of Modernization of Mind
C. Management of Innovations

- **Management of Control through Technology**

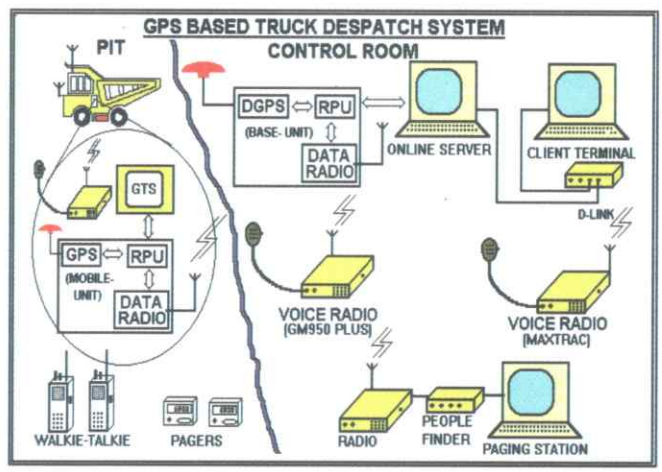
Opencast Mining is a capital intensive industry under adverse working condition. In order to get higher returns of asset used under safe condition, technology guided equipment should get an edge over operator guided equipment, though one must not undermine the importance of high skilled operators. With this philosophy, our major thrust have been in the area of selection of features of HEMM which suits our requirement fully debated and on facts backed up by analysis of .data. Out of many examples few are indicated below:

- ❖ Auto Central Lubrication System
- ❖ Lubrication station on RD & EX
- ❖ Payload Monitoring System on RD
- ❖ Engine ECM logged Events
- ❖ Fast Fill Fuel Systems
- ❖ Fuel Tank suitable for 26 Hours Operation
- ❖ Operator Comfort
- ❖ Truck Dispatch System
- ❖ Rear View camera
- ❖ Automatic Retarder Control

EMS Data Analysis

- ❖ *fuel filter restriction*
- ❖ *coasting in neutral*
- ❖ *transmission abuse*

This data is being monitored and analyzed with corrective action, through Real time GPS monitoring system so that proper interfacing of equipment and systems is maintained.



Similarly on line Payload Monitoring system with Positioning of HEMM in field gives the input for decisive performance management. Many proactive Maintenances features are outcome of Technological up gradation of equipments

- ➢ Application Severity Analysis of Haul Road
- ➢ EMS Data Analysis
- ➢ Fuel Filter Restriction
- ➢ Engine Over speed
- ➢ Coasting in Neutral
- ➢ Transmission Abuse etc

With application of TPM and integration with TQM, we have reduced not only the Breakdown hours but also reduced the variability in availability of equipment.

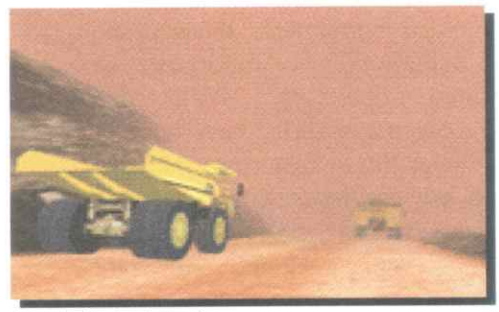
MANAGEMENT OF MODERNIZATION OF MIND

One of the biggest challenges in modern management is modernization of mind. With the help of Technology and a practical and challenging training module the workforce was developed for competitive era who can understand the implications of not changing with time. We realized that roots for modern mind takes place while working in a environment friendly atmosphere which a person often dreams of, which led to following changes to betterment.

- Ergonomically designed Cabin
- Excellent machine control
- Exceptional all-around visibility
- Resiliently-mounted, sound suppressed cab
- Sound levels less than 80 dB (A)
- Air suspension seat fully adjustable
- Air conditioned cabin
- Environment free from Dust

With the setting up of platform simulator Training was provided to get a feel of a real time situation, which is first of its kind in Mining industry of India.

Simulator



Real time situation

The above initiative backed by real time training such as outdoor training has changed the behavior pattern and helped in the modernization of mind to harvest the thoughts for constructive and focused approach.

MANAGEMENT OF INNOVATION

Tata Steel aspires for even more and seek even greater challenges. Sometimes, we invent them by changing our frames of reference because we wish to constantly harness the potential of human spirit.

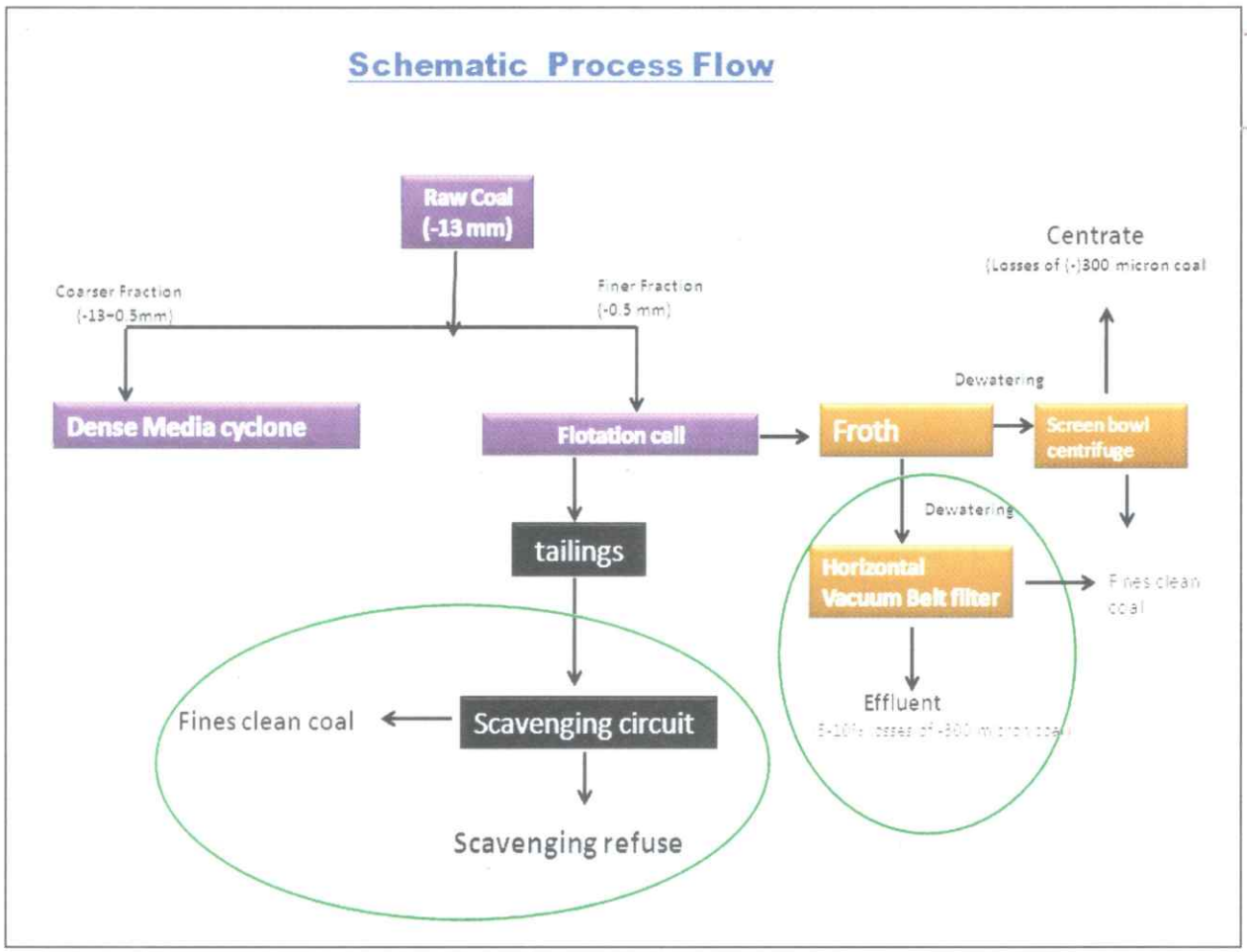
Sometimes we climb new peaks only to discover newer ones that were otherwise invisible. And, thankfully, the external environment keeps changing to pose new challenges and keep us on our toes.

People are already dreaming and envisioning what can be there in future.

SCOPE TO RECOVER CLEAN COAL

- For dewatering of fine coal we have been using scrolled bowl centrifuge. Under this process Pulp is fed to the chamber of centrifuge. This has long trammel having small aperture. Pulp is moving inside the chamber under the influence of centrifugal forces which lead to decant out the cent rate from the chamber and discharge the dry portion from other end of the chamber. In this process low ash ultrafine (-300 micron) coal is lost due to centrifugal force during dewatering.

- We are using froth flotation process for processing of fine coal (-0.5 mm). The separation takes place depending on the surface characteristics of coal particle. That low ash particle coal which have low floatability in character is lost through the tailing, a discard from FF system.

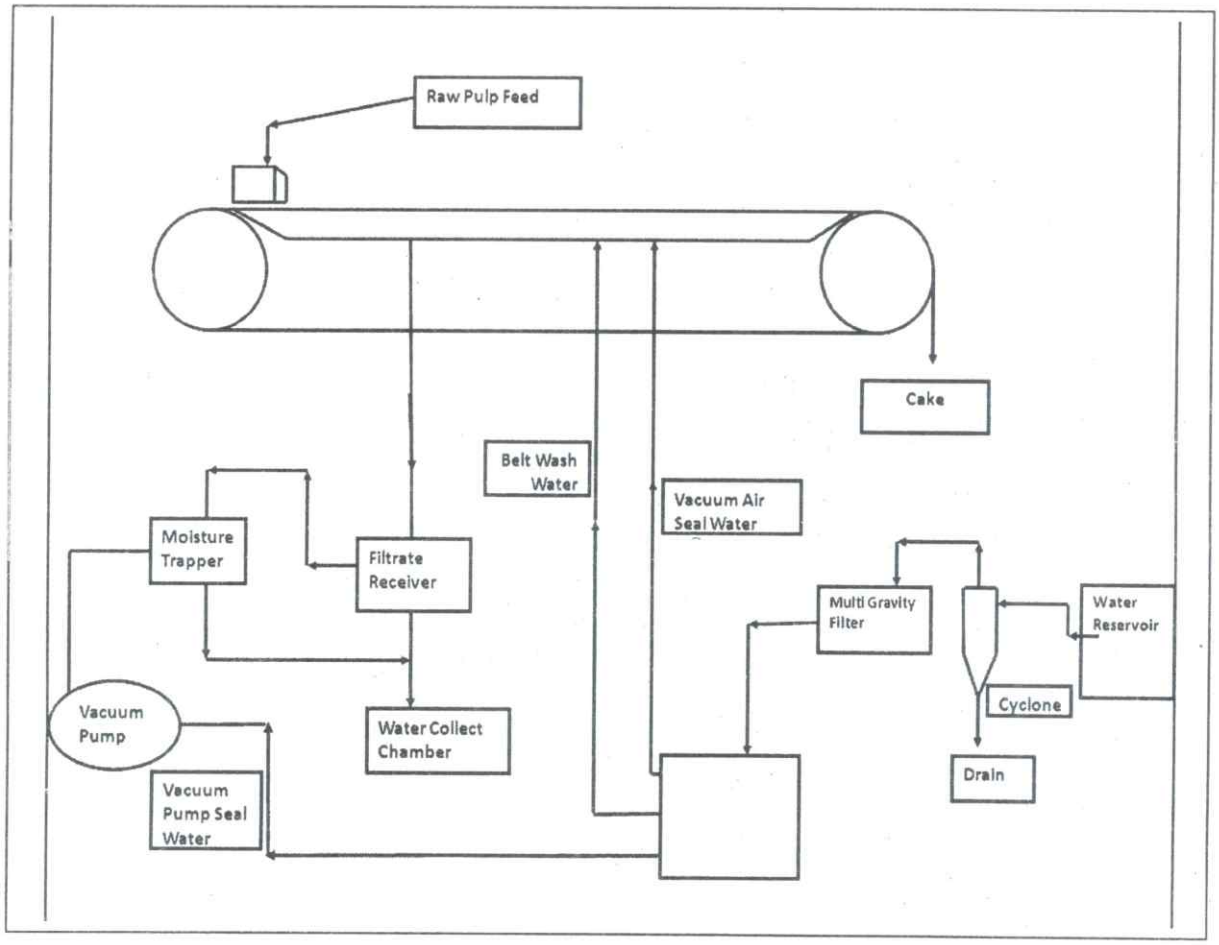


HORIZONTAL VACUUM BELT FILTER

It is a technology for arresting (-) 300 micron low ash coal particle, which is lost through centrate of scroll bowl centrifuge. To overcome the loss of low ash clean coal we have installed Horizontal Vacuum Belt Filters for dewatering of concentrate of Froth Flotation cells. The Filter used here is the biggest in size for coal application.

BASIC PRINCIPLES OF WORKING

It is a gravity fed method, where the coal slurry is fed on the top of the filter. As expected the coarse particles tend to settle out first in the form zone .This creates autogenously filter medium for remaining part of the fine coal pulp. This allows the balance of the particle to pack tightly and thereby reducing the void which resulted in higher filtration rate and lower residual moisture. All the above activities are done by applying vacuum pressure from the bottom of filter cloth.



FOLLOWING ADVANTAGES ARE OBSERVED IN THIS PROCESS

- 90% of (-)300 micron low ash coal particle of froth is recovered through horizontal vacuum belt filter which was earlier lost through centrate of Scroll bowl centrifuge
- 1% improve in yield of clean coal by recovering more coal from both coarse as well as in fine circuit
- Water consumption becomes less by increased recovery of water through horizontal vacuum belt filter
- Effluent water clarity become more effective

SCAVENGING CIRCUIT FOR FINE COAL BENEFICIATION

This unit has adopted a technology for recovery of clean coal from tailing, discard of froth flotation system.

Basic principle of Reflux Classifier:

Reflux Classifier combinedly works on two basic principles:

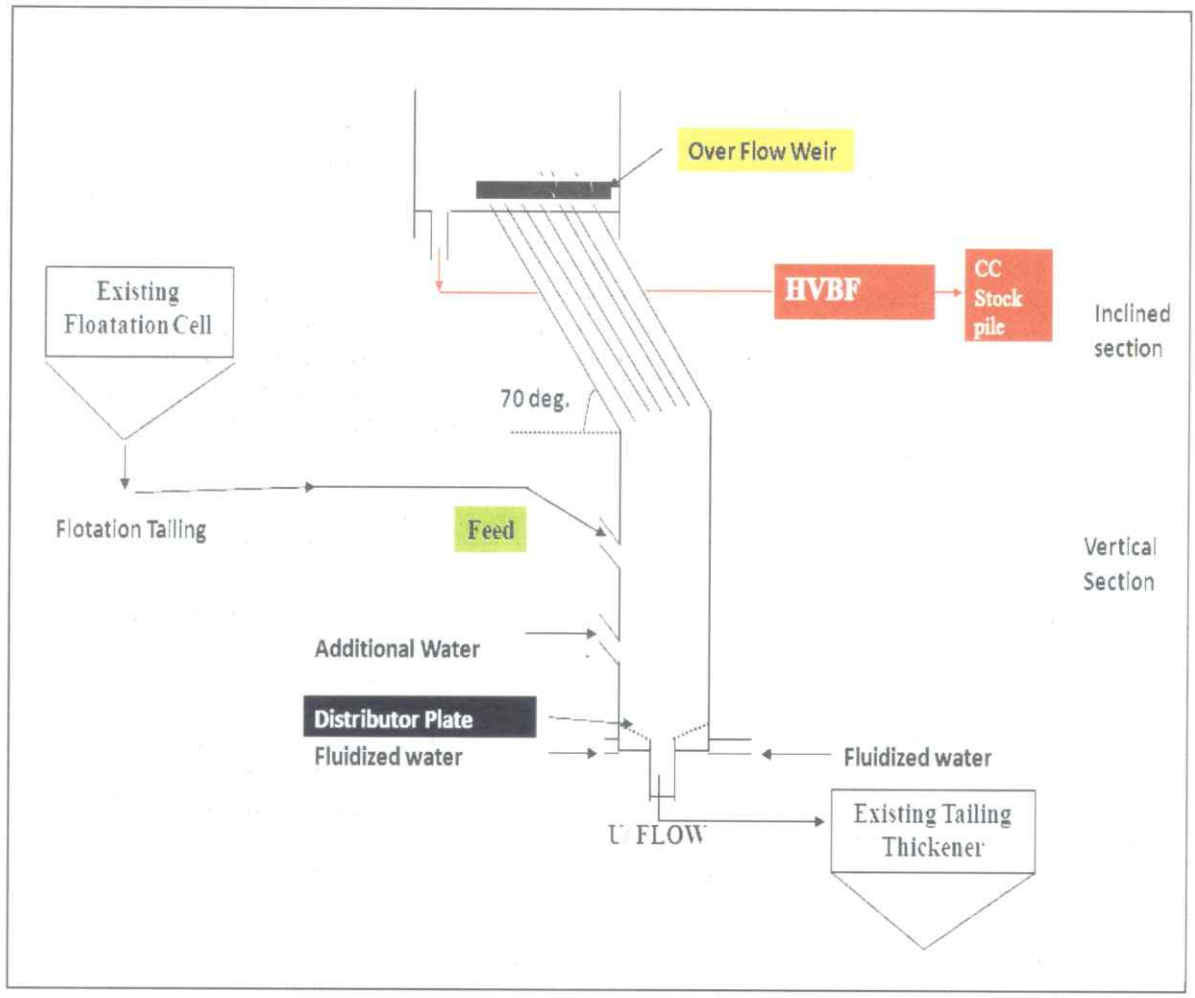
1. Separation in fluidized bed
2. Separation using inclined lamella plates

Separation in Fluidized Bed:

Separation occurs with the lighter and finer particles being carried by the up flowing water to the overflow and heavier and coarser particles sink to the bottom. The particles having the same settling velocity compare with the up flowing velocity of the water form a fluidized Bed (autogenous medium).

Separation using inclined Lamella Plates:

- Within an inclined channel, the segregation rate of particles from the liquid is much more rapid than within a vertical channel.
- The Same Density Particle in the inclined Plate will settle out of the water around 3 times faster than in vertical plate
- The inclined channel provides an increased effective area available for segregation



***Benefits of Reflux* Classifier:**

- It can operate in wide range of feed type & condition.
- It is more efficient & compact compared to other fine beneficiation equipment.
- It can operate consistently under low RD cut point.
- Overall yield at any target ash will be significantly improved.
- It has operation & maintenance friendly features.
- Annual generation of 0.64 Lakh ton of additional clean coal.

Tata Steel believes in the saying of Sir Edmund Hillary that:

"It's not the mountain we conquer, but ourselves."

With these efforts and perseverance, Tata Steel continues its mission to its target of maintaining a perfect harmony with nature.

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ENVIRONMENT AND DEVELOPMENT ISSUES TODAY AND SUSTAINABILITY

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ABSTRACT

India is one of the mega-biodiversity countries of the world. The development pressure due to social needs and urban and industrial growth is on the rise and almost all ecosystems from agro-ecosystem to marine-ecosystem are facing problem of environmental degradation. The global action under United Nation's umbrella aims at strengthening the capability of the nations to improve upon the quality of the environment and adopt means and measures for sustainable development. The Ministry of Environment and Forests has been taking various programmes for biodiversity conservation and environment protection in the country. There are still several areas where we need strengthen our capacities to deal with prevention and control of pollution and initiating research and development programmes by strengthening the institutions for taking up areas for research on environment. The present paper highlights various issues being faced by the country and likely impact on the natural environment and path to achieve sustainable productivity.

***Key words**: Development, Population, Forest, Biodiversity, Climate Change, Restoration*

INTRODUCTION

Livelihood issues and wide gap between developed and developing nations in consumption and material production patterns will always impact the projects and programmes at both global and regional level which are being considered to address environmental concerns. The environmental degradation arising due to above factors needs to be addressed effectively. The crises of hunger and malnutrition are to be effectively addressed to ensure success in upcoming Rio + 20 "UN Conference on Sustainable Development" as recommended in a report by Food and Agricultural Organisation (FAO, 2011). The Earth Summit will take place in Rio de Janeiro from Jun. 20-22, 2012. The FAO report states that despite progress in food production, hundreds of millions of people lack access to sufficient quality of food for a healthy and productive life. We must make all efforts for hunger reduction which alone will help substantially to achieve the goals of sustainable development. The FAO report reveals that Agriculture and food systems use over 30% of world's energy and are major consumers of natural resources. The crop and livestock sectors use 70 percent of all water withdrawals. Global food losses and wastes across nations have been estimated approximately 30% for cereals, 40-50% for root crops, fruits and vegetables, 20% for oil seeds and 30% for fishes. The Rio + 20 Conference aims at reaching an agreement on the transition to a green economy, through investment in renewable energy and efficient use of natural resources.

At the third round of informal negotiations on draft outcome document which was held in New York from 26 May to 2 June under UN Conference on Sustainable Development (also known as 'Rio+20'), substantial differences between developed and developing countries surfaced over understandings and intentions of the 'green economy' concept. However, paragraph 52 of document stated as we affirm that green economy policies in the context of sustainable development and poverty eradication should:

(a) Respect each country's national sovereignty and right to

development, as well as its national circumstances, objectives and priorities with regard to the three dimensions of sustainable development;

(b) Be supported by an enabling environment and well-functioning institutions at all levels with a leading role for governments and with the participation of all relevant stakeholders;

(c) Promote sustained and inclusive economic growth, foster innovation and provide opportunities, benefits and empowerment for all, while taking into account the needs of developing countries, particularly those in special situations;

(d) Strengthen international cooperation, mobilize the efforts of all countries and means of implementation from all sources, and avoid unwarranted conditionality on ODA and finance;

(e) Avoid creating trade measures that constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade;

(f) Contribute to closing technology gaps between developed and developing countries and reduce the technological dependence of developing countries;

(g) Enhance the welfare of indigenous peoples and their communities and other local communities, recognizing and supporting their identity, culture and interests and avoid endangering their cultural heritage and traditional knowledge;

(h) Enhance the welfare of women, children, youth, people with disabilities, small and subsistence farmers, fishers and those working in small and medium enterprises, and support the livelihoods and development of people in vulnerable situations;

(i) Promote pro-poor productive activities in developing countries;

(j) Acknowledge that countries' priorities, based on national circumstances, include, inter-alia, eradicating poverty, education, health, food, water and energy for the basic well being of people;

(k) Preserve and promote community practices and non-market approaches that have demonstrated to be useful in eradicating poverty and protecting the environment;

(l) Address the concern about inequalities between and within countries and the related concentration of income and wealth.

STRATEGY FOR SUSTAINABLE DEVELOPMENT

The FAO report broadly hints at integrating food security and environmental objectives and implementing reforms in agriculture and food system. The health of world's ecosystem will be affected by the discussions of Natural Response Manages. Integrating the production and consumption system for equitable sharing and sharing the financial burden by society for sustainable development will be achieved if following issues are effectively addressed:

- Combating poverty
- Empowering people
- Using core competence in science and technology
- Setting environmental standards Conservation of Natural Resources Improving Core Sectors of Economy

The natural ecosystems have the capacity of resilience as these respond to environmental change to bring back stability to maintain their structure and function. Although natural ecosystems are self regulating, increased human management and control on these ecosystems in the form of external disturbance, sudden shock and cumulative or continuous stresses has affected the resilience capacity of these ecosystems, so much so that these ecosystems now suffer from irreparable losses that lead to species extinction and sometimes collapse of all or some ecosystem services which finally affect the human society.

We normally define the development as, "Change leading to Improvement or progress". The economic development aims at achieving set of goals. By not integrating the concepts of 'Development or Economic Development' and 'natural resource management', we tend to get disoriented from the principles of sustainable development. Sustainable development aims at increasing per capita wellbeing over time. Sustainable development is a measure of non-declining natural wealth which maintains that each generation should inherit at least a similar environment and aggregate of natural (or manmade) capital must not decline between one generation and next. The following questions during development of any policy or programmes will help us to evaluate if sustainable environmental objectives are being integrated into development plans:

- Whether value additions through development are linked to optimum resource utilization.
- How much weightage in terms of value addition is given to site of resource availability?
- Whether all waste streams have been thoroughly investigated to reduce resource loss.
- Whether development has shown overall commitment to sustainable development.

There have been significant developments towards achieving the goals of sustainable development at the world level especially under umbrella of United Nations. Following international Treaties/ Conventions/Declarations aim at strengthening the environmental policies and programmes of Nations towards achieving the goals of environmental protection and conservation of biodiversity:

- Stockholm Conference 1972
- Agenda 21 Rió Declaration
- Convention on Biological Diversity
- Convention to Combat Desertification
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Prior Informed Consent (PIC), Rotterdam Convention (For certain Hazardous Chemicals in International Trade) Yet to be signed and ratified by India)
- Basel Conv. on the Control of Transboundary Movements of Hazardous Wastes
- United Nations Framework Convention on Climate Change
- Intergovernmental Panel on Climate Change (IPCC)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- World Trade Agreement
- Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 percent
- Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (NOx Protocol)
- Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (VOCs Protocol)
- United Nations Conference on Environment and Development (UNCED)
- Convention Secretariats of the UNEP

THE PROBLEM AREAS AND SOLUTIONS

Fresh Water Management

Fresh water management is a key issue in our country as most of our surface and ground water resources have been showing deterioration in quality and depletion in stock. Availability of fresh water is the most pressing problem in India. There is continued stress on water resources due to urban growth, increased industrial activities, intensive farming, and the overuse of fertilisers and other chemicals in agricultural production. The studies carried out for surface water irrigation projects in India have indicated water use efficiency of about 35-40% as compared to 50-60% in developed countries. Untreated

water from urban settlements and industrial activities, run-off from agricultural lands carrying chemicals are primarily responsible for the deterioration of water quality and the contamination of lakes, rivers, and groundwater aquifers. The average annual water availability of water in the country has been assessed 1869 billion cubic meters (BCM). Government of India has launched National Action Plan on Climate Change envisaging setting up of 8 National Missions, including 'National Water Mission' with an objective of conservation of water, minimizing wastage and ensuring its more equitable distribution through integrated water resources development and management. The five identified goals of the Mission are: (a) comprehensive water data base in public domain and assessment of impact of climate change on water resources; (b) promotion of citizen and state action for water conservation, augmentation and preservation; (c) focused attention to vulnerable areas including over-exploited areas; (d) increasing water use efficiency by 20%, and (e) promotion of basin level integrated water resources management.

The average annual precipitation in India is estimated to be about 4,000 Billion Cubic Meters (BCM). After accounting for evaporation and evapotranspiration, the average annual water availability, as stated above, has been assessed as 1869 BCM. Due to topographic, hydrological and other constraints, the utilizable water is only 1123 BCM, which comprises of 690 BCM of surface water and 433 BCM of replenishable ground water resources. The National Commission on Integrated Water Resources Development (NCIWRD), in its report in 1999, had assessed total water requirement for various uses in the country as 1180 BCM by the year 2050. Further, Water stress situation exists in our country due to large temporal and spatial variability in availability of water. As per the report of Ministry of Drinking Water & Sanitation, out of the total 16,64,186 rural habitations in India, 99,380 habitations are affected with water quality issues (PIB Release 14th May, 2012). There is another estimate stating that average annual per capita water availability in the country (2011 census) is 1545 cubic meters. We are yet to assess state-wise per capita water availability since data state-wise surface water availability is not available.

Central Ground Water Board collected long term water level data during pre-monsoon period between May, 2002 and May, 2011 which indicate that 44% of the observation wells monitored throughout the country have registered decline in ground water levels and the remaining 56% of the wells have registered rise. The National Water Policy, 2002 stresses that exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, linking the issue to ensure social equity.

MoEF (PIB Release dated 27-March, 2012) have developed a road map for Pollution free Rivers. The CPCB in association with SPCBs/PCCs have established a network of 1085 Water Quality Monitoring Stations along various river stretches. The results of Water quality data collected from the stations indicate that Bio-chemical Oxygen Demand (BOD) has exceeded the desired water quality criteria (< 3 mg/per litre) in 150 river stretches covering 121 rivers. The discharge of untreated and partially treated domestic effluents by various municipalities across the country are the major causes of rising organic pollution in these rivers particularly BOD. The MOEF and the States with their ongoing and collective efforts are working for pollution abatement in identified river stretches under National River Conservation Plan (NRCP). This programme covers 40 rivers in 190 towns spread over 20 states for implementing pollution abatement schemes like interception, diversion and treatment of sewage, low cost sanitation works on river banks and electric/improved wood crematoria etc.

Land Degradation

Land degradation occurs through both the natural and man-made processes of wind erosion, water erosion and water-logging. This issue is one of the priority concerns.

Results of such degradation are the loss of invaluable nutrients and lower food grain production. Poor land use practices and management are responsible for the rapid land degradation. It is estimated that about 10 m ha of forestland are subject to shifting cultivation. The increased population pressure on shifting cultivation and resultant decline in soil fertility has reduced the cultivation cycle from 15-20 years to 3-4 years. It is recommended that compatible agro-forestry models could only halt the degradation of fragile land due to shifting cultivation.

Agro-forestry practices allow growth and interactions among tree, crop and livestock systems on a land area to help achieving sustainable management system. This cultivation/farming practice as a multi crop system helps growth of trees and crop while maintaining the fertility of soil achieving efficient nutrient cycling. The diversification helps better land output, improving the economy of farmers. The traditional agriculture practices in India ensuring complementary relationships between trees and crops were forgotten during intensive agriculture programme in our country. Of the 329 m ha total geographical area, about 175 m ha is under moderate to severe land degradation. Degradation due to water erosion has affected 107 m ha of land; water logging and salinity affected 10 m ha. More than 50 per cent of forest area is suffering from various degree of degradation. There is immediate need for restoration of degraded lands and prevention of potentially vulnerable lands from degradation for achieving sustainable land management system. It is reported that the import of wood and non-wood produce has reached around Rs. 8,000 crore per annum. About 2 m ha area covered under rubber, cashew, coconut and mango plantations (non-forest sources) account for about 50 per cent of total wood supply in the country.

The restrictions have been imposed on felling and transportation of trees grown even on farmland to basically prevent pilferage from government forests and to map the kind of trees being cut from non forest lands. Legal requirements for obtaining permits for felling and transportation are being streamlined to encourage the farmers for undertaking tree planting on farmland softening these restrictions. States have identified many agro forestry species which are exempted from the regulation of felling and transit restrictions. A massive awareness programme about regulation and tree plantation needs to reach to the farmers as a measure of encouragement to generate income from such practices.

The lands suffering from desertification, degradation and drought in India are critical and greatly linked to livelihood and poverty issues as these lands contribute significantly to rural livelihoods. We need to take up management interventions to restore these areas and reduce intensity of deforestation, fragmentation, degradation and drought to help restoring the fertility of the lands which will help farmers to benefit and come out of poverty. About 228 mha (69%) of India's total geographical area (about 328 mha) is under the category of dry lands (arid, semi-arid and dry sub-humid) and is highly populated. In these areas, people are most vulnerable to environmental stress which impacts their livelihoods directly (MoEF 2011).

To address these problems, Govt. of India has identified 22 major programmes for implementation including the "Mission for Green India". One of the Missions under the National Action Plan on Climate Change focuses on dry land forests, in addition to other ecosystems. The 4th National Report submitted to United Nations Convention to Combat Desertification (UNCCD) Secretariat covers t hese issues comprehensively and also seeks Civil Society's contribution. The main highlights of the Report are given below:

- ✓ About 69 percent of India is dry land – arid, semi-arid and dry sub-humid
  - o These areas are heavily populated
  - o Degradation has severe implications for livelihood and food security for millions of people living in these areas.

- ✓ An estimated 32 percent of India's total land area is affected by land degradation (of which desertification is a major component).
- ✓ 81.45 million hectares, or 24.8 percent of the country's geographic area is undergoing desertification
- ✓ Water and soil erosion are major causes of land degradation; water erosion is most prominent in agricultural regions.
- ✓ The key anthropogenic factors resulting in degradation are unsustainable agricultural practices; diversion of land to development programmes; industrial effluents; mining and deforestation.
- ✓ Unsustainable resource management practices drive desertification, and accentuate the poverty of people affected by desertification.

Land rehabilitation is a major priority since as replicated in several policies and programmes of the country to address desertification and degradation. Various programmes viz., Desert Development Programme; Integrated Wasteland Development; National Watershed, Development Project for Rainfed Areas; Soil Conservation in the Catchment of River Valley Projects; National Afforestation Programme; Arid Zone Research; Mahatma Gandhi National Rural Employment Guarantee Scheme; National Rural Drinking Water Programme etc. have been implemented since independence in the country.

Strategies need to be developed including policy intervention, promoting research and stakeholder participation, and technological intervention to check land degradation. Ministry of Environment and Forests (PIB Release 20-December, 2011) encourage and Promote Fruit Bearing Plantation in Forests under National Afforestation Programme (NAP) Scheme with emphasis on regeneration of degraded forests and adjoining areas by planting local and indigenous species in the country. The scheme is implemented through a decentralized mechanism of State Forest Development Agency (SFDA) at State level, Forest Development Agency (FDA) at Forest Division level and Joint Forest Management Committees (JFMCs) at village level. JFM Committees select the species for plantation as per their needs, ecological conditions and other local factors. The native forest species are encouraged for plantation in the forest areas giving importance to trees with multiple uses including fruit bearing trees. The constitution of species and proportion of forest, fodder and fruit bearing species in such plantations is decided by the JFM Committees considering local conditions and the micro plan of the area.

Dealing with Livelihood Issues

Ministry of Environment and Forests (MOEF), on various occasions while dealing with livelihood issues and social development responsibilities, have relaxed environmental norms including clearance norms for environment and forest clearances. MOEF accorded 22,448 approvals under the Forest (Conservation) Act, 1980 (FCA) for diversion of 11,33,469 hectares of forest land (as on 31.10.2011) for developmental needs. These include 5,977 proposals involving diversion of 43,202 hectares for roads and 64 proposals involving 3,648 hectares for Wind Energy Projects. There is standing general approval for diversion of 1.00 hectare of forest land, for execution of public utility projects of 11 specified categories. For creation of public utility infrastructure in Left Wing Extremism (LWE) affected districts, general approval was also accorded (03.11.2010) for a period of five years i.e. up to 31.12.2015, for diversion of 2.00 ha forest land for execution of public utility infrastructure of 13 specified categories. On 13th May 2011 this was further relaxed by enhancing the limit up to not more than 5.00 ha of forest land in 60 LWE affected districts selected under Integrated Action Plan (IAP). In such cases, compensatory afforestation shall not be insisted upon (MoEF letter 16.06.2011).

The provisions of FCA have been above to successfully reduce the average annual rate of diversion of forest land from 1.65 lakh ha/yr from 1951-52 to 1975-76 (totalling

to 4.135 mha of forest land) to 36,548 ha/yr after FCA 1980 (totalling to 1.133 mha of forest land). The statistics indicate that during the period from 01.01.1991 to 15.03.2012 the Central Government accorded 20,267 approvals under the Forest (Conservation) Act, 1980 for diversion of 8, 64,178.79 hectares of forest land for establishing new industries (PIB, 2012). MoEF releases funds to State CAMPAs with due compliance of order dated 10th July, 2009 of the Supreme Court of India in IA No.2143 in WP(C) No.202 of 1995. Release of funds to the State CAMPAs has been permitted within a limit of about Rs.1000 crores per year for the next 5 years (PIB, 2011).

Encroachment on Forest Land

A Centrally Sponsored Scheme 'Intensification of Forest Management' has been launched by MoEF to strengthen forest protection machinery in states by way of infrastructure development, use of modern technology, improved communication and providing arms ammunition to the front-line forestry force. These initiatives have been taken to help in demarcation of forest with boundary pillar, enhancing the patrolling capabilities and strengthening efforts for eviction of forest land encroachers. The encroachment on the forest land is serious problem which can be visualised from the Table-1 (PIB 2011). MoEF also provides Funds for Development of Forests under the three major Centrally Sponsored Schemes (i) National Afforestation Programme, (ii) Intensification of Forest Management Scheme and (iii) Integrated Development of Wildlife Habitats. The details of funds released up to 28.11.2011 in given on Table-2.

Table-1: The status of encroachment of forest land in the country

Sl. No.	Name of States	Area Under Encroachment (in ha.)	As on (Date)
1	Andhra Pradesh	2,56,000.00	11.03.2011
2	Bihar	Nil	01.12.2010
3	Chhattisgarh	1,18,494.60	07.03.2011
4	Gujarat	34,791.00	31.03.2010
5	Haryana	184.63	24.11.2011
6	H.P	1,832.1403	21.03.2011
7	Karnataka	96,014.349	14.03.2011
8	Kerala	42,420.5085	16.05.2011
9	M.P	8,077.72	27.08.2011
10	Maharashtra	85,388	31.12.2010
11	Odisha	78,505.077	01.01.2004
12	Punjab	7404	23.11.2011
13	Tamil Nadu	14,352.16	07.03.2011
14	Uttaranchal	9,676	31.03.2010
15	West Bengal	12,660.972	31.03.2010
16	Arunachal Pradesh	58,553.07	04.03.2011
17	Assam	2,59,700.00	18.03.2011
18	Manipur	1,918.37	02.08.2011
19	Meghalaya	9,378.00	21.03.2011
20	Mizoram	12,057.90	01.10.2010
21	Nagaland	2,671.86	22.11.2010
22	Sikkim	3,300.96	27.05.2011
23	Tripura	47,758.14	16.03.2011
24	A & N Islands	3,326.63	10.03.2011
25	Chandigarh	14.00	11.03.2011
26	D&N Haveli	613.30	22.12.2010
27	Daman & Diu	87.83	28.09.2010
28	Lakshadweep	Nil	16.03.2011
29	Puducherry	Nil	

Source PIB Release dated 28.11.2011

Table-2: Development Programmes for Forest & Wildlife (Source: PIB release 2011)

Sl. No.	State	National Afforestation Programme Scheme	Intensification of Forest Management Scheme	Integrated Development of Wildlife Habitats
		Amount Released 2011-12 (Nov, 2011) Rs. in crore		
1.	Andhra Pradesh	7.60		0.00
2.	Bihar	2.63		0.00
3.	Chhatisgarh	9.06	4.30	1.91
4.	Goa	0.00	0.00	0.00
5.	Gujurat	8.42	1.84	0.00
6.	Haryana	6.12	0.56	0.24
7.	Himachal Pradesh	3.50	2.47	1.95
8.	Jammu & Kashmir	0.00	0.00	3.56
9.	Jharkhand	0.00	2.70	0.47
10.	Karnataka	3.40	2.72	2.13
11.	Kerala	1.95	1.36	2.23
12.	Madhya Pradesh	2.18	5.22	3.82
13.	Maharashtra	7.78	3.73	2.81
14.	Odisha	3.15	1.33	1.91
15.	Punjab	0.00	0.00	0.00
16.	Rajasthan	4.39	1.61	1.87
17.	Tamil Nadu	3.08	2.46	1.51
18.	Uttar Pradesh	8.11	1.40	1.62
19.	Uttarakhand	0.00	1.50	2.01
20.	West Bengal	2.58	0.51	1.12
	Total (Other States)	**73.95**	**33.71**	**29.16**
	NE & Sikkim			
21.	Arunacha Pradesh	0.00	0.00	0.00
22.	Assam	0.00	0.89	0.00
23.	Manipur	4.92	1.59	0.00
24.	Meghalaya	0.00	0.95	0.00
25.	Mizoram	6.57	1.01	0.84
26.	Nagaland	4.16	0.00	0.00
27.	Sikkim	4.25	1.07	1.32
28.	Tripura	6.68	0.35	0.00
	Union Territories		5.68 (Total)	
29.	A & N Islands		0.31	1.08
30.	Chandigarh		0.34	0.20
31.	D & N Haveli		0.00	0.00
32.	Daman & Diu		0.00	0.00
33.	Lakshadweep		0.00	
34.	New Delhi		0.00	0.00
35.	Puducherry		0.00	
	Total (NE States)	**26.58**	**0.65 (Total)**	**3.44**
	G. Total	**100.53**	**40.22**	**32.60**

The Urban Innovation

Cities have enormous potential to mitigate climate change by transforming as a habitat with rich biodiversity. The Japanese district of Yokohama, with 3. 5 million people, emitted almost 20 million tons of CO_2 in 2007 due to extensive urban development works. The cities have enormous potential of creating biodiversity which will help in stabilizing the local climate. A new tax system was introduced to conserve green areas, and develop greenery roof tops and walls with an aim becoming a low-carbon city and to reduce per capita emissions by at least 60 percent by 2050.

"Cities have enormous potential in creating and maintaining biodiversity as evident from research work of Stockholm Resilience Centre in its Cities and Biodiversity Outlook. To achieve smaller spatial footprint, cities have to develop larger green areas as more green space and vegetation will act as a carbo n sink for offsetting urban emissions. "Green corridors built on periphery will connect larger patches of natural areas and provide connectivity between natural spaces and also allow species greater access to nature. These green areas will serve us to provide better health, cheaper drinking water, and temperature regulation functions. "Green cities are crucial for building climate change resilience" as stated by Mr. Braulio Dias, Executive Secretary of the CBD. The 193 Parties of the CBD have adopted a Plan of Action to involve cities, on climate change and biodiversity.

The "Brownfields", or land previously used for mining and industrial purposes or certain commercial uses, can also be turned into natural habitats with minimal human interference to develop them as carbon sinks rather than emission sources. The Urban expansion programme in Orissa needs to adopt and support "Green roofs to absorb excess water, and help regulating micro-climates and provide habitats for species. There is scope to go for Vertical greening, such as growing shrubs and vines on the surfaces of tall buildings, to reduce the heat-island effect of buildings and pavements. All these measures will contribute significantly to both climate adaptation and mitigation," as stated by Professor Thomas Elmqvist of Stockholm Resilience Centre. These mitigate measures are cheaper and more sustainable to control the heat impact.

Pollution

Pollution in India can broadly be attributed to rapid industrialisation, energy production, urbanisation, commercialisation, and an increase in the number of motorized vehicles. Vehicles are a major source of pollutants in cities and towns. Other factors contributing to the increasing vehicular pollution in urban areas include the types of engines used, age of vehicles, density of traffic, road conditions, and the status of automotive technologies and traffic management systems.

There are threats posed to environment due to surface and ground water pollution. There are number of monitoring stations spread across the country and CPCB in collaboration with SPCBs controls and monitors flow of untreated wastes as well as industrial effluents into water bodies. The industrial discharges are creating pollution in water bodies and surface water flowing systems in almost all the States except Himalayan and North-eastern states have been significantly affected. CPCB is monitoring water quality of various water bodies in the country at 2500 stations in 28 States and 6 Union Territories. The monitoring network covers a total of 445 rivers, 154 lakes, 12 tanks, 78 ponds, 41 creeks/Sea water, 25 canals, 45 drains, 10 Water Treatment plants and 807 Wells are covered under monitoring network in the country. MOEF has identified 150 polluted river stretches of 121 rivers for implementing various programmes on pollution abatement and restoration of water quality. The cost of the projects taken up for rivers and lakes conservation is shared in the ratio of 70:30 between Central and State Government. The ratio for North-East region is 90:10. MOEF, however, provides, 100 % financial assistance for conservation of wetlands

projects under management action plans in identified wetlands in the country. The Bio-Chemical Oxygen Demand and bacterial contamination in terms of faecal coliform are reported to be exceeding the maximum permissible limit at a number of locations along major rivers.

An innovative scheme launched by the Ministry in close collaboration with industries for implementing the Charter on Corporate Responsibility for Environmental Protection (CREP) in respect of highly polluting industries in promoting waste minimization technologies and for adoption of cleaner technologies is under implementation in the country. To deal with Polluted Industrial Clusters, the Central Pollution Control Board (CPCB) along with Indian Institute of Technology (IIT), Delhi and other reputed institutions has done environmental assessment of polluted Industrial Clusters across the country under the Comprehensive Environmental Pollution Index (CEPI) system. The Ministry of Environment & Forests (MoEF), based on CEPI, have taken action in respect of 43 industrial clusters with CEPI score > 70 and identified these as critically polluted areas (Table-3). The developmental activities have been put to halt as far as Environmental appraisal under EIA notification 2006 is concerned. MOEF has directed all the State Governments that no project in these areas will be considered for environmental clearance unless a regional level environmental action plan is prepared by the States, vetted by CPCB and approved by MOEF. Thus, all the states are to prepare an action plan for implementing the mitigative measures in such regions in collaboration/association with projects of the region. The moratorium has been lifted in 25 cluster regions after Regional Environmental Management Plan has been prepared and accepted by Ministry of Environment and Forest on the recommendation of CPCB (Table-3). Financial assistance to State Pollution Control Boards is also being provided by MoEF for strengthening of laboratories under the Scheme "Assistant for Abatement of Pollution". The details about financial support provided to SPCBs/PCCs for strengthening of laboratories during 2010-2011 is given in Table-4. In case of non-compliance of environmental safeguards stipulated by authorities, directions are issued by CPCB to concerned SPCB under Section 18(1) (b) of the Water Act, 1974 or the Air Act, 1981 to ensure compliance of standards. Actions in the form of show cause notices, closure orders and prosecutions are initiated by the SPCBs against the erring industries. Sometimes, directions are issued directly under section 5 of the Environment (Protection) Act, 1986 by CPCB or by the Ministry of Environment and Forests.

Table-3: Critically polluted areas identified by MoEF on the basis of comprehensive environmental pollution index (CEPI)

State	Critically Polluted Industrial clusters/ areas (CEPI >70)	Moratorium lifted
Andhra Pradesh	Vishakha patnam, and Patancheru-Bollaram	Patancheru-Bollaram
Chhatisgarh	Korba	
Delhi	Nazafgarh drain basin	
Gujarat	Ankaleshwar, Vapi , Ahmedabad, Vatva, Bhavnagar and Junagarh	Vapi, Bhavnagar, Junagarh
Haryana	Faridabad and Panipat	Faridabad and Panipat
Jharkhand	Dhanbad	
Karnataka	Mangalore and Bhadravati	Mangalore and Bhadravati
Kerala	Cochin, Greater	Cochin, Greater
Madhya Pradesh	Indore	Indore
Maharashtra	Chandrapur, Dombivalli, Aurangabad,	Dombivalli, Aurangabad,

State	Critically Polluted Industrial clusters/ areas (CEPI >70)	Moratorium lifted
	Navi Mumbai and Tarapur	Tarapur
Odisha	Angul Talchar, Ib valley and Jharsuguda	Angul Talchar, Ib valley and Jharsuguda
Punjab	Ludhiana and Mandi Gobind Garh	Ludhiana and Mandi Gobind Garh
Rajasthan	Bhiwadi, Jodhpur and Pali	
Tamil Nadu	Vellore, Cuddalore , Manali and Coimbatore	Cuddalore, Coimbatore
Uttar Pradesh	Ghaziabad, Singrauli, Noida, Kanpur, Agra and Varanasi-Mirzapur	Ghaziabad, Singrauli, Noida, Agra and Varanasi-Mirzapur
West Bengal	Haldia, Howrah and Asansole	

Table-4: Release of funds to State Pollution Control Boards/Committees (2010-11)

S. No.	SPCB/PCCs	Rupees in Lakhs	S. No.	SPCB/PCCs	Rupees in Lakhs
1.	Assam	66.87	9	Meghalaya	45.54
2	Bihar	50.00	10	Mizoram	21.92
3	Chandigarh	31.25	11	Nagaland	69.02
4	Goa	46.25	12	Orissa	10.24
5	Himachal Pradesh	7.02	13	Sikkim	23.35
6	Karnataka	37.95	14	Tripura	13.00
7	Maharashtra	21.25	15	Uttar Pradesh	100.00
8	Manipur	34.14		TOTAL	577.80

Source: PIB release 28th November, 2011

Significant amount of Pollution is caused by Industries of highly polluting category. The Central Pollution Control Board (CPCB) has identified 17 categories of highly polluting industries (HPIs) which include thermal power plants, cement plants, distilleries, steel plants, aluminium, lead, zinc and copper metal based industries etc. A total of 2720 such industries have been identified by CPCB in the country, out of which 2076 units are reportedly complying with the environmental standards whereas, 261 units are closed and 383 units have not provided adequate facilities to comply with the environmental standards. CPCB undertakes inspections of 17 categories under Environmental Surveillance Squad (ESS) scheme to monitor compliance of environmental standards. The State Pollution Control Boards (SPCBs), in addition to CPCB also ensure the compliance of environmental standards under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981.

The ministry of Environment and Forests has established six Regional Offices for carrying out monitoring of developmental projects which are accorded environmental clearance under the provisions of EIA Notification. These regional offices carry out monitoring of the projects which are covered under the monitoring mechanism by CPCB and SPCB. It is significant to state that there are other projects which are neither covered by CPCB nor by SPCBs. These are monitored only by the Regional Offices. Such projects are River valley projects and CRZ projects. Table-5 gives a glimpse of the total number of projects covered under environmental clearance and monitoring mechanism in the Eastern Region and the extent of workload on the Regional Office, Bhubaneswar for monitoring. The strengthening of monitoring infrastructure is the pressing need today.

Table-5. Total number of Projects located in the eastern region covered under environmental monitoring (as on 30th March, 2012)

Sl. No.	Type of the Projects	Odisha	West Bengal	Jharkhand	Bihar	A & N Islands	Tota l
1	River Valley						
	a. Hydro-electric	7	4	4	6	2	23
	b. Irrigation	18	7	5	2	NIL	32
	c. Multipurpose	2	NIL	1	NIL	NIL	3
2	Mining	196	40	116	NIL	NIL	352
3	Industry	145	160	80	28	2	415
4	Thermal	36	25	21	8	14	104
5	Coastal Harbour	24	15	NIL	NIL	43	82
6	Tourism	NIL	NIL	NIL	NIL	NIL	0
7	Nuclear	2	NIL	8	NIL	NIL	10
8	Oil Refinery	NIL	8	NIL	3	NIL	11
9	Transportation	NIL	5	NIL	4	NIL	9
10	Others	28	31	5	17	45	126
Total		**458**	**295**	**240**	**68**	**106**	**1167**

Hazardous Waste Management

Significant quantities of municipal solid and hazardous wastes are being generated in India. The rate of generation of solid waste in urban centres has outpaced population growth. The Urban wastes are generally disposed in low-lying areas of the city's outskirts without any facility of treatment and scientific management. Hazardous wastes generated by petrochemicals, pharmaceuticals, pesticides, paints and dyes, petroleum, fertilisers, asbestos, caustic soda, inorganic chemicals, and general engineering industries are regulated under Hazardous Waste Management Notification issued by Environment (Protection) Act, 1986. The Government has promulgated various rules and guidelines on the management and handling of urban waste and industrial hazardous wastes.

The State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) are delegated with powers for implementation of the Bio-medical Waste (Management & Handling) Rules, 1998, notified under the Environment (Protection) Act, 1986 and for regulating the generation, segregation, collection, packing, storage, transportation, treatment and disposal of the waste generated from Health Care Establishments (HCEs). The Government of India have also delegated powers under Section 5 of the Environment (Protection) Act, 1986 to all the SPCBs and PCCs to issue directions to any industry or any other authority for violation of Standards and Rules, relating to Bio-medical Waste (Management & Handling) Rules, 1998. The SPCBs/PCCs are to take necessary legal actions against the establishments which violate these Rules and monitor the implementation of the Rules by the Health Care Establishments (HCEs). E-waste rules notified in May, 2012 in the country require manufacturers of electronic wastes to have mechanism in place for collecting and recycling their goods. The rules are supported by guidelines which aim at helping the stakeholders i.e. manufacturers, collectors or dismantlers and recyclers to establish a mechanism for e-waste management. The State Pollution Control Boards have been assigned the responsibility of these rules and stakeholders need to register with SPCBs within 60 days of issue of this notification. It is understood that 74 companies including 16 waste recyclers have already registered. As per one estimate of CPCB, e-waste generation is more than 8 lakh ton every year in the country and 90% of this goes to the informal sector. Scientific e-waste management needs to be strictly implemented looking at the growth of IT

and IT enable services in the country which will generate huge e-wastes in coming years.

CLIMATE CHANGE OBSERVATION AND ASSESSMENT

Strengthening of Research Capacity

Climate Change Action Programme of India is being taken up by the Ministry of Environment & Forests during the 12th Five Year Plan. The programme is approved by the Planning Commission for i) advancing scientific research into and assessment of the phenomenon of climate change, ii) building an institutional and analytical capacity for research and studies in the area of climate change, and iii) supporting domestic actions to address climate change at both national and state level. The Climate Change Action Programme envisages following scientific schemes:

i. National Carbonaceous Aerosols Programme;
ii. Setting up of Long Term Ecological Observatories for Climate Change Studies;
iii. Coordinated Studies on Climate Change for North Eastern Region; and
iv. Setting up of Centre for Climate Change Studies.
v.

India's National Action Plan on Climate Change (NAPCC) has comprehensive research components. NAPCC also includes National Mission on Strategic Knowledge for Climate Change with the objective to strengthen and build research capacity and generating strategic knowledge for climate change. The proposed budget allocation for the 12th Five Year Plan period for the National Mission on Strategic Knowledge for Climate Change is Rs. 1050 Crore.

Environmental Management of Abandoned Mines and Reclamation

India has provisions in several acts and rules which stress on environmental management of mines. These tools have not yielded the desired results and we are facing with problems of several kinds in mining industry which includes violations of legislations, wastage of low grade minerals, lack of competent technical manpower and overall absence of inbuilt mechanism in projects to implement sustainable productivity options. Research and development input is abysmally low making the industry handicapped to adopt clean and green technologies. We need to consider institute mechanisms for the following purposes;

- ✓ Establishing a separate Authority for reclamation purposes
- ✓ Delegate acquisition power with authority to control the abandoned mines/degraded sites and filling of voids and sealing of tunnels, shafts and entry ways and other such areas.
- ✓ Enforcement and collection of the reclamation fee
- ✓ Institute Studies, research and demonstration projects in all mining related issues for long term perspective with public and private partnerships.
- ✓ Long term plan at regional scale for restoration, reclamation, abatement, control or prevention of adverse effects of mining including emergency preparedness plan
- ✓ Ensure Grants to the authority through levying appropriate reclamation taxes on mining industry to accomplish the purposes
- ✓ All operators of coal mining operations shall pay a reclamation fee for minerals produced by surface coal mining and underground mining
- ✓ Legal mechanism to deal with false statement, representation or certification, or knowingly failing to make any statement, representation or certification in the form of punishment by heavy fine, or imprisonment

The State of Odisha has been facing severe degradation in mining areas which may have generated both due to mining development and non-implementation of programmes for improving the social and

environmental quality in mining regions. The anthropogenic activities in addition to the mining also have impacted the terrestrial ecology especially forest degradation, siltation on river and urban pollution. Regional approach for addressing these issues in an integrated way will help regenerating the forests and restoring the environmental and social quality.

NATURAL AND PROTECTED AREAS

Biodiversity: Restoration and Conservation Strategies

Loss of biodiversity is of great concern to India since many plant and animal species are severely threatened due to destruction of their habitat and over-exploitation of natural resources. Large number of species are either endangered or on the verge of extinction. We need to implement existing policy and develop institutional mechanisms including comprehensive policy guidelines for biodiversity conservation, biodiversity legislation and participation of communities. A clear perspective on intellectual property rights leading to international patents on Indian biodiversity and strategies and actions are required to protect the India's rich bio-wealth. One of the negative impacts of development (agriculture or industrial) is the decline in natural resource wealth. We must keep in mind that biological systems are dynamic and resilient as long as disturbance is within their carrying capacity. Irreversible impacts will result in loss of several species and species once lost is lost forever and no man made capital can create a species. Ministry of Environment and Forests (PIB Release dated 19-December, 2011) have taken several initiatives towards protection of terrestrial and Marine Bio-Diversity in the country. These measures to protect biodiversity in the country include:

- ✓ Various Plan Schemes for conservation and management of protected areas including mangroves and coral reefs in the country.
- ✓ Implementing an Integrated Coastal Zone Management Project for marine national park conservation in Gujarat and coral regeneration, and development of marine aquarium and a research centre in West Bengal and coastal management programmes in Odisha.
- ✓ "Task Force for Conservation of Marine Biodiversity" to formulate steps for protection and conservation of marine biodiversity, including identification of gap areas in coastal and marine biodiversity, assess the existing capacity of institutions involved in coastal and marine biodiversity research, and to develop capacity on survey and monitoring of marine biodiversity; and recommend strategies and action plans for marine biodiversity conservation.
- ✓ Externally aided projects for coastal states with aim at sectoral mainstreaming including knowledge management for coastal and marine biodiversity conservation, institutional capacity development, and sustainable community livelihoods and natural resource use in project land/seascape.
- ✓ Funds to the State Governments for National Parks and Sanctuaries in the country for conservation and management of wildlife habitat including fishes under the Centrally Sponsored Scheme on 'Integrated Development of Wildlife Habitats'.
- ✓ Assistance to Botanical Gardens.
- ✓ CAMPA to raise compensatory afforestation.

The National Action Plan on climate change aims at developing a strategy to promote the adaptation to climate change and enhancement of the ecological sustainability. The eight missions on Climate Change are the Jawaharlal Nehru National Solar Mission, the National Water Mission, the National Missions on Enhanced Energy Efficiency, Sustainable Habitat, and Strategic Knowledge for Climate Change, and the National Missions for Sustaining the Himalayan Ecosystem, a Green India and Sustainable Agriculture. An amount of Rs. 848 crore

was released to State Level Compensatory Afforestation Fund Management & Planning Authorities to carry out protection, conservation and regeneration of natural forests in addition to compensatory afforestation. National Ganga River Basin Authority (NGRBA), Mission Clean Ganga has sanctioned Rs.2600 crore for development of sewer networks, sewage treatment plants and sewage pumping stations, electric crematoria, community toilets and development of river fronts.

Forest Cover in the Country is yet to reach to 33% level as envisaged in National Forest Policy (MoEF,2011). Increased urbanisation, industrialisation and rehabilitation affect the ecosystem especially forest area which are used for these purposes. The State of Forest Report 2009, (FSI, 2011) indicates that there is an increase in the forest cover of the country from 690171 square km in 2005 to 690899 square km in 2007. Some of the projects directly connected with the social and security needs of the country like defence, health, drinking water, irrigation, railway, roads etc are essentially approved for using forest lands. As stated earlier in this paper, the National Afforestation Programme (NAP) Scheme for regeneration of degraded forests and adjoining areas in the country is being implemented through a decentralized mechanism. 800 FDA projects have been approved in 28 States in the country as on 31.10.2011 to treat an area of 18.32 lakh ha since 2002. For taking up expansion of Forest areas in the Country, there is no shortage of land in the country. From inception till March, 2011 an amount of Rs. 2547.36 crores has been released for afforestation works over an area of 1.74 million ha across the country. During 11th Plan (2007-08 to 2010-11), an amount of Rs. 1366.72 crores was released to the states under NAP for afforestation. During the financial year 2011-12, an amount of Rs. 104.89 crores was released for taking up afforestation works including new works in an area of 86.648 ha till 31st October, 2011. Beside NAP, following steps are being taken to increase the forest cover in the country:

- 13th Finance Commission has recommended Rs. 5000 Crore for five years starting from 2010-11 for conservation and development of forests.
- Additional Central assistance of Rs. 81.66 Crore has been released to the States during 2009-10 for Restoration and Regeneration of Forest Cover.
- Tree planting is also taken up under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), and other schemes of Central and State Governments.

National mission for a Green India is one of the eight Missions under the National Action Plan on Climate Change(NAPCC) which focuses on enhancing ecosystem services and carbon sink through afforestation and eco-restoration of 10 million ha forest and non forest lands over 12th and 13th Plan period. The details of forest cover in the country, state-wise is given in Table-6.The details of funds released and area approved during the current five year plan are given in Table-7.

Table-6: Forest Cover in States / UTs in India (area in km^2)

State/UT	Geograph. area (GA)	Forest Cover				% to GA	Change in forest cover	Scrub
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total			
Andhra Pradesh	275,069	820	24,757	19,525	45,102	16.40	-129	10,372
Arunachal Pradesh	83,743	20,858	31,556	14,939	67,353	80.43	-119	111
Assam	78,438	1,461	11,558	14,673	27,692	35.30	-66	179
Bihar	94163	231	3,248	3,325	6,804	7.23	-3	134
Chhattisgarh	135,191	4,162	35,038	16,670	55,870	41.33	-59	107
Delhi	1,483	7	50	120	177	11.94	0	1
Goa	3,702	511	624	1,016	2,151	58.10	-5	1
Gujarat	196,022	376	5,249	8,995	14,620	7.46	16	1,463
Haryana	44,212	27	463	1,104	1,594	3.61	-10	145
Himachal Pradesh	55,673	3,224	6,383	5,061	14,668	26.35	2	327
Jammu & Kashmir	222,236	4,298	8,977	9,411	22,686	10.21	-3	2,036
Jharkhand	79,714	2,590	9,899	10,405	22,894	28.72	172	683
Karnataka	191,791	1,777	20,181	14,232	36,190	18.87	-10	3,176
Kerala	38,863	1,443	9,410	6,471	17,324	44.58	40	58
Madhya Pradesh	308,245	6,647	35,007	36,046	77,700	25.21	-39	6,401
Maharashtra	307,713	8,739	20,834	21,077	50,650	16.46	-11	4,157
Manipur	22,327	701	5,474	11,105	17,280	77.40	328	1
Meghalaya	22,429	410	9,501	7,410	17,321	77.23	116	211
Mizoram	21,081	134	6,251	12,855	19,240	91.27	640	1
Nagaland	16,579	1,274	4,897	7,293	13,464	81.21	-201	2
Odisha	155,707	7,073	21,394	20,388	48,855	31.38	100	4,852
Punjab	50,362	0	733	931	1,664	3.30	4	20
Rajasthan	342,239	72	4,450	11,514	16,036	4.69	24	4,347
Sikkim	7,096	500	2,161	696	3,357	47.31	0	356
Tamil Nadu	130,058	2,926	10,216	10,196	23,338	17.94	24	1,206
Tripura	10,486	111	4,770	3,192	8,073	76.99	-100	75
Uttar Pradesh	240,928	1,626	4,563	8,152	14,341	5.95	-5	745
Uttarakhand	53,483	4,762	14,165	5,568	24,495	45.80	2	271
West Bengal	88,752	2,987	4,644	5,363	12,994	14.64	24	29
A&N Islands	8,249	3,762	2,405	495	6,662	80.76	-1	53
Chandigarh	114	1	10	6	17	14.91	0	1
Dadra-NagarHaveli	491	0	114	97	211	42.97	-5	1
Daman & Diu	112	0	1	5	6	5.04	0	3
Lakshadweep	32	0	16	10	26	82.75	0	0
Puducherry	480	0	13	31	44	9.14	2	0
Grand Total	3,287,263	83,510	319,012	288,377	690,899	21.02	728	41,525

Source: Forest Survey of India

Table-7: Release of grants by Ministry of Environment and Forests to States for increase in forest covers of the country (2011-12)

S.No.	State	Total Release (in crore)	Total area (in ha.)
1.	Andhra Pradesh	50.62	34017
2.	Bihar	29.26	21813
3.	Chhattisgarh	135.80	69783
4.	Goa	0.00	0
5.	Gujarat	118.97	61270
6.	Haryana	83.95	26329
7.	Himachal Pradesh	24.69	16717
8.	Jammu and Kashmir	30.40	17655
9.	Jharkhand	80.67	56650
10.	Karnataka	69.95	44635
11.	Kerala	31.76	19364
12.	Madhya Pradesh	91.49	65827
13.	Maharashtra	96.27	57838
14.	Orissa	63.80	75695
15.	Punjab	12.20	9874
16.	Rajasthan	29.81	21000
17.	Tamil Nadu	36.59	18909
18.	Uttar Pradesh	127.20	76670
19.	Uttarakhand	33.10	31609
20.	West Bengal	26.10	20567
21.	Arunachal Pradesh	15.99	12030
22.	Assam	38.92	25650
23.	Manipur	43.10	22314
24.	Meghalaya	21.63	15645
25.	Mizoram	66.42	28320
26.	Nagaland	39.33	24690
27.	Sikkim	43.01	15399
28.	Tripura	26.22	22556
	Grant Total	1467.25	912826

Source: Ministry of Environment and Forests, PIB release 28th November, 2011

PUBLIC AWARENESS AND RESEARCH

The Eco-clubs have been set up in the schools under the National Green Corps (NGC) Programme since 2000-01, with underlined objective of spreading environmental awareness amongst school children. National Environmental Awareness Campaign (NEAC) of MoEF envisages awareness among the stakeholders in the country. Each year, MoEF provides funds to NGOs and other organisations to take up programmes on environmental awareness. The Environment Education Awareness and Training (EEAT) scheme is being used to educate students in rural areas. Under the Environment Education Awareness and Training (EEAT) Scheme, National Green Corps (NGC) Programme is being used to educate student in rural areas about environmental issues. These programmes focus on action oriented environment programme through the active involvement of the students and communities. The financial assistance under the Programme is restricted to 250 eco-clubs per district Rs.@ 2,500/- per Eco-club per annum. National Green Tribunal (NGT) has been established for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources.

We need to strengthen the R&D infrastructure in all sectors to cope up with the demand of desired input in the form of achieving resource use efficiency, clean technology and regulatory research. Human infrastructure is largely lacking in the country to take up environmental issues on research and on extension platform. There is strong need (as a measure to fight climate change scenarios) to carry out research work to find out optimum level of SOM (soil organic matter) in agro-ecosystems habitats and degraded soils for appropriate intervention to achieve viable restoration and rehabilitation of land for sustainable use. The research should also focus on implications for nutrient balance on climate change and doubling of CO_2. The relationship between biomass production, organic matter production, and long-term carbon storage, especially in terrestrial habitats which are being degraded due to natural and anthropogenic factors and development projects. The issues relating to shifting cultivation and encroachment could be prioritized. Clear property rights or tenure security should be developed with the help of local land users to address the concern. The clarity on land rights will largely solve the issue of encroachment and deforestation arising due to livelihood compulsions. Community participation is essential for any technology driven development so that experience or knowledge of local people can be utilized and socio-ecological harmony in development is achieved. Our policies and programmes must be formulated as per ground reality. We may remember that economic growth can only be achieved by diversifying energy sources, decreasing energy intensity and technology transfer. The projects must contribute to enhance basic social services to help maintenance of environmental functions and sustainable resource-use practices or systems. Price of environmental commodities should be fixed and projects taxed realistically, depending on the project profile and extent of damage to environment and sustainability implications of the development.

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GEOLOGY AND ECONOMICS FOR MINING AND BENEFICIATION OF LOW-GRADE ORES

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ABSTRACT

Ore mineralisations in the earth`s crust form due to very complex geological processes resulting in marketable ores that are located in a few places and where the ores are intricately intertwined with low-grade ores (not directly marketable) and gangue materials(having very little market value). Therefore, mining operations with economic profits require adequate high sell value of high-grade and beneficiated low-grade to marketable grade ores; so that the operational costs of mining, beneficiation and disposal of mine-wastes are compensated to result in adequate profits/year.

Geological factors(total of FIVE) such as total reserve(W, tons), proportions of high-(W(H)) and low-grade ores(W(L)) and proportion of gangue (1- W(H))- W(L)) are important of which only three are independent as well as two independent assay values, such as, of high-grade(A(H)) and of low-grade (A(L) ores. Economic factors (total of TEN)include Profit/year(P) which must be positive, life of mine(L = W/ production rate per year in tons), sale price per ton of marketed ore ((S(H)), capital cost for mine operations(C(M)), capital cost of beneficiation plant (C(B)), interest rate on capital costs (r), efficiency of beneficiation plant to upgrade low-grade ores to marketable ores(e), per ton running costs for mining(R(M)), beneficiation(R(B)), as well as of disposal of mine-waste (R(D)). All these fifteen factors are necessary for an economic profitability analysis and to decide whether mining is feasible and whether ore beneficiation is necessary or not and feasible. Profits (P per year) are computed here on annual basis for convenience of tax payments and fiscal discipline. Then the total profit over the entire mine life (L years) is given by PL.

Large mines have considerable non-marketable low-grade ores and these should establish beneficiation plants for upgrading and marketing these upgraded ores. This is scientifically and economically optimal for profits as well as more acceptable to prevent environmental degradation. However, smaller mines and those having little proportion of low-grade ores should operate without the beneficiation plants at mine-site but think of ore beneficiation by pooling several nearby mines of same metallic/non-metallic ores.

I. INTRODUCTION:

Low-grade ores (non-marketable) are invariably associated with high-grade marketable ores along with gangue materials of little market value in any mineraliation in the crust due to complex geological processes which result in very complex interlocking textures and structures among these three components of the ore body. The main problems for a mining company are: (i) How to optimally mine the ore to make sufficient profits per year of mining , so that the project is economically viable; (ii) How to optimally beneficiate the mined low-grade ores to marketable grade(s) in order to augment the profits per year, and (iii) How to minimize costs of mining, beneficiation and mine-waste disposal and the associated costs of environmental remediation.

Optimal solutions for these mining, beneficiation, waste disposal and environment remediation etc. must include both geological and economic factors The FIVE independent geological factors include Total Reserve of ore materials including ores and gangues (W), Assay value of high-grade ore(A(H)) and its proportion in ore(W(H)), Assay value of low-grade ore(A(L)) and its proportion in ore (W(L)), and a non-independent factor of proportion of gangue in ore (W(G)) which is equal to (1—W(H)-W(L)) which does not have any economic value but have to be disposed off as waste at cost.

The TEN independent economic factors are recognized as: Capital Costs of acquiring the mine and mining equipments (C(M)) and of the beneficiation plant, if required, (C(B)), interest rate on capital burrowing (r), Running costs per ton of mine operation (R(M) and of beneficiation plant R(B), as well as of waste disposal costs per ton(R(D)), efficiency of beneficiation plant (e) with 0<e<1, Market value of saleable ore per ton (S(H)), and life of mine in years(L) which is dependent on minimum production in tons per year of ore from the mine(W/L or less), Profit per year, in Rupees, of sold marketable ore (P).The economic variables are mostly dynamic types varying with time, technology, other economic indices; whereas the geological factors are static types that do not change with time. So, the total number of factors is Fifteen and these are necessary for feasibility analyses of any mine with or without the associated beneficiation plant at the mine site. For smaller mines and for those having less proportion of low-grade ores, a pooled beneficiation plant operating at an appropriate central site with proportionate profit sharing may be more economic and hence, recommended. More details on liberation of ore minerals by beneficiation and on ore reserve and grade estimation are given in Sahu, (2010,2003 and 2008), respectively, and also in King (2001).

II. ECONOMIC ANALYSES FOR MINING OPERATIONS:

The economic analyses of profitable mining operations , with beneficiation plant at mine site, with pooled beneficiation plant at some other central site or without any beneficiation plant, can be assessed by simple economic cost/profit (P, per year of mined ore in tons) studies on a per year basis and this can be multiplied to total reserve of ore(W) to obtain the profit over the life(l years) of mine operation. The profit per year of mining ores (P) without ore beneficiation is given by:

$$P = (W\ W(H)\ S(H)/L) - (C(M)\ (1+ r)\ ^{\wedge} -(L\ ) - (W\ R(M)/L) - (W-W(H)A(H)/L)\ R(D) \ldots\ldots\ldots(1),$$

where, the symbols are already defined in Section I and where P must remain positive and be about twice (or more) of the cost of mining, beneficiation and waste disposal costs in order to avoid risks due to dynamic economic factors. This equation is non-linear and cannot be linearised to gain further simplicity as the nine different factors in its RHS are complexly interacting among themselves.

However, if the mineralization has high proportion of low-grade ores (W(L)) with assay value of ,say, A(L), then it would be prudent to install a mine-site ore beneficiation plant to upgrade the low-grade ores having assay (A(L)) into saleable high-grade ores with assay (A(H)) which further augments the mine profits. Then, economic analysis for mine operations along with ore beneficiation yields Equation 2 as follows:

$$P = ((W(\ W(H) + W(L))S(H)/L) - ((C(M) + C(B))(1 + r)\ ^{\wedge} -L) -(\ W\ R(M)/L) - (\ ((W - W(H)\ A(H) - W(L)\ e\ (A(H) - A(L))/L\ )\ R(D)) - (W\ R(B)/L), \ldots.\ (2)$$

where all the symbols are defined in Section I above. Again Equation 2 is a very complex non-linear equation that cannot be linearised further for any simplification. It has five geological and ten economic factors (Total of 15 factors), where P must be positive for installation of a mine-site beneficiation plant to augment the profits for the mine.

It may be noted that equation 2 is more general than equation 1 and reduces to Equation 1 if W(L) is negligible and taken as ZERO and in which case the mine-site onre beneficiation plant becomes economically unviable with the associated costs C(B) and R(B) also becoming ZEROES. However, in a real mining situation W(L) is seldom very low and it

would be prudent to use a beneficiation plant at mine site for larger mines. For smaller mines it would be then prudent to pool all low-grade ores from nearby mines at establish a pooled central beneficiation plant with proportionate profit sharing for each mine in the pool. In any case, establishing a beneficiation plant in mining areas is scientifically appropriate, ethical and reduces environmental degradation. In addition, mining industry can earn further profits through sale of mine wastes for land-filling, brick making, road constructions and beautification / landscape planning of damaged areas around mining sites.

III. CONCLUSIONS:

(i) Equation 2 is more general than equation 1 and reduces to equation 1 if the proportion of low-grade ores (W(L)) is negligible or effectively zero. The per year profit (P) in equation 2 must be positive (preferably greater than twice the mining costs to prevent financial risks) for the mine with its beneficiation plant to be feasible and economically viable. Equation 2 should be used for large and very large mining operations where large amounts of low-grade ores are invariably present. Equation 2 is scientific, ethical, economically optimal for greater profits and environmentally more acceptable than using equation 1.

(ii) Equation 1 (reduces easily from general Eqn 2) is applicable if negligible proportion of low-grade ores are present, especially in case of smaller mines. In such cases, mine-site beneficiation plant becomes economically unviable and must not be installed.

(iii) The geological factors in Eqn.(2)/ Eqn.(1) are static type variables whereas the economic variables therein are dynamic which vary over time and/or space, technology change, mine-sites , costs of mine operation, ore beneficiation operation, waste disposals, sale price of marketable ores, interest rate of loan, and many other time-varying costs such as, wages, transportation, discount rates government tax laws, etc. The profitability for mining operations has high financial risks as well due to dynamic economic factors, which must also be incorporated in profit evaluation and feasibility decisions.

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REVIEW ON BOOKS

1. Coastal Tract of Odisha

The book on 'Coastal Tract of Odisha' deals with various aspects of the coastal sedimentary basin occurring both in the onshore and offshore areas of Odisha State. It deals with geology, evolution, natural resources, ecosystems, biodiversity, environmental problems and human activities of the past and the present. The development of the coastal basin has a direct link with the formation of the Indian Ocean Basin due to breaking apart and drifting of the continental units of the East Gondwanaland (India, Antarctica and Australia) towards the later part of the Mesozoic Era. A coastal graben was superimposed on the then existing Mahanadi-Lambert Rift. East flowing rivers from Central Indian high lands brought in sediments to the coastal graben depositing about 8km thick sediment pile dating from late Cretaceous to the present. The sedimentation was associated with several major transgression and regression of the sea. The Pleistocene Ice Age had a direct impact on the sedimentation history.

The coastal tract on the onshore is associated with extensive sedimentary plains, many large and small rivers with their delta systems, enclosed lagoons, tidal swamps and sandy beaches. On the offshore, it shows sedimentary basins in the continental shelf and slope areas. Some of the morphologic features such as Chilika lagoon, Bhitarkanika tidal swamps and sandy beaches are now seen as ideal ecosystems hosting unique biodiversity such as migratory birds, mangrove forest, olive ridley turtles and horse shoe crabs etc.

The coast is associated with many natural resources such as fertile soil, water, mineral and hydrocarbons etc. which are utilized for social and economic development.

The human society along the coast has been associated with many economic, maritime, and cultural activities since time immemorial. They have created world class monuments such as Konark temple, Puri temple, Lingaraj temple and Buddhist monuments. The coastal tract is a tourist paradise for its natural ecosystems and human creations of art and culture.

Many natural hazards such as floods, cyclones, and coastal erosion torture the people now and them on a regular basis. The fear of tsunami cannot be ruled out along the coast. There are many other problems both natural and anthropogenic which haunts the coast. Many Govt. agencies e.g. Chilika Development Authority, Department of Forest, Water Resources, Tourism, Archeology, and OSDMA are working together for the sustainability of the coastal environment and human well being.

The various aspects of the Odisha coast have been colorfully described in vivid details in twenty long chapters as given below. It is hope that the book will be of use to different sections of the society e.g. the academics, planners, tourists and the common intelligentia.

The Chapters with their authors are as under:

1.	General aspects of the coastal tract	-	N.K. Mahalik (Utkal University)
2.	Morphotectonics of the coastal tract	-	N.K. Mahalik (Utkal University)
3.	Geology and stratigraphy of the coastal tract	-	N.K. Mahalik (Utkal University)
4.	Geomorphology	-	N.K. Mahalik (Utkal University)

5.	Geology of the continental shelf	-	B.M. Faruque (Geol. Survey of India)
6.	Evolution of the coastal tract	-	N.K. Mahalik (Utkal University)
7.	Surface water resource	-	N.K. Mahalik (Utkal University)
8.	Ground water resource	-	N.K. Mahalik (Utkal University)
9.	Hydrocarbon potential on the onshore and near offshore	-	D. Dash (Oil India Ltd.)
10.	Hydrocarbon potential on the far offshore	-	R. Bastia & others (Reliance Industries Ltd.)
11.	Soil resource and agriculture management	-	K.N. Mishra & D. Jena (OUAT) & N.K. Mahalik (Utkal University)
12.	Beach placer deposits	-	P.C. Mishra, Directorate of Geol., Govt. of Odisha
13.	Tourist resources	-	Biranchi Mishra, Dept. of Tourism & N.K. Mahalik (Utkal University)
14.	Port facilities and maritime activity	-	Ajay Pradhan (DHI) & N.K. Mahalik (Utkal University)
15.	Unique biodiversity of Orissa Coast	-	S.K. Kar, Wild Life Organisation Dept. of Forest, Govt. of Odisha
16.	Resources and problems of Chilika lagoon	-	Ajit K. Patnaik (Chilika Development Authority)
17.	Mangrove ecosystem of Orissa	-	S.K. Patnaik, C.S. Kar & S.K. Kar Wild Life Organisation, Dept. of Forest, Govt. of Odisha
18.	Olive ridley turtles		C.S. Kar, Wild Life Organisation, Dept. of Forest, Govt. of Odisha
19.	Natural hazards along Orissa coast	-	N.K. Mahalik (Utkal University)
20.	Coastal Zone Management	-	N.K. Mahalik (Utkal University)

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Coastal Tract of Odisha: Geology, Resources, and Environment.
2012. Ed. N.K. Mahalik, Published by Geomin Consultant, Pvt. Ltd., 288 pp.
ISBN 978-93-5067-462-8, Price Rs. 2000, US $100

This edited book by Professor N.K. Mahalik, formerly Professor and Head of Geology Department, Utkal University, Bhubaneswar, brings the different aspect of the coastal region of Odisha. It is useful to have basic information and base level data on the coastal zone ecology, oceanography, rainfall, water resources, fauna, flora, mineral resources, fishing and agriculture. These all effect the population and hence justify inclusion in the volume. This basic information would certainly help planner, developers to make use for in a balanced and integrated development of the region.

The book has 3-sections, Section A of Geology combines 6 article - covering

(1) General aspect of the coastal tract, (2) Morph- tectonics of the coastal tract, (3) Geology and statrigraphy of the coastal tract, (4), Geomorphology of the coastal tract, (5) Geology of the continental shelf, (6) Evolution of the coastal tract. Section B

- comprise resources, and include contribution covering (7) Surface water resources of the costal tract and its management, (8) Groundwater resources of the coastal tract, (9) Hydrocarbon potential of the onshore and near shore coastal basin of Orissa (1). Hydrocarbon potential in the far offshore basin along Orissa coast, (11) Soil resources and agricultural practices in coastal tract, (12) Beach placer deposits along Orissa coast, (13) tourist resources along the coastal tract of Orissa, (14) Port facility and Maritime activity along Orissa coast. The section C - comprise environment. This include (15) Unique biodiversity of Orissa coast, (16) Resources and problem of Chilka lagoon, a Tourist Paradise along Orissa coast, (17) Mangrove Ecosystem of Orissa with special references to Bhitarkanika, (18) Olive ridley turtles of Orissa coast, (19) Natural hazards along Orissa coast, and (20) Coastal zone problem and management.

This book is well printed, on art paper with adequate figures supporting photograph. I hope the book well of use to most of the groups and individuals who wish to contribute to an interpreted development of the coastal region of Odisha state.

(G.S. Roonwal)

2. Atlas of Oxide Ores of India and their Textures

The book on "Atlas of Oxide Ores of India and their Textures" written by Dr. R.K. Sahu an eminent geoscientist and former scientist of Institute of Minerals and Materials Technology, Bhubaneswar covers a compendium on various oxide ores of India and their associated structures. The book highlights on Bauxite, Chromite and Nickel ore, Iron ore, Manganese ore, Manganese Nodule, Placer Minerals, Radioactive minerals, Tin and Tungsten ore, Vanadium ore and others mostly available in Odisha and other parts of the country. This volume, first of its kind has more than 200 plates, more than a thousand photographs, microphotographs depicting important primary and secondary textures. This volume has also photographs of important mines exposing these oxides ores. The book is proved to be a definite source of information on these oxide ores which would help the researchers and scientists to develop their academic pursuit on the subject. Educational institutions imparting teaching and research on Earth Science subjects can have this book in their library as reference.

The book can be had for purchase from the author at the following address:

Dr. Rama Krishna Sahu, Scientist (Retd.), RRL Plot No. 137, Lane – 5, Jagannath Vihar, Baramunda, Bhubaneswar–751 003.

- **Seminar on Approach and Strategy for Integrated Development of Joda-Barbil-Koira Mining Area held at Barbil on 23 – 24 September 2011**

The Seminar organised by SGAT was held in the midst of deluge caused by record heavy rainfall in the area resulting in complete disruption in power supply, tele link and road communication. In spite of such deterrents, there were 170 participants including representatives from national media. 11 papers were presented in 4 technical sessions besides 3 keynote papers by Dr. R.C. Mohanty, President, SGAT, Shri T. Mahanta, Jt. Director of Geology on behalf of Dept. of Steel & Mines, Govt. of Odisha and Shri R.L. Mohanty, President, EZMA and a presentation by President, Keonjhar Citizens' Forum. Other notable presentations were by MoEF, IBM, Tata Steel, MECON, Vale India, S.E. Railway and OSPCB.

The Seminar was addressed by Padmasri Dr. Tulasi Munda, Shri K.S. Ramachandran, IAS (Rtd.), Shri Nilmadhab Mohanty, IAS (Rtd.), Shri J.K. Tewari, IFS, CCF, MoEF and Shri K.P. Nyati, Sr. Advisor, FIMI, who graced the event as Guests of Honour.

The participants were unanimous in their view that Joda-Barbil-Koira area calls for substantial improvement immediately in the fields of infrastructure, health care, education, employment opportunity, availability of clean drinking water and environment management and for this purpose, a comprehensive action plan should be worked out by SGAT and implemented with active involvement of all stake holders.

SGAT was represented by its President, Dr. R.C. Mohanty; Vice Presidents, Dr. S.K. Sarangi & Dr. G.B. Mishra; General Secretary, Shri B.C. Patnaik; Joint Secretary, Shri G.C. Das and Treasurer, Shri K.C. Pradhan among others. Also present were Dr. C.R. Das, Chairman, Environment Appraisal Committee, Odisha.

The Seminar was sponsored by EMIL and EZMA. Shri B.K. Mohanty, Advisor, SGAT coordinated and supervised the event.

- **INTERNATIONAL SEMINAR ON MINING LEGISLATIONS HELD ON 2-3 DECEMBER 2011 AT BHUBANESWAR**

The 2-day Seminar organised by the Society of Geoscientists and Allied Technologists (SGAT) in collaboration with C-TEMPO, Ministry of Mines, Government of India, Department of Steel and Mines, Government of Odisha.

Federation of Indian Mineral Industries, Eastern Zone Mining Association Mining Engineers' Association of India, successfully completed with a Valedictory Address by Hon'ble Justice A.K. Patnaik of the Supreme Court.

Besides the Inaugural and the Valedictory Sessions, there were as many as 15 presentations spread over 3 Technical Sessions. There was a panel discussion and the panelists include Prof. B.B. Dhar, Prof. G.S. Roonwal, Mr. V.S. Rao, Dr. R.C. Mohanty with Shri B.K. Mohanty, Advisor, SGAT acting as moderator. Shri Manoj Ahuja, IAS, Commissioner-cum-Secretary, Govt. of Odisha, Dept. of Steel & Mines addressed the Seminar both in the Inaugural and Valedictory Sessions.

The highlights of the Seminar were inaugural address by Shri Prafulla Chandra Ghadei, Hon'ble Minister for Finance and Public Enterprises, Govt. of Odisha, presentations by Shri P.N. Padhi, IFS, PCCF, Govt. of Odisha; Prof. M.C. Dash, former Chairman, Odisha Pollution Control Board and VC, Sambalpur University; Shri B.L. Bagra, Chairman-cum-Managing Director; Dr. R.C. Mohanty, President, SGAT and Dr. S.K. Sarangi, Vice President, SGAT and summing up of the proceedings by Shri B.K. Mohanty, Advisor, SGAT.

