CHAPTER – 7
ADDITIONAL STUDIES

7.1  RISK ASSESSMENT [Industry TOR # 59]

7.1.1  INTRODUCTION

Risk analysis deals with the identification and quantification of risks resulting from the hazards present in the factory, which will lead to accidents. Hazard analysis involves the identification and quantification of the various hazards that are likely to occur in the industry. Both hazard and risk analysis are very extensive studies, and they require a very detailed design and engineering information.

The various hazard analysis techniques that may be applied are Hazard and Operability (HAZOP) studies, Fault - Tree Analysis (FTA), Event –Tree Analysis and Failure and Effects Mode Analysis.

Risk analysis follows an extensive hazard analysis. This requires a through knowledge of failure probability, credible accident scenario etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

7.1.2  SCOPE OF THE STUDY

The scope of study includes the study of proposed operations, storage and handling of raw materials with respect to Hazard Identification. Risk Assessment and Preparation of Emergency Preparedness and Response Plan and Disaster Management Plan for natural calamities. Based on the Hazard Identification and analysis, the major emergency scenarios will have been predicted to estimate the consequence of failure. An Emergency Preparedness and Response Plan and Disaster Management Plan have been evolved to meet the emergency situation.
Plant Configuration

The configuration of the proposed integrated project is as follows:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Plant Configuration</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Limestone Mining</strong> (Extent of mining area – 377.68 Ha.)</td>
<td>5.0 million tons per annum</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Cement plant</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing of Cement (Ordinary Portland Cement, Portland Pozzolona Cement &amp; Portland Slag Cement)</td>
<td>3.5 million tons per annum</td>
</tr>
<tr>
<td></td>
<td>Generation of Power through Waste Heat Recovery Boiler from Waste Hot Gases</td>
<td>8 mw</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Captive Power plant</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generation of Power</td>
<td>2 x 50 mw</td>
</tr>
</tbody>
</table>

Raw Material/Correctives/Additives/Fuels/Transportation

- **Limestone**
  Limestone will be sourced from captive mine located adjacent to the site and will be transported by covered conveyor upto the site.

- **Coal**
  Imported Coal required for the proposed power plant will be sourced from Indonesia/South Africa and Indian coal will be sourced from Singareni Collieries Company Limited (SCCL). Imported coal will be transported through sea route to the port. From the port through railway rakes upto the nearest railway station and from there in covered trucks. Indigenous Coal will be transported through railway rakes upto the nearest railway station and from there in covered trucks.
  Other Corrective’s viz., Bauxite, Laterite, Iron Ore & Additive’s like, Gypsum, and Fly ash will be transported through covered trucks/bulkers.

- **LDO/HFO**
  The Fuel Oil system will be provided for
  A. Boiler start-up
  B. Flame stabilization during low load operation with (or) without coal firing
There will be LDO storage tanks and HFO storage tanks. These fuels will be brought to the site by tanker-trucks.

### 7.1.3 FIRE PROTECTION SYSTEM

The following Fire Protection system will be provided in the Mining & Cement plant:

- Hydrant system covering the entire plant including all important auxiliaries and buildings is proposed. The system will be complete with piping, valves instrumentation, hoses, nozzles and hydrants, valves etc.

- Portable extinguisher such as pressurized water type, carbon dioxide type and foam type will be located at strategic locations throughout the plant and mines also.

- Modular type carbon dioxide panel injection fire extinguishing system will be provided in control equipment room, cable space below control room and at other unmanned electrical and electronic equipment room.

- Automatic Medium Velocity water Sprinkler system for coal conveyors, crusher house and transfer points.

- Foam injection system for fuel oil storage tanks consisting of foam concentration tanks, foam pumps, piping, instrumentation, valves etc.

- Fire water reservoir will be part of the water storage tank.

The following pumps will be provided in the fire protection system:

**Fire water pumps.**

(Fire water reservoir is part of the main water reservoir)

a) AC motor driven fire water pumps for hydrant, medium velocity water spray system and foam system.

b) AC motor driven fire water pumps for water spray system.

c) Diesel engine driven pump as stand by for the above.

d) Jackey pump 1 no. (AC motor driven) for maintaining pressure.

Required number of electric motor driven and diesel engine operated hydrant and spray pumps with automatic starting will be provided for the above systems. The fire water pumps will take suction from the fire water reservoir to be created in the plant area.
7.1.4 FIRE ALARM SYSTEM

The fire alarm system proposed is furnished below.

- Cable areas, control room will be provided with Ionization and photo electric smoke detectors.
- The above system will be designed as per the requirements of Tariff Advisory Committee (TAC) of Insurance companies of India.

7.1.5 METHODOLOGY OF MCA ANALYSIS

The MCA Analysis involved ordering and ranking of various sections in terms of potential vulnerability. The following steps were involved in MCA Analysis.

