Order

Subject: Constitution of the Committee to look into the technical aspects of mining of heavy mineral placer deposits in the coastal area in the Beach Sand, primarily for Garnet, rutile and Ilmenite extraction—regarding.

A large percentage of concentration of heavy minerals such as illeminite, sillimanite, rutile, garnet, monazite and magnetite is found along the sandy beaches (high grade) and/or associated dunes (low grade) and the sand bed of shallow sea up to a depth of 20 m of coastal stretches of Kerala, Tamil Nadu, Andhra Pradesh and Orissa with the CRZ area and some time also available as inland deposit. These minerals are called heavy minerals because their densities vary between 4 and 5.5 (much greater than quartz, being the main constituent of most sand). The principal heavy minerals of commercial utility are widely used in the areas of extraction of titanium, welding, pigment, rubber, ceramics, refractory, nuclear and rare earth industry and has a good export potential. In order to attain the objectives of scientific mining and to arrest illegal extraction/mining of heavy minerals, it has been decided to constitute a Committee in the Ministry of Mines to make recommendations for a policy for grant of leases for beach sand after taking into account the technical aspects of regulating mining of heavy mineral placer deposits (both bed and dune) and proper balancing of ecosystem. The composition of the Committee will be as follows:

1. Shri M. S. Nayar, CMD (Retd.), Ms Indian Rare Earth Limited - Chairman
2. Geological Survey of India - Member
3. National Institute of Ocean Technology - Member
4. Department of Geology and Mining, Government of Tamil Nadu - Member
5. Deptt. of Geology and Mining, Government of Andhra Pradesh - Member.
The terms of reference of the Committee will be as under:

(a) To have an idea on the nature of replenishment of heavy minerals by tidal wave action all along the east coast from Andhra to Tamilnadu so as to check the trend of production pattern and thus avoid illegal mining/collection of such minerals;

(b) To form an idea on nature of occurrence of heavy minerals within sand dunes w.r.t. patta land;

(c) Zone-wise, fixation of Bulk Density of heavy minerals including gemel in beach sand for assessment of reserve

(d) To ensure adoption of suitable flow sheet for proper separation of heavy minerals so that all the mineral fractions are collected by the lessees

To suggest a proper mechanism for effective and proper coordination between State Government, Indian Bureau of Mines and Atomic Mineral Directorate for Exploration and Research (AMD) in respect of grant of leases, mining, mineral separation etc.

To suggest suitable measures to overcome the problems of illegal mining of gemel along the shore between HT & LT, the areas prone to replenishment of heavy minerals in the beach sand.

To suggest possible restriction on grant of fragmented mining lease by splitting the areas and to ensure that as far as possible the MIs are less than 15 hectares that Ministry of Environment and Forest forms are
A report on the technical aspects of mining of heavy mineral placer deposits in the coastal area in the Beach Sand, primarily for Garnet, Rutile and Ilmenite extraction.

By

The multiorganisational committee formed by Ministry of Mines, New Delhi

Under the Chairmanship of Sh. M.S. Nagar, Retd. CMD, IREL, New Delhi

BANGALORE

April. 2010
CHAPTER II
BEACH MINERAL RESOURCES

(Revised Edition of Beach Placer Deposits and their Controlling Factors, 1974)

Global Beach Mineral Resources, Onshore and Off-shore Components, State wise Breakup.

Formation of Beach Placer Deposits and their Controlling Factors

Although heavy minerals are found as accessory minerals in igneous and metamorphic rocks, economic deposits of these minerals occur as detrital accumulations mostly in young shoreline or beach placer deposits or as fluvial placers. Minerals with specific gravity greater than 2.89 are termed as heavy minerals. Mechanical concentration by natural gravity and separation of heavier minerals from lighter ones under the action of moving water, wave and wind, results in the formation of a placer heavy mineral deposit. Beach placers are important because of their extent and large tonnages. The factors controlling formation of beach placer deposits are broadly the following:

1. Geological factor: Hinterland geology (Provenance rocks) controls the type and nature of HM assemblage in the placer deposit.

