ENVIRONMENTAL IMPACT ANALYSIS AND ASSESSMENT OF SAND BENEFICIATION PLANTS — A CASE STUDY.

ABSTRACT

The planet earth in which the mankind along with innumerous living things flourishing presently, is a tiny speck in the universe and evolved into existence nearly 4.5 billion years ago. The earliest history of the earth marks the Precambrian Time which was composed of the Azoic, the Archeozoic and the Proterozoic Eras making up almost 80 per cent of the earth's total history spanning the first 4 billion years. Only small creatures originated in this period and the environment in its various forms emerged on the surface of the earth.

The human beings came into existence only in the Pleistocene Epoch of the Quaternary Period of the Cenozoic Era around 3.5 million years ago, by which time, the earth was bestowed with full blossom of the nature with a combination of biological and physical forces shaping the earth into a wonderful planet to live in.

Initially the human beings lived in groups and survived by hunting and gathering food for living. As the number of people were increasing, they started to migrate into the different parts of the earth because the surrounding land could not support the growing population in hunting and gathering way of life. Because human beings are the most intelligent living organisms, they made use of the ingredients of the earth's resources to the best of their advantage and multiplied their numbers by heaps and bounds. Owing to this reason, the human population increased enormously and hence they had to change the life sustenance to other modes such as agriculture, domestication of wild animals, rearing cattle, etc.

These acts of improvement on the part of the human beings brought changes in the social environment as well, of the mankind as humans started to settle down at different geographic locations
resulting in the growth of the villages, relegating the nomadic way of life, hitherto lead by the humans. Till this time, the interaction of the human beings with their surroundings - the environment, was minimum. With the advent of agriculture production, the natural environment was disturbed. But, the disturbance was meager initially.

The unabated population growth, was insatiable by the agriculture sector alone, necessitating to ponder into new vistas of growth to sustain the growing population. This necessity mooted the industrial sector to emerge into the scene. During the latter part of the eighteenth century A.D., great changes took place in the lives and work of people in several parts of the world. These changes resulted from the development of industrialization. The Industrial Revolution which refers to the changes that occurred in the industrial sector resulting in rapid industrialization during the period began in the United Kingdom around 1790's. It started spreading to other parts of Europe and to North America in the early 1800's. By the mid-1800's, industrialization had become wide spread in western Europe as well as the northeastern United States.

The industrial revolution created an enormous increase in the production of many kinds of goods by engaging power-driven machinery instead of the earlier practice of usage of hand or simple machines. It eventually took manufacturing out of the home and workshop into large premises of factories wherein power-driven machines and workers to operate them were engaged. Most of the historians, presently agree that the industrial revolution was the great turning point in the history of mankind. Industrialization brought many benefits, but it also created many number of ill-effects which still pose problems in the present day world, such as environment degradation resulting in air, noise, water pollution, waste generation deranging the environment surrounding the industries, producing constant threat to the more industrialized parts of the world. Because
of this reason, it is necessary to constantly monitor the environment and to warn the public of the potential harmful effects that may befall on them on account of the industries in their vicinity on the surrounding environment. The monitoring of the environment can be effectively carried out by the process called Environmental Impact Assessment (EIA).

The criterion for development of a country has always been in terms of economic growth which aims at more jobs and more consumer goods. This, in turn, should have lead to an improvement in the quality of life of its citizens, but this has not necessarily resulted in significant improvement in that direction. Growing abundance of economy has not always solved the problem associated with environment. Increased consumer activities with emphasis only on industrial development lead to generation of wastes in solid, liquid and gaseous forms, proliferation of slums and ecological imbalance. Good quality of life refers to the life of citizens in a society in an atmosphere of clean air, pure water, sanitation, good housing, safety, education and health care, free movement of transport, aesthetic surroundings and environment allowing the survival, growth, reproduction and well-being.

One of the prices paid for the progress and development is deterioration in the quality of environment. Environmental Impact Assessment (EIA) can be considered to be a planning tool which assists planner in anticipating potential future impacts, both beneficial and adverse, with a view to maximise beneficial effects and mitigate adverse impacts on the environment. While most of the industrial projects are executed in the past, without knowing the potential environmental implications, there is an urgent need to monitor their environmental impacts. Such monitoring is necessary for all the existing large scale industries for effective implementation of eco-friendly measures. The present research investigation is carried out in that direction.
An existing sand beneficiation plant of M/s. Saint Gobain India Ltd., located at Tada town of Nellore district in Andhra Pradesh state in India, is a large scale sand beneficiation plant to produce usable sand in glass manufacturing process. This industry is considered for the present study. The plant is involved in sand mining operations, which are carried out in the vicinity of about 80 km and also sand beneficiation (purification) activities at the plant site. Both these exercises may contribute significant impacts on the environment. The impact of this industry on the environment is carried with a view to identify adverse and beneficial impacts on all phases of environment and to suggest a strategic additional environmental management plan to the industry for implementation so as not to degrade the surrounding environment further. As such the major objectives of the present research work are:

- To identify the sources of impacts on the environment, from the related activities of sand mining processes and sand beneficiation plant processes.
- To recognize the environmental components which are critical to the changes or the impacts.
- To predict the likely environmental impacts of the sand beneficiation plant using extensive data collection and monitoring as well as using quantitative and qualitative models.
- To suggest ways to reduce unacceptable impacts by protective measures.

**SAND BENEFICIATION PROCESS**

The process consists of five distinguished steps:

1. Removal of trash/weeds or lumps (> 3mm size) by scalping vibrating screens.
2. Removal of over size (> 630 μ) and under size (< 100 μ size) sand particles by the principle of hindered settlement with water jets.
3. Attrition and washing with water to separate fines and clay which is adhered to the sand particles.
4. Heavy mineral separation through the principle of density separation from the sand in the spirals. Heavy minerals having a specific gravity of >2.6 will get separated from sand.

5. Dewatering of the treated sand in a vibrating screen down to 15% moisture.

The raw sand feed to the sand beneficiation plant is about 80TPH and the rejected sand and clay particles which go as waste through the liquid in the entire process is about 20 TPH.

WATER REQUIREMENTS

The water requirement for the entire sand beneficiation process is about 410.3 m³/hour. About 402 m³/hour of water is recovered after treatment in a high rate thickener and is recycled back to the process. Considering losses in the process, the fresh water requirement is about 12.9 m³/hour. As the plant works about 16 hours in a day, the total fresh water requirement is about 200 m³/day.

POLLUTION OF THE INDUSTRY AND MANAGEMENT PRACTICES

Wash water Management

Wash water is generated from various stages of the sand processing like hydrocyclones and dewatering screens. The total quantity of process wash water generated is about 400 m³/hour.

The wash water contains mostly clay particles and very fine sand as suspended impurities. The solids concentration is 2500 mg/L with a pH of 7.0 to 7.4.

The wash water is treated with polyelectrolytes and clarified in a thickener. The clarified water is recycled totally with a make-up water of 200 m³/day. The sludge is sent to sand basins for drying as well as to collect overflow by pumping back to the process. Thus the industry
did not have any contribution of water pollution to the surrounding land and aquatic environments.

AIR POLLUTION MANAGEMENT

The sources of air pollution emissions from the sand beneficiation process are

- Raw sand dump hopper house
- Scalping vibrating screen operations
- Trucks and front end loaders movement within the plant area.

Dump hopper (truck unloading) house and scalping screen house have dust extraction equipments of capacity 1750 m³/hour each. The dust picked up by the system, contains about 9580 mg/Nm³, is passed through bag filters and is let out through the stacks of 15 m height for dispersion into the atmospheric environment.

The suspended particulate matter (SPM) concentration at the stack emission is 90-95 mg/Nm³ and is well below the standard prescribed by Andhra Pradesh Pollution Control Board (APPCB).

The flue gases generated during the operation of DG sets (in case APSPDCL power failure) is dispersed into the atmospheric environment by venting through the standard size and height of chimneys prescribed by Central Pollution Control Board (CPCB).

NOISE POLLUTION MANAGEMENT

Noise pollution is contributed in the industry by

- DG sets (during operation)
- Compressors
- Pumps and motors and trucks and front end loaders.

The equivalent noise levels in the industry vary from 45 dB(A) to 70 dB(A) which is well within the limits of Andhra Pradesh Pollution Control Board (APPCB).
SOLID WASTE MANAGEMENT

Rejected sands during the sand beneficiation process and ETP sludge are the solid wastes generated in the industry. The rejected sand is about 17 TPH and ETP sludge is 1.48 TPH.

Rejected sand is sold to water works for use as filter media in rapid sand filters and in construction industry as fine aggregate and ETP sludge to brick manufacturing units at free of cost to use as admixture to produce quality bricks and excess is used as land fill.

GREENBELT DEVELOPMENT

The management has planted a variety of trees to develop greenbelt in and around the industry. The greenbelt width is about 7-15m all around the fence. Also gardens are developed within the large open spaces where it is not hinderence for work and future expansion.

IMPACT OF THE SAND BENEFICIATION PLANT ON ENVIRONMENT

- The industry did not have any significant impact on ground water depletion and its quality as the ground water consumption is limited to 200 m³ / day.
- All most all wash water generated from sand beneficiation process is recycled after treatment and even a drop of wash water is not discharged into the environment. As such, the factory did not have any direct or indirect impact on land and water ecosystems.
- Dust pollution into the environment is within the prescribed limits of APPCB. Dust emitted in the dump hopper house and scalping screen house are extracted and passed through bag filters before venting into the atmospheric environment for dispersion through 15 m height stacks. Thus dust emitted into the environment did not have significant impact on changes in
air quality, visibility and particulate deposition on soil, water and plants of surrounding environment of the industry.

- Noise levels within and adjacent to the boundary of the industry are within the prescribed limits of work environment and ambient noise levels prescribed by Occupational safety and Health Association (OSHA) and Central Pollution Control Board (CPCB). As such, the industry did not have any significant impact on changes in ambient noise levels. Consequently, it has no adverse on health risks, work environment, migration of birds and native animal population in the surrounding of the project site.

- The solid waste generated in the industry are totally utilised elsewhere for sand media (rejected sand), for brick manufacture as admixture (ETP sludge) and for land fill. As such, there is no impact on disturbance of land, landscape and native flora and fauna.

- Sand mining practices did not have any significant impact on degradation of land, dust pollution of air, pollution of surface and ground water resources, deforestation, and loss of biodiversity (flora and fauna).

- The industry has profound positive impact on socio-economic and cultural environment. Improvement in employment, communication and transport facilities, local economy through employment and commercial activity are the potential benefits derived out of the existing sand beneficiation plant.

* * *

XX