- Preparation of an inventory of major storages and rank them on the basis of their hazard properties.
- Identification of potentially hazardous storage sections and representative failure cases.
- Visualization of chemical release scenarios.
- Effect and damage calculation from the release cases through mathematical modeling.
- Inventory Analysis (IA) and Fire & Explosion and Toxicity Index (FETI) are the two techniques employed for hazard identification process.

7.1.6 IDENTIFICATION OF EMERGENCY SCENARIOS

MINES

The complete mining operation will be carried out under the management control and direction of a qualified mine manager holding a First Class Manager’s certificate of competency. The DGMS have been issuing a number of standing orders, model standing orders and circulars to be followed by the mine management in case of emergency, if any. Moreover, mining staff will be given refresher courses from time to time to keep them alert and up to date on safety measures required. However, following natural/industrial hazards may occur during normal operation.

- Inundation of mine pit due to flood/excessive rains;
- Slope failure of the pit & waste dumps
- Accidents due to blasting
- Accident due to heavy mining equipment;

In order to take care of above hazard/disasters the following control measures will be ensured.

- Checking and regular maintenance of garland drains and earthen bunds to avoid any inflow of surface water in the mine pit
Providing high capacity standby pumps with generator sets with sufficient quantity of diesel for emergency pumping especially during monsoon

- Following all safety precautions and provisions of metalliferous mine regulation 1961 during all mining operations

- Prohibiting entry of unauthorized persons

- Fire fighting and first-aid provisions in the mines office complex and mining area providing all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs & ear muffs etc. to the employees and regular checking for their use

- Training and refresher courses for all the employees working in hazardous premises

- Working of mine, as per approved plans and regular updation of the mine plans

- Cleaning of mine faces regularly

- Regular maintenance and testing of all mining equipment as per manufacturer’s guidelines

- Suppression of dust on the haulage roads by water sprinkling

- Increasing the awareness of safety through competitions, posters and annual safety weeks & environmental weeks, encouraged through suitable rewards and other similar drives

The management will be able to deal with the situation efficiently keeping in view of the likely sources of dangers in the mine.

**INUNDATION**

**Action plan to prevent surface inundation**

a) A seasonal nallah is flowing from south to north passing through this trough like topography dividing Pedagarlapadu block into two portions. Further, in the southern extremity of Pedagarlapadu block two more seasonal nallahs one flowing from southwest and the other flowing from southeast join the above nallah flowing in south to north directions. This nallah further joins with the main nallah flowing in between Pedagarlapalli block in south and Kesanupalli block in the north, thus dividing the ML area into two blocks. This main nallah also forms the village boundaries of Pedagarlapalli and Kesanupalli and ultimately flows towards northwest joining with Naguleru vagu streamlet located about 0.5 km northwest of ML. Fifty meters wide safety/protection barriers will be left on both sides of all the above nallahs passing through the ML area and protective BCS bunds will be erected. Wide green belt will be developed over these bunds.

b) Every entrance in to the mines will be so designed, constructed and maintained that its lowest point is not less than 1.5m above highest flood level.

c) For deciding the height of entrance to mine, the following points will be considered.
i) Time taken to withdraw the persons and machinery
ii) Rate of rise of water in the river from the past experience.

d) Proper surface drainage system will be developed.
e) Benchmarks to indicate highest flood level.
f) A careful assessment on dangers due to inundation from surface water will be made before onset of every monsoon.
g) Effectiveness of the precautions and weakening or breach of bunds and obstructions in the normal drainage flow will be checked properly.
h) During heavy rains, a competent person nominated by manager will inspect daily all the vulnerable points with surface drainage flow and effectiveness of the safety measures undertaken. He will record and bring the deficiencies to the notice of Manager.
i) Specific precautions to be observed in case of inundation will be permanently displayed at critical points.
j) The water danger plan covering the area of BCS dumping will also be updated and maintained.
k) Additional capacity standby Pumps will be kept in readiness to tackle any eventuality.
l) At pit bottom a deep sump will be created and any excess water collected will be pumped out, after sedimentation for reuse in the afforestation works, for dust control etc.

**BLASTING**

Blasting cause accidents due to

- improper use of explosives,
- not taking precautions during the blasting and
- release of excessive ground vibrations and fly rocks due to unsystematic blasting.

**Action plan to prevent accidents due to blasting**

The following measures will be taken to prevent accidents due to blasting

- 150 mm dia wagon drills with compressors will be used to drill blast holes in limestone as well as in reject. A bench height of 9 meters will be maintained for 150 mm dia holes and ‘V’ pattern will be followed for better fragmentation and optimum powder factor.
- The explosive charge per hole will be as minimum as possible in order to reduce the blasting effect. Low density ANFO mixtures along with booster slurries will be used for blasting, with a stemming column of 3.0 m with deck loading.
Millisecond delay detonators & Detonation Fuse will be used for initiation of blast holes which will minimize Boulder generation, Frