PRE-FEASIBILITY REPORT

1. Executive Summary

IREL(India) Limited is a Government of India Undertaking under the Administrative Control of Department of Atomic Energy. IREL(India) Limited has been engaged in the mining and beneficiation of the heavy minerals from the Chavara deposit in Kollam district of Kerala state since 1965. Besides Chavara, IREL has plants at Manavalakurichi in Kanyakumari district (Tamil Nadu) and at Chatrapur in Ganjam District (Odisha).

Neendakara-Kayamkulam (NK) Block IVEE – Mining of heavy mineral sand in Alappad, Panmana and Ayanivelikulangara villages of Karunagapally Taluk in Kollam District for an area of 180 Ha. (G.O (Rt.) No. 746/07/ID dated 08/06/07 by the Government of Kerala) by IREL(India) Limited, Chavara , Kollam. The lease is valid up to 07.06.2031.

IREL has appointed NIIST – (CSIR) – Thiruvananthapuram, to evaluate the environmental aspects and their possible associated impacts that would arise due to the proposed heavy mineral sand mining operations and to work out environmental management plans and environmental monitoring programme to prevent, control, minimize or eliminate the adverse environmental impacts envisaged from the mining activity.

The field studies shall be carried out for the study area (buffer zone) within 10 km radius with the IRE-ML area (core area) at the centre. No major industries exist in the core area except M/s Kerala Minerals & Metals Limited (KMML) which is about 2.5 km from the IREL Mineral Separation Plant. The mining lease about 18 km from the IREL processing plant at Chavara.

EIA study is a well recognized, effective planning tool which ensures environmentally sound activity. In this report the impacts on relevant discipline of environment due to the operation of the proposed project have been identified and assessed quantitatively as far as possible. Environmental management programme for mitigation of impacts are delineated. An environmental monitoring programme has been suggested for post operational phase of the project. The monitoring programme of specifies the locations, parameters and frequency of monitoring of significant aspects. Capacity building in terms of staff, technical expertise and monitoring facilities are also suggested.

Improved roads and communication, electrical facilities already exists. The report

shall lay stress on the probable occupational health hazards involved and the remedial measures.

The present ML area does not come under `forest land' and hence no compensatory afforestoration is required.

Data regarding the existing socioeconomic conditions shall be collected and Social Impact Assessment (SIA) will be prepared and the R & R scheme will be formulated.

2 Introduction of the Project/Back Ground Information

In the year 1965, IREL(India) Limited, succeeded in taking over the assets of two companies viz M/s Travancore Mineral Concern and M/s Hopkins & Williams Ltd, and rationalized and reorganized the production of economic mineral outputs from the Chavara sand deposits. Initially, their activities were confined to the utilization of beach washings containing the rich heavy minerals deposited over the beach by the wave action between high and low watermarks. The Atomic Minerals Directorate for Exploration and Research under the Department of Atomic Energy carried out geological exploration of the area and the company is engaged in inland dredge mining operation since 1990.

The deposit of heavy minerals is commonly known as "Chavara deposits". It occurs in a 22.5 km long barrier beach with an average width of 200 m between the two tidal channels at Neendakara in the south and Kayamkulam in the north. The western part of the deposit is bounded by the Arabian Sea. The deposit is seen to extend beyond Kayamkulam estuary (or Pozhi) up to Thottapalli but the area to the North of the Pozhi has not been mined so far. The area south of Kayamkulam Pozhi has been under intensive mining since 1932. During this period, it was the main center for export of Ilmenite. This has been the only deposit so far on the Indian coast, to have a heavy mineral content running as high as 60 to 76 %. Also the Chavara Ilmenite known as Quilon grade or `Q' grade ilmenite has high TiO_2 content of 59 sto 60%.

2.1 Identification of Project and Project proponent

Mining of heavy mineral sand by IREL(India) Limited, Chavara, Kollam

Neendakara- Kayamkylam (NK) Block IV EE – Mining of heavy mineral sand in Alappad,Panmana and Ayanivelikulangara villages of Karunagapally Taluk in Kollam District for an area of 180 ha. [G.O. (G.O (Rt.) No. 746/07/ID dated 08/06/07 by the Government of Kerala) by IREL(India) Limited, Chavara, Kollam. This lease came into effect on 08.06.2011 and was valid for a period of 20 years ie, up to 07.06.2031.