Hon'ble Minister in his Inaugural Address observed "Whatever blame game you may resort to and paint mining as the most despicable activity, our existence on the earth will not be possible without mining and use of minerals. This is the truth". He called upon the mining industry to bridge the trust gap with the community which is widening day by day. Shri Ghadei was of the opinion that the MMDR Bill 2011 doesn't address the legitimate concerns of the mineral rich states. The approach of the Ministry of Mines to completely overhaul the existing MMDR Act is not necessary as the broad objectives of the new MMDR Bill could have been achieved by inserting a few sections in the proposed Act. He mentioned that the State Govt. is under tremendous pressure to meet the increasing demands in the areas of education, healthcare, environment, infrastructure and community welfare. Considering the need to raise additional resources to meet these increasing demands, Hon'ble Chief Minister, Odisha has demanded imposition of a Mineral Rent Resource Tax @ 50% of the surplus rent on account of super normal profits made by the mine owners on sale of iron ore and he has written to the Hon'ble Prime Minister in the matter. The State Govt. has demanded ban on export of iron ore and chromite. He mentioned that the State is rich but its people are not. He recalled that a few years ago, the state had 50% of its population below poverty level. Now it has come down to 28%. GDP growth rate of the State is more than the national average.

Shri P.N. Padhi, IFS, PCCF, Odisha, presented an elaborate account of evolution of forest laws in India. He mentioned that Forest (Conservation) Act 1980 is the smallest Act having largest impact. Shri Padhi dealt with interpretation of "Forest" by Hon'ble Supreme Court in 1995 after 15 years of enactment of Forest (Conservation) Act. He referred to guidelines issued by MoEF in 2011 about preparation of Geo-referenced District Forest Map after 15 years of orders of the Hon'ble Supreme Court. He reiterated the fact that renewal of ML is grant of fresh ML and TWP can be given only after forest clearance. He observed that environment clearance, forest clearance and wild life clearance are being given by the same

Ministry i.e. MoEF and felt that there should be one composite clearance. Concluding his presentation, Shri Padhi observed that although mining activities are indispensable for a mineral rich state like Odisha, these have to be carried out within the ambit of law and adequate environmental safeguards. He drew the attention of the delegates to the directive of Hon'ble Supreme Court ".....Time has come for us to apply the constitutional "doctrine of proportionality" to the matters concerning environment as a part of the process of judicial review in contradiction to merit review .It cannot be gainsaid that utilization of the environment and its natural resources has to be in a way that is consistent with principles of sustainable development and intergenerational equity, but balancing of these equities may entail policy choices".

Prof. M.C. Dash presented a detailed account of environmental pollution control laws as applicable to mining and legal implications of non-compliance. He mentioned that the pollution controlling mechanism is money intensive as it requires input of modern technology. The Indian legal system at present provides three major environmental laws namely (i) The Water (Prevention and Control of Pollution) Act, 1974, (ii) The Air (Prevention and Control of Pollution) Act, 1981,(iii) The Environment (Protection) Act, 1986 and Rules. The existing and running mines come under the consent administration of SPCB with respect to the Water Act-1974, Air Act-1981 and Hazardous Waste Management Rules-2008. Establishment of new mines come under the provisions of EP Act-1986 and the notifications of EIA-1994 and subsequent amendments of 1997, 2006, 2009, and 2011. He observed that no general comprehensive law exists to deal with pollution prevention, control and abatement.

Shri Manoj Ahuja, mentioned that the State Govt. is expecting revenue of Rs. 4000 crores from royalty during 2011-12, an increase of as much as Rs. 1000 crores collected during 2010-11. He observed that exploration effort for discovery of new mineral deposits in the state is rather low and emphasized for much higher input in this area. Shri Ahuja felt that the deliberations in the Seminar by renowned experts in the field will reveal new dimensions to the MMDR Bill 2011 and this can be communicated to Ministry of Mines and the Parliament Standing Committee. He observed that only through scientific mining, environment management, good rehabilitation schemes and community welfare, the negativity about mining can be overcome.

Speaking on MMDR Bill 2011, Sri Bagra mentioned, there would be problem in auctioning deposits with known reserves. As regard to value addition, there can't be a standard for all minerals. Each mineral has to be considered separately and it has to be specified with value addition to the extent possible. Location of industry should be left to the discretion of the investor. Govt. should not detect location of any industry. As regard to the National Fund and District Mineral Fund, question is who will control and administer the fund. There should be adequate safeguard against misuse for these funds. There are three bills awaiting assent of the Parliament. These are MMDR Bill, Land Acquisition, Rehabilitation & Resettlement Bill and Companies Bill. Combined effect of all the three bills piloted by different Ministries of Govt. of India will surely result in scaring away potential investors in mining industry. It is necessary that the purpose and objectives of all the three bills so far as they relate to the mining industry are made in one composite bill. The MMDR Bill provides for Mutli Regulatory Authorities which is certainly not conducive to the development of the mineral industry.

Justice A.K. Patnaik, Judge, Supreme Court of India in his Valedictory Address drew the attention of the delegates on how legislation seeks to preserve the environment from the adverse effects of mining in India. He cited the constitutional provisions for protection and improvement of the environment,

safeguarding of forest and wildlife. He reiterated the fact that the land and mineral rights belong to the state. Justice Patnaik mentioned that every individual has a fundamental right to life under the constitution and right to life includes right to a clean environment. He referred to the Environmental Guidelines for Mining Operations issued by the United Nations, commonly referred to as "the Berlin Guidelines (I)", where it is stated that mining can be a potential source of wealth in developing countries, but in addition to generating wealth, mining can also be a major source of degradation to the physical and social environment unless it is properly managed. The Guidelines, therefore, suggest that balanced environmental legislation must aim at minimising the damage of mining operations by adopting sound environmental practices drawing on the enhanced knowledge base.

Justice Patnaik explained the various legislative provisions for clearance of mining project from environment and forest points of view. He mentioned that the National Green Tribunal Act, 2010 has now constituted a Tribunal, which has the jurisdiction over all civil cases where a substantial question relating to environmental law arises out of the implementation of the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 and the Forest (Conservation) Act, 1980 amongst other Acts. This Tribunal has the power to grant relief and compensation to the victims of pollution and other environmental damage and pass orders for restitution of property damaged and for restitution of the environment for such area or areas, as the Tribunal may think fit. This Tribunal has also the appellate jurisdiction over the decisions of the State Pollution Control Boards and the State Government under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 and the Forest (Conservation) Act, 1980 and over the decisions of the Central Government under Section 5 of the Environment (Protection) Act, 1986.

He hinted that Govt. of India is contemplating to enact a legislation constituting a regulatory authority for environment.

Concluding his address, Justice Patnaik observed that mining is necessary for development, but development at the cost of environment will only lead to destruction. Moreover, mines and minerals cannot be depleted for the benefit of the present generation only. Mines and minerals have also to be preserved for the benefit of future generations. Hence, the Supreme Court in the recent case in *Lafarge Umiam Mining Private Limited* has held that mining must take care of the equitable principles of intergenerational equity and sustainable development as an on-going process.

He complimented the Society of Geoscientists and Allied Technologists (SGAT) for selecting "Mining Legislations" as the topic for the Seminar and inviting him to express his views.

The Seminar was convened by Dr. S.K. Sarangi, Vice President, SGAT.

- **Interaction with Director General, GSI (Sri Soondera Moorty) on 07.11.2011 at 5.30pm at Hotel Swosti**

President, Vice-president, General Secretary and Jt. Secretary, Sri G.C. Das of SGAT interacted with the Director General of G.S.I accompanied by Dr. Srinivas Madhabhusi, Dy. D.G. of Eastern Region, Dr. H. Sarvothaman, Dy. D.G. of Odisha and Dr. S.B. Ray, Director on 07.11.2011. Discussions were held on reassessment of iron, chromite, and manganese. SGAT wanted G.S.I to take lead role in the exploration of these minerals which is urgently required for development of mineral sector and simultaneously the mining areas and mineral conservation. It was suggested that G.S.I. also take up with MoEF on relaxation of restriction of putting boreholes in forest areas.

- **Mineral Development Awareness Quiz (MDAQ) – 2011 held on 27 & 28 August 2011 at Bhubaneswar**

With a view to updating the students pursuing PG courses in Geoscience, Degree courses in Mining, Metallurgical and Environment Engineering about the latest developments in the fields of mineral exploration, mining, processing and beneficiation, mineral based industries, environment management among other, **Society of Geoscientists and Allied Technologists** has been organizing **Mineral Development Awareness Quiz (MDAQ)** on annual basis for the last 20 years.

This year's programme consisted of the following activities:-

i. Visit (one full day programme) Chromite mines, Chrome ore beneficiation plant, Environment protection measures (including Effluent treatment plant) and Charge Chrome plant.
ii. Visit to Regional Museum of Natural History, Bhubaneswar
iii. Identification of Rock, Ore and Mineral samples; Products of beneficiation and metallurgical plants; Photographs of mines, HEMM and equipment
iv. Interpretation of satellite imageries
v. Oral Quiz
   a. Subject specific b. General

14 teams from 10 institutions participated in the programme. The Institutions are:

1. IIT, Kharagpur
2. Indian School of Mines, Dhanbad
3. Utkal University
4. Sambalpur University
5. Khallikote Autonomous College
6. BESU, Shibpur
7. Andhra University
8. IGIT, Sarang
9. NIT, Rourkela
10. OSME (Degree Stream), Keonjhar

The Applied Geology team of Indian School of Mines, Dhanbad represented by S/Shri Prasanta Kumar Mishra and Nitish Kumar was adjudged the overall best team in the completion. All the participating students were awarded certificates and prizes. Their accommodation and board at Bhubaneswar and visit to mines were arranged by SGAT.

- **Observance of Utkal Divas**

Society observed Utkal Divas on 1st April 2012. The function solemnized with addresses given by different dignitaries specifically on various issues of mineral development in Odisha. The function was presided by Dr. S.K. Sarangi, President of SGAT. Eminent speakers include Mr. Deepak Mohanty, Director of Mines, Govt. of Odisha, Dr. R.C. Mohanty, former ED, NALCO and Ex-president, SGAT, Dr. S.N. Patro, working President, Orissa Environmental Society and few others. Sri B.K. Mohanty, Advisor, SGAT presented the documentary film on 'Mining & Environment' developed by the Society.

- **FORTHCOMING EVENTS OF SGAT**

- **National Seminar on Mining and Community Welfare** is going to be held on 22 & 23 September 2012 at Hotel Crown, Bhubaneswar.

- A.G.M. of Geological Society of India, Bangalore shall be organised on 23 September 2012 at 6.00pm in SGAT Building at Plot No. ND-12(P), VIP Area, IRC Village, Nayapalli, Bhubaneswar - 751015.

- A programme for the school children to promote awareness of geosciences is proposed to be ogranised jointly by SGAT and Geological Society of India on 24 September 2012 at SGAT Building.

- A **National Seminar on Waste to Wealth** is going to be organsied jointly by IIM, Bhubaneswar Chapter on 14-15 December 2012 in SGAT Building The Seminar topic includes - Mineral and Mining Industries M-Waste), Chemical Industries (C-Waste), Electronic Industries (E-Waste), Bio-Sector Waste (B-Waste), Municipal Solid Waste (MS-Waste). Authors are requested to submit the abstract by 30.09.2012 and full paper by 15.011.2012. The registration fee for members of IIM/SGAT- Rs. 1500.00, Non-members- Rs. 2500.00 and Student/ Research Scholars- Rs. 1000.00. Sponsorship, Co-sponsorship and Advertisement fee are Rs. 1,00,000.00, Rs. 50,000.00 and Rs. 20,000.00 (Full page colour), Rs. 10,000.00 (Half page colour) respectively. The payments are to be made in shape of DD/Cheque in favour of 'W 2 W – 2012' payable at Bhubaneswar. All the enquiries and registration fee shall be sent to Dr. J.K. Mohanty, Convener, W2W, Scientist, IMMT, PO: RRL, Bhubaneswar–751003, Mob: 09437499117.

- **32nd Annual General Body Meet** shall be held on 15th December 2012 at SGAT Hall. The meeting shall commence at 6.00pm. All the members are request to grace the occasion.

AWARDS 2012

- **SGAT AWARD OF EXCELLENCE – 2012**

Nominations are invited for SGAT Award of Excellence – 2012 in the Proforma enclosed. Persons awarded in the past should not be re-nominated. The proforma (4 sets) completed in all respects and duly signed by the proposer should reach the General Secretary, SGAT at 267, Kharavela Nagar, Bhubaneswar – 751 001 on or before **31st October 2012.**

The Award will be in the form of a citation and a cash award.

Any person (member or non member) who has made outstanding contribution in the field of Geosciences, Mining, Metallurgical and Mineral Process Engineering, Mineral Beneficiation or whose work has led to significant development of mineral resources shall be eligible for the award. Self nomination is also accepted.

1.	Name of the persons proposed	:
2.	Date of birth	:
3.	Designation & address	:
4.	Educational qualifications	
5.	Professional experience	:
6.	Membership of Professional bodies	:
7.	List of publications with names of journals Vol. and Issues (if possible, send important reprints)	:
8.	Details of outstanding work (Please attach a separate sheet)	:
9.	Any other information	:

Signature

Place:

Date:

Full name and address of the Member/Institution proposing

- **SITA RAM RUNGTA MEMORIAL AWARD – 2012**

Nominations are invited for Sita Ram Rungta Memorial Award in the proforma given below. Any person (member or non-member) who would have made significant contribution in Mineral Exploration, Planning and/or Mineral Beneficiation involving utilisation of mine waste/sub-grade ores and minerals will be eligible for the Award. Persons awarded earlier should not be re-nominated. The Award will be in the form of a citation and cash. Self nomination is also accepted. The work should be original, innovative and of applied nature.

Proforma for Nomination

1.	Name of the persons (in Block letter) proposed	:
2.	Date of birth	:
3.	Designation & address	:
4.	Educational qualification	:
5.	Professional experience	:
6.	Membership of Professional Bodies	:
7.	List of Publications with names of Journals (Issues/volumes) if Possible, send important reprints	:
8.	Details of outstanding work (Please attach a separate sheet)	:
9.	Any other information	:

The nomination (in 4 sets) in the prescribed proforma should reach the General Secretary, SGAT at 267, Kharavela Nagar, Bhubaneswar – 751 001 on or before **31st October 2012.**

Signature

Place:

Date:

Full name and address of the Member/Institution proposing

- **SMT. VEENA ROONWAL MEMORIAL AWARD - 2012**

Nominations are invited for Smt. Veena Roonwal Memorial Award in the proforma given below. Any person (member or non-member) who would have made significant contribution in Environmental planning & management to achieve sustainable development of mining and mineral based industries will be eligible for the Award. The Award will be in the form of a citation and cash. Self nomination is also accepted. The work should be original, innovative and of applied nature.

Proforma for Nomination

1.	Name of the persons (in Block letter) proposed	:
2.	Date of birth	:
3.	Designation & address	:
4.	Educational qualification	:
5.	Professional experience in environmental studies	:
6.	Membership of Professional Bodies	:
7.	List of Publications with names of Journals (Issues/volumes) if Possible, send important reprints	:
8.	Details of outstanding work (Please attach a separate sheet)	:
9.	Any other information	:

The nomination (in 4 sets) in the prescribed proforma should reach the General Secretary, **Society of Geoscientists and Allied Technologists (SGAT)** at 267, Kharavela Nagar, Bhubaneswar – 751 001 on or before **31st October 2012.**

Signature

Place:

Date:

Full name and address of the Member/Institution proposing

➢ NEWS ABOUT MEMBERS

- Dr. R.C. Mohanty, Ex-president presented a paper 'Mineral Potential of Odisha' in the Earth Science System session in the Indian Science Congress on 06.01.2012 on behalf of SGAT.

- Sri B.K. Mohanty, Advisor, presented a paper titled "Mining, Environment and Community" on 05.01.2012 in the 99th Indian Science Congress, Bhubaneswar.

- Sri S.K. Das, Director of Geology and Mining I/c retired on 31.12.2011 from Govt. service on superannuation.

- Smt. Maitrei Patnaik assumed the office of Director of Geology and Mining I/c on the 31.12.2011.

- Shri P.K. Bose got promoted to the post of Additional General Manager (Geology), OMC Ltd. since 21st May 2012.

- The following members of SGAT serving as Geologists of Directorate of Geology, Bhubaneswar were promoted to the post of Dy. Director of Geology and are posted at different zones of Directorate.

  1. Sri Mayadhar Sahoo – Dy. Director of Geology, Bhubaneswar.
  2. Sri Anup Ku. Rout – North Zone, Sambalpur.
  3. Sri P.C. Vajani – South Zone, Berhampur.
  4. Sri Manoj Oram – Balangir Zone, Balangir.
  5. Sri T.B. Munda - Balangir Zone, Balangir.
  6. Sri Peter Tirkey – Koraput Zone, Koraput.

- Dr. More Ramulu has been awarded for National Geoscience Award-2010 for Mining Technology by Ministry of Mines, Govt. of India. Dr. Ramulu is the Principal Scientist, Rock Excavation & Blasting Engineering at Central Institute of Mining & Fuel Research, Regional Centre (CSIR), Nagpur.

- Sri G.S. Khuntia presented a paper in Indian Science Congress, Bhubaneswar on 5/1/2012 entitled "Status of Iron ore resources development in context of Investment in Steel sector in India with special references to Odisha state, threats, opportunities & roadmap" as an Invited Speaker.

- Dr. R.N. Mishra conferred the LIFE TIME ACHIEVEMENT AWARD on 17th Mar' 2012 by The South Asian Association of Economic Geologists presented through the hands of Prof. Nisha Dube, Vice Chancellor of Barkatullah University, Bhopal.

Obituary

Members of SGAT place on records its deep sorrow and anguish on the sad demises of three of its esteemed members as follows

- Shri N.M. Bhuyan, a renowned metallurgist and former General Manager of IPICOL is expired.
- Sri. Sangram Keshari Misra, an eminent Mining Engineer and former Director of NALCO went to his heavenly abode on the 3rd of May 2012.
- Sri Sricharan Swain, a profound Geoscientist and former Joint Director of Geology, Dept. of Steel & Mines, Govt. of Odisha is died on 16th May 2012.

Members of the Society pray before God to impart peace to the departed souls.

NEW MEMBERS

1. **Mr. T.S. Suresh Kumar**
Chief, Natural Resources Division,
Tata Steel Limited,
3rd Floor, Commercial Centre,
(Room No. 349),
P.O.: Jamshedpur – 831 001,
Jharkhand.

2. **Mr. Nedunuri Venkata Sairam**
Principal Geologist,
Tata Steel Limited,
3rd Floor, Commercial Centre,
(Room No. 349),
P.O.: Jamshedpur – 831 001,
Jharkhand.

3. **Mr. Rajeeb Kumar Mohanty**
Principal Geologist
Natural Resources Division,
Tata Steel Limited,
3rd Floor, Commercial Centre,
(Room No. 349),
P.O.: Jamshedpur – 831 001,
Jharkhand.

4. **Mr. Santosh Kumar Pandey**
Regional Geologist,
Tata Steel Limited,
N.R.D., Geological, JCPP,
P.O.: Jamadoba – 828 112,
Dist.: Dhanbad (Jharkhand)

5. **Mr. Sangeeth Gopi**
Geologist,
Natural Resources Division,
Tata Steel Limited,
3rd Floor, Commercial Centre,
(Room No. 349),
P.O.: Jamshedpur – 831 001,
Jharkhand.

6. **Mr. Paratpar Mishra**
Vice President, Mineral Resource,
M/s. Vandana Global Limited,
H. No. 8, Rishabh Residency,
B/4, Fruit Market, Amlidih–Lalpur Road,
P.O.: Devpuri, Raipur (Chhattisgarh)
Pin - 492 001.

7. **Mr. Asitabha Datta**
Director (Retd), GSI,
346/16, N.S.C. Bose Road,
Kolkata – 700 047
West Bengal

8. **Mr. Sitaram Kemmannu**
Exploration Manager
Vale India Private Limited,
Ashok Apartment CGHS Ltd,
Plot No.62, Sector-56,
GURGON-122011
HARYANA

9. **Mr. Bhaskar Nath**
Consultant,
"Shreekunj", Flat- 4D,
60/2 Lake Road,
Kolkata – 700 029

10. **Mr. K. Ram Chandar**
Asst. Professor,
Department of Mining Engineering,
NIT, Karnataka, Surathakal
PO: Srinivasnagar – 575025
Mangalore

11. **Mr. Debasish Roy**
Former Director (GSI)
B-8/118, Kendriya Vihar,
VIP Road, Kolkata - 700052

12. **Mr. Sahid Umar**
Former Sr. Geologist (GSI),
130, VIP Area, Ekamra Vihar,
I.R.C. Village,
Bhubaneswar – 751015

13. **Mr. Rajesh Kanungo**
Consultant,
M/S. Sun Consultancy and Services,
16/C, Engineers' Colony, Budheswari,
Bhubaneswar – 751006

14. **Mrs. Sushree Anupama Jena**
Geologist
Directorate of Geology, Odisha
125, Saheed Nagar
Bhubaneswar – 751 007.

15. **Dr. Lalit Narayan Patnaik**
116/Mechatech House
Kalyani Nagar
Cuttack – 753013
Odisha

16. **Mr. Amal Chandra Paira**
Qrs.No. A/168
Koelnagar, Rourkela – 14
Dist: Sundergarh
Odisha

17. **Mr. S.K. MD. Equeenuddin**
Assistant Professor
Dept. of Mining Engineering
National Institute of Technology
Rourkela – 769008
Odisha

18. **Mr. Girija Prasad Mohapatra**
Deputy Director General
Marine and Coastal Survey Division
Geological Society of India
Pandeshwar, Mangalore
Karnataka

19. **Mr. Sabyasachi Mohanty**
Jt. General Manager (Mining)
Arcon Retreat
Flat No. DE – 512
Patia Square, Nandan Kanan Road
Patia – 751031
Odisha

20. **Mr. Sushanta Kumar Mishra**
Chief Resident Executive
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Tata House
273, Bhoumanagar, Unit – IV
Bhubaneswar – 751001
Odisha

➢ OTHER NEWS

Australia's strategic ties with India are set to benefit with the Australian governing Labor party voting to overturn its long standing ban on exporting uranium to India. According to experts, an important obstacle is now out of the way with regards to Indo-Australian relations.

Australian defense minister Stephen Smith was in India recently, on his first visit after the ban was withdrawn. Smith reportedly has held several discussions and meetings with the defense services and held uranium export talks with senior ranking officials in India. "Talks on uranium exports have gathered steam," a high ranking official who was present at the discussion reportedly said.

Smith, who has favoured uranium exports to India, was quoted by newswire agencies as saying that India represented a `unique' case for uranium sales. In a missive, Smith underlined that the uranium export decision reflected India's global standing, and predicted it would become ``one of the world's three great powers", along with the US and China.

India is the sixth largest energy consumer in the world, accounting for 3.4% of global energy consumption. As of 2010, India has 20 nuclear reactors in operation in six nuclear power plants, generating 4,780 MW. Another five plants are under construction and are expected to generate an additional 2,720 MW, according to trade experts.

Australia holds around 40% of the world's estimated low cost uranium reserves. With large deposits in the Northern Territory, northern and central Western Australia, northwestern Queensland and in central South Australia, the decision to lift the ban on exporting uranium to the growing Asian power has been welcomed in all circles.

India's External Affairs Minister S.M. Krishna told reporters recently that bilateral cooperation in the energy sector was one of the important facets of India's multifaceted ties with Australia.

"Australian Prime Minister Julia Gillard's change in the ruling Labour Party's policy on sale of uranium to India is a recognition of our energy needs, the impeccable record of our non proliferation treaty accord and strategic partnership," Krishna reportedly told a section of the media.

The Secretary General of the Federation of Indian Mineral Industries R.K. Sharma has also said it would be desirable to invest in Australian uranium assets. Several Indian companies have already invested billions of dollars in Australian coal assets in the past year to fuel the country's fast growing economy.

Welcoming the initiative, the president of Australia India Business Council Ravi Bhatia said the decision by the Australian Labor Party ``is momentous and historic. The resulting accelerated economic development, job creation, industrial development and more power for irrigation are indeed far reaching effects of the Australian decision as are the corresponding social justice implications," he said, adding the decision validates India's unblemished record as a responsible nuclear power.

Moreover, R.K. Sinha, Director of Bhabha Atomic Research Centre said India would look for opportunities of owning uranium mining assets overseas, apart from considering long term supply contracts.

Though Australia ships nuclear fuel to China, Japan, Taiwan and the United States, it had excluded sales to India because the country is not a signatory to the Nuclear Non Proliferation Treaty.

- **SUBMISSION OF PAPERS FOR SGAT BULLETIN**
  (Instruction to Authors)

Research papers, review articles, short communications, announcements and letters to editors are invited on topics like geosciences, mineral exploration, mining, materials science, metallurgy, mineral industry and trade, mineral economics, environment, education, research and development, legislation and infrastructure related to mining, mineral policy and mineral development planning.

Submission of manuscript implies that the same is original, unpublished and is not being considered for publication elsewhere. Two copies, complete in all respect (with copies of figures and tables) are required to be submitted. Originals of figures and tables should be enclosed separately. Each manuscript must accompany by a computer diskette (floppy) containing the electronic version of the text. Electronic files of figures, if available, should be submitted in a separate diskette. In each case, the details of software and type of equipment used should be clearly indicated. The copies of manuscripts, strictly in accordance with the instructions to authors given below may be sent to the editor of the bulletin.

Journal Format: **A-4 size**
Language: English
Manuscripts: Manuscripts should be typed in double spacing with wide margins in one side of A-4 size paper either by electronic typewriter or computer (size 12 point Times New Roman font). The title page should include the title of the paper, name(s) of author(s) and affiliation(s). The title should be as brief as possible. An informative abstract of not more than 500 words to be included in the beginning. Not more than 5 key words are to be listed at the end of he abstract. Text of research papers and review articles should not exceed 4000 words. The short communication is for quick publication and should not exceed 1200 words.

Headings: Different headings should be in the following format.

(a) Title: Centrally aligned, bold, capital
(b) Author(s): Centrally aligned, short name, bold, first letter of all words capital followed by communication address (Not Bold)
(c) Abstract: Left aligned, bold
(d) Key words: Left aligned, bold
(e) Primary heading: Left aligned, bold, capital
(f) Secondary heading: Left aligned, first letter of each word capital
(g) Tertiary heading: Left aligned, first letter of first word capital
(h) Acknowledgements: Left aligned, bold, first letter capital
(i) References: Left aligned, bold, first letter capital
(j) Figure Caption: Left aligned, first letter of first word capital, below the figure
(k) Table Caption: Left aligned, first letter of first word capital, at the top of the table

Illustrations: All illustrations should be numbered consecutively and referred to in the text. They should confirm to A-4 size and carry short captions. Lettering inside figure should be large enough to be accommodate up to 50% reduction. One set of hard copy of all figures (either tracing in ink or laser prints) should be provided in a separate envelope marked "Original Figures". Photographs should be of good quality with excellent contrast, printed on glossy paper. Colour photos are acceptable, provided the author(s) bear the cast of reproduction. Figure captions should be provided on separate sheet.

Tables: Each table must be provided with a brief caption and must be numbered in the order in which they appear in the text. Table should be organised within A-4 size and should be neatly typeset for direct reproduction. Tables will not be typeset by the printer, so their clarity and appearance in print should be taken into account while the author(s) prepare(s) them. Use of 10 points Time New Roman/Arial Font for table is recommended.

References :

(a) References in the text should be with the name of the author(s) followed by the year of publication in parenthesis, i.e. Patnaik (1996); Patnaik & Mishra (2002); Nayak et al. (2001)

(b) Reference list at the end of the manuscript should be in alphabetical order, in the following format: Sehgal, R.K. and Nanda, A.C.(2002) Palioenvironment and palioecology of the lower and middle Siwalik sub-groups of a part of North-western Himalayas. Jr. Geol. Soc. Ind, vol. 59, pp. 517-529

(c) Articles from the books should follow the format given below: Windley, B.F. and Razakamanana, T. (1996) The Madagascar – India connection in a Gondwana framework. In:Santosh, M. and Yoshida, M. Eds.) The Archaean and Proterozoic terrains of South India within East Gondwana. Gond. Res. Group Mem. No.3, Field Sci. Publ., OSAKA, pp. 25-37

(d) Books should be referred to as: Sengupta, S.M. (1994) Introduction to sedimentology. Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi, 314 pp.

Submission of manuscript

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