2. Climatic factor: Tropical to subtropical climate with heavy rainfall aids deep weathering and erosion resulting in decomposition and disintegration of the rock and liberates the heavy minerals. These conditions favour the formation of laterites - a sort of pre-concentration. Rich placer deposits of the world occur in tropical zone – between 30° N & S latitudes.

3. Drainage factor: High density youthful rivers play a great role in bringing large amount of sediments to the site of deposition.

4. Coastal processes: Wave nature, long shore current and wind action play an important role in concentration of beach placers.

5. Coastal morphology: Presence of bays and coves combined with Promontories/ headlands, backwater system are favourable features. Wide continental shelf with gentle slope favours concentration on the beaches.

Like wise, there are factors which influence Replenishment of these minerals, which is dealt with in the next Chapter.

Beach Placer Mineral Deposits (India and World)

Beach Placer Deposits of India can be categorised into these types according to their location on the beaches and landward and seaward extensions thereof:

1. Beach/Shoreline Deposits,
2. Inland Placer Deposits - are Teri sand deposits, paleo-strandline deposits and riverine placers,
3. Heavy Mineral Deposits in shallow seas, as extensions of the beach deposits.
CHAPTER III

ZONE WISE MARKING OF BULK DENSITY

In this chapter, the three subjects relating to beach sand minerals on which important terms of reference have been raised are dealt with. The related introductory back grounders followed by critical analysis of the issues involved lead to the recommendations summarised on these TORs in Chapter VI.

MINERAL REPLENISHMENT

Beach Sand Mineral resources may be viewed as 'In situ' and 'Replenishable'. This is an unique feature of this category of minerals, unlike other terrestrial mineral formations.

Resources accumulated due to geological processes in the past are called 'In situ'. These deposits have resulted from shoreline processes in the past and preserved due to receding coast line. The shoreline is highly fluctuating and apparent deposition of materials also changes from time to time and place to place. Hence resources in dynamic swash zone are prone to change invariably. For this reason, a 20 m-30 m zone is not considered for estimation of in situ mineral resources while exploring coastal tracts. The 'in-situ' reserves lend themselves for reliable five yearly production planning in the Mine Plans approved by IBM/AMD, provided the deposit dimensions, grade and description of all the suit minerals to be won, are properly reflected in the Geological Report on which the Mine Plan is designed.

On the other hand, 'Replenishable' reserves or 'Replenishments' are a here and now offering from the waves and or winds on the coasts or adjacent areas in the wind ward direction. Replenishable resources are deposited in the foreshore area by wave action and in the backshore area and beyond by wind action. The factors influencing wave replenishment are: wave energy, swash-backwash action, shore configuration (slope of foreshore), long-shore drift, tides and sediment supply by rivers/streams and coastal erosion. The factors influencing wind replenishment are - wind velocity (> 5 m/sec) required for 'saltation' (sand movement by successive bouncing action), vegetation, configuration of coastal plain and availability of wide sandy beach. The winnowing action of the swash-backwash zone helps in sorting and concentration of heavy minerals. Natural addition also can take place by long-shore drifts.

Replenishments are observed in almost all the coasts on the fore-shore areas, where beach minerals are found insitu. They are apparently far more substantive in the southern coastal beaches of Tamilnadu up to around Kayamkulam lake area in Kerala. By and large, replenishment is active from April to November for about 200 days on the beach, the main producer of Garnet in Tamilnadu.

Given the situation, production from both types of resources would prima-facie seem adequate and desirable from an economic and conservation point of view. In fact, the
Approved Mine Plans for Beach Minerals are seen to provide for both the types of production, though only the total production of ROM is reported by the Operators. In short, there is nothing 'illegal' about tapping replenished minerals perse.

Clearly understanding when does any production from 'Replenishment' becomes 'illegal', if at all, or is it that some other illegitimate activity in the mines is being passed of as 'Replenishments', we have to look at such undesirable acts and devise ways to curb the same. This has been attempted in this Chapter.

First, we take a look at the two TORs 2(a) and 2(f) on this subject, as they are framed.

TOR 2 (a) on Prevention of 'Illegal Mining'

"To have an idea on the nature of replenishment of heavy minerals by tidal wave action all along the east coast from Andhra to Tamilnadu so as to check the trend of production pattern and thus avoid illegal mining/collection of such minerals."

TOR 2 (f) on Overcome the Problems of Illegal Mining

"To suggest suitable measures to overcome the problems of illegal mining of garnet along the shore between HT & LT, the areas prone to replenishment of heavy minerals in the beach sand."

The first part of the TOR 2(a), i.e. nature of replenishment of heavy minerals, has been explained above. There is undoubtedly a degree of variability in such replenishments and also a likely decline in volumes of replenishments over time, if tapped regularly. As such, the 'replenishments' component of any production planning exercise cannot be of a definitive nature, though there are scientific techniques to determine such accretions and depletions on any stretch of a beach. Some of the Institutes such as NIO, NIOT, CES and Marine Depts of Universities have the capability to undertake projects on Sediment Budgeting on selected beaches. Even such studies would provide only approximate estimates of likely replenishment, but the study results would be useful to verify if the figures given in the Mine Plans on this count, are in a reasonable range.

The knowledge of replenishment potential of a mineral yielding beach would be helpful for various other purposes, such as, evaluating the pros and cons of sea walls or other protective structures on the beach or severe erosion etc if any. It is worthwhile therefore to commission such studies and the valuable information gathered may be added to the data bank on the selected beach.

The second part of the TOR 2(a), about avoiding 'illegal mining/collection of such minerals' has to be examined with clear understanding that there could be 'illegal mining' unrelated to 'replenishments' and all production from 'replenishment' source need not be 'illegal'. What is important is to identify the patentilly undesirable or non permissible production activities under the shelter of tapping replenishment. This has been attempted in this Report.
The Committee decided that the term 'legal mining' should be used only for those cases where the mineral is mined or obtained from a non lease-hold area or where the particular mineral is secured from a lease-hold/tailing dump which does not include that mineral in its mining lease deed. Even within the lease-hold, if any production is done from explicitly prohibited areas (such as tapping replenishment between low and high tide lines. taking the stones on the beach front), the act would not pass the 'legal mining' test.

However, if the reported production is seen to be at rates far in excess of the quantities stipulated in the approved Mine Plan, it does not cross the 'legal' line as the MCDR has a provision under Rule-10 for modification in the Mine Plan. The obvious remedy in such cases is to fix a time limit within which the mine operator should get the mine Plans rectified, rather than tolerate such mismatches for the entire balance period of five years, i.e. when the Plan becomes due for review. The reasons for such wide departures by way of reported over production, should also be critically examined for which purpose, securing the figures of 'insitu' and 'replenishment' production separately for every month or quarter, is necessary.

On the other hand, all production from pre-existing deposit or permitted replenishment quantities of any of the listed minerals from the foreshore area (beyond the HT line, but within the lease-hold) and within the +/- 20% of the permitted production level, does fall within the definition of 'legal mining' on which, the first stage Royally is payable.

A close examination of typical 'Mine Plans' and cross-fire of complaints on the subject, reveals that in several cases, the sources of all the raw sand required for the production of the main mineral garnet or associated mineral ilmenite, cannot be accounted for logically. Same is reportedly the case at some of the Mineral Processing Plants, where part of the mineral throughput received, defies proper account.

Consequent on pooling their knowledge about the multifarious ways that illegal mining takes place, the Committee has recorded various ways and means of plugging the same, but so as not to impair the over all production by fair means. These measures include

(a) The incidence of replenishment being only marginal in the case of inland areas, it is better to confine all resource valuation and production planning to the insitu reserves only.

(b) Building scientific data on replenishment in different areas and promoting material budgeting exercises based on which, the mine plans should be cast and approved, rather than on the basis of guess-estimates of RQPs

(c) Certain changes are required to be made in the preparation and processing of Mine Plans, as elaborated under the TOR dealing with that subject.

(d) Clubbing the large number of fragmented small leases in to larger holdings, which are more amenable to closer control

(e) Making it compulsory to report figures of fresh production (from pre-existing deposit) and collection of replenishments separately.