The mining was mainly through dredging with annual production capacity of 2,37,500 tonnes. Now the project proponent propose to enhance the mining activity by using two dredgers. As per the revised Mining Plan the annual production capacity is 7,50,000 tpa. The DWUP shall have a throughput capacity of 125 tph and will be operating about 6000 hours in a year. Hence to enhance the production capacity

Environmental Clearance is applied for.

2.2 Brief description of the nature of the Project

Sand mining is carried out by dredging. The raw material collected from the different mining lease areas is the feed material for the mineral separation plant (MSP).

The process employed at MSP is based on the physical properties of the minerals such as magnetic susceptibility, electrical conductivity, size, specific gravity etc and no chemical process is involved. Low intensity magnetic separators separate the highly magnetic Ilmenite and high intensity separators separate weakly magnetic Monazite. The electrical conductivity of the mineral is uutilized to separate the conductive Ilmenite & Rutile and `non-conductive' Zircon and Sillimanite.

The mineral sand from different mining areas as well as dredged sand from DWUP site is fed to HUP, where it is passed through a set of spirals and is separated into heavies and tailings (lighter) fractions. The heavies are passed through Wet High Intensity Magnetic Separator (WHIMS) to get magnetic and non- magnetic fractions.

The dewatered Magnetic Fraction of WHIMS from HUP is dried in Fluidized Bed Drier (FBD) and is fed to the High Tension Separators (HTS) to get conducting fraction which is the Ilmenite product and non-conducting fraction, which is enriched in Monazite, is sent to monazite plant for further processing.

The dewatered Non-magnetic Fraction of WHIMS from HUP is dried in another FBD and fed to HTS to get conducting fraction and non-conducting fractions.

The conducting fraction is fed to Magnetic separators to get three fractions viz;

(1) Magnetics (Ilmenite product)
(2) Non-magnetic (Rutile product) and
(3) Middling fraction (Leucoxene product)

The non-conducting fraction from the HTS in Rutile plant is fed to another set of Magnetic separators, the Magnetic fraction of which is fed to Monazite circuit. The heavies fraction from these spirals is further upgraded through Wet Tables, Magnetic Separators, HTS etc to produce Zircon product. The tailings from the spirals are treated in Kelsey Jig and wet tables to recover Zircon. The tailings fraction from Kelsey Jig is treated in Spirals, Flotation cells etc to produce sillimanite product.

2.3 Need of the Project and its importance to the country and or region

Beach sand of this region consists of several important minerals of industrial importance. The major minerals present are Ilmenite, Rutile, Zircon, Sillimanite and Monazite. Monazite is a source of Rare-Earths and Thorium. Mining of these valuable

minerals are required to meet the demands of several user industries in the state as well in the country.

Ilmenite (FeO TiO_2) is the main raw material for the Titanium Dioxide Pigment and Titanium Metal industry. The Ilmenite is sold to the nearby industries Kerala Minerals and Metals limited (KMML) and Travancore Titanium Products (TTP) for production of Titanium pigment, Cochin Minerals and Rutiles Limited (CMRL) for manufacturing synthetic rutile.

Rutile (TiO_2) is used for the manufacture of TiO_2 pigment, welding electrodes and titanium metal & its alloys. Titanium is very light corrosion resistant and erosion resistant and is used in highly corrosive environment as alloys. Titanium metal is also extensively used in aircraft industry.

Zircon (ZrO_2 SiO_2) is used in the production of foundry moulds, refractory bricks and crucibles, and in the ceramic industry as opacifier. Zirconium alloys are used for nuclear power reactors and as jet engine parts in Aircraft industry. Zirconium Alloys are also extensively used in the manufacture of surgical instruments.

Sillimanite (Al_2O_3 SiO_2) finds the largest application in the manufacture of refractory products for lining furnaces and it is also used in ceramic industry.

Monazite (Ce,Y,La,Th (PO_4)) is a phosphate of rare earths with variable amounts of thorium usually combined with silicate or phosphate. Thorium is largely used as a breeder in the Nuclear Reactors. Mixtures of rare earths are used in glass polishing, arc carbons and flint for lighters. They are used in optical lenses, prisms, television tubes, faceplates etc. Monazite contains 0.3% of Uranium and 8-9% of thorium which are of strategic importance.

2.4 Demand – Supply Gap

The demand for Ilmenite in the state is approximately 2 lakh tons. IREL is currently able to supply less than 50% of the quantity of Ilmenite due to shortage of Raw sand.

There is also a huge demand for minerals like Rutile, Zircon and Sillimanite for use in the state and across the country. Due to shortage of the above minerals the users have to resort to imports. IREL Chavara unit is currently able to meet only above 25% of the demand of Zircon and Sillimanite

2.5 Imports Vs Indigenous production

The end uses of the minerals supplied by IREL are mostly substitutes.

2.6 Export Possibility

There is huge export potential for Ilmenite and Sillimanite in the overseas

market.Domestic and Export Market

The user industries of our minerals are spread across the country. IREL caters the requirements of a wide range of industries viz pigment, ceramics (traditional and advance), foundry, refractory, abrasive, electronics, automobiles, chemicals, metals & alloys, sports, air-craft, satellite launch vehicle, health care and medical, optics, nuclear power etc.

The major export market includes US and Japan etc.

2.7 Employment Generation (Direct and Indirect) due to the Project

The mining and plant operation in this area is being carried out for the last 40 years and the various personnel for running the plant and the mines shall be maintained. IREL manpower will be utilized. However, indirect employment to the locals (~50 temporary workers) is envisaged.

3.0 Project Description

The mining lease is located in the Neendakara-Kayamkulam (NK) belt of beach sand deposit (Survey of India Toposheet no. 58 C/8). The coastal strip from Neendakara to Kayamkulam was divided into 8 blocks for sanctioning mining lease by Kerala Government. The mining lease areas even four blocks have been allotted to IREL, whereas the odd four blocks have been allotted to kerala Minerals and Metals limited (KMML). The coastal deposits are placer deposits formed between the two tidal channels and are deposited along the coast by the tidal action. The raw sand mined from the beach is used as feed to the mineral separation plant for the separation of mineral like Ilmenite, Sillimanite, Zircon, Rutile, Leucoxene and Monazite.

4.0 Site Analysis

The area applied for the lease has been extensively explored by AMDER in the year 1993 and the reserve with a heavy mineral content of 17.62%, which is as estimated was 1,061,983 tonnes. AMDER will be doing the detailed exploration work in this area to ascertain the reserves/resources of the area as per UNFC codification.

4.1 Connectivity

The mining area is well connected by both all weather roads and National Waterways (NW -3). Mining lease area is about 19 km from the plant and about 30 km from Kollam

town and the nearest railway station is Kollam. Export of minerals is through Cochin

port, which is about 130 km from the plant site.

4.2 Land Form, Land Use and Land Ownership

The land is flat. There is no forest area in the mining lease area. There is no stream in the area. the area is mostly inhabited with fisherman community people. Most of the land is under possession of IREL.

4.3 Topography

The area of the mining lease is marked on the Survey of India Topo-sheet No. 58

C/8. Latitude: 9^0 00' 55.97" to 9^0 02' 03.80"

Longitude: 76^0 31' 17.19" to 76^0 30' 29.90"

4.4 Existing Land use pattern

Mostly the area is now lying agricultural land with coconut trees. There is no Natural Park, wild life sanctuary and national monuments existing in the present lease hold area. The detail land use area will be given in the EIA report.

4.5 Existing Infrastructure

The proposed lease area does not contain any building and other infrastructure.

4.6 Soil Classification

Soil analysis will be carried out as a part of the EIA study.

4.7 Climate data from secondary source.

Kollam district has a tropical humid climate, with an oppressive summer. The hot season from March to May is followed by the southwest monsoon season from June to September. October – November may be termed the post monsoon or the retreating monsoon season. December to February is the northeast monsoon season.

Temperature

There are three observatories in the adjacent districts, two at Thiruvananthapuram and one at Kovalam. Of the two observatories at Thiruvananthapuram, one is in the city and other is at the aerodrome. The description that follows is based on the Thiruvananthapuram observatory (city) data. The temperature and other meteorological conditions are fairly uniform throughout the district except on the Ghats, and hence the data of Thiruvanananthapuram is taken as representative of the district. The temperature

variations through the seasons are not large. March, April and May are the hottest

months, the mean daily maximum temperature being of the order of 30.5^{0}C. On some days the maximum temperature may reach 36^{0}C. In April and May, the oppressive heat is relieved somewhat by thundershowers. With the onset of the monsoon by the end of May, the weather becomes cooler. After September, the day temperature increases gradually till they reach maximum in the hot season. The average daily minimum temperature during December to February is 22.6^0 C.

Humidity

The air is highly humid almost all the year around, the relative humidity being over 75%. The relative humidity during the months in December to May is slightly less than that during the rest of the year.

Cloudness

Skies are heavily clouded or overcast on most of the days in the monsoon months and to a lesser extent in the post monsoon months. In the summer and post monsoon months cloudiness generally increases in the afternoons. During the rest of the year skies are highly clouded or clear.

Winds

Winds are moderate to strong during the months of May to September. In other months they are light to moderate. Wind speeds are generally more in the afternoons in the non-monsoon months. During the period of December to February winds are northeasterly or easterly in the mornings and westerly or south-westerly in the afternoons. In the summer months they are mainly northwesterly or northerly in the mornings backing to a more westerly direction in the afternoons. In the monsoon months winds blow from directions between west and north, afternoon winds being more westerly than in the mornings and westerly to northwesterly in the afternoons. In November winds are light and variable and in the afternoons they blow from directions between south west and northwest. Wind rose diagram plotted season wise from data of Alappuzha meteorological station is given as Annexure

4.8 Social Infrastructure available

IREL is spending around Rs 1.0 to 1.50 crores every year for Corporate Social Responsibilities (CSR) activities. A hospital with two Doctors and required number of staff for assistance is maintained in the plant. Canteen is maintained in the plant area for the convenience of workers.

5.0 Planning Brief

The existing mining lease area is under possession and operation of IREL since 2011. The mining is carried out both by manual and mechanized method.

Mining is carried out by mechanized method using a cutter suction dredger. The mineral sand will be mined out up to the depth of its occurrence and concentrating the dredge output using the gravity concentrators. The waste sand from the Dredge and Wet Up-gradation Plant (DWUP) will be pumped back to the dredge pond for backfilling.The whole exuipment for these is mounted on a set or pontoons and will be floating in the dredge pond. This unit is called DWUP. The concentrate from the DWUP is pumped to the land for discharge as a heap. This concentrate is transported to the Heavy Up- gradation Plant (HUP_ for further treatment to produce marketable minerals products.

The Mining operation goes hand in hand with reclamation. About 80% of the raw sand will be deposited back to the mining area and will be used to reclaim the mined area. The effect of operation will be restricted to the dredging pond. At all stages efforts will be taken to ensure that environmental impact of the operation is minimum. Since it is a wet process, no dust is generated. The concentration in DWUP is purely physical process and no chemicals are used. No effluent is also generated.

6.0 Proposed Infrastructure

An office cum store is separately maintained. A first Aid room is also maintained with suitable staff in the area for the benefit of the workers. A small site workshop is used, as no major machinery is used for the working. Drinking water is supplied by Kerala Water Authority.

7.0 Rehabilitation and Resettlement (R & R) Plan

IREL is having a Rehabilitation and Resettlement package formulated in co-ordination with District Administration, local people and IREL. The same will be followed.

8.0 Project Schedule and Cost Estimates

This is the existing mining lease area under possession and operation of IREL since 2011.

9.0 Analysis of Proposal

- Mining and mineral processing involve transportation activity for day to day operation. Substantial amount of revenue is expected to be generated by transportation activities along with employment e.g. labour, helper, etc. Project authorities shall engage (on contract) the local people for transportation or at least can arrange for loading and unloading heavies/tailings by local people.
- In case of direct manpower required for mining and mineral processing operations, local people are employed as much as possible especially in the categories of unskilled and semi skilled labours subject to rules and procedures in vogue for Public Sector undertakings.
- A section of local youth are trained in phases so that they can take up some jobs (mining contractor ship, building contractor ship, supply of mining/MSP

materials and also small scale rural business developments) of their own (self employment) or in mines (on contract basis) or elsewhere.

- IRE is providing training from time to time for improved agro-techniques, first aid and safety, adult literacy programme to the villagers.
- IRE is providing regular grant to neighbouring schools and constant encouragement for cultural activities in local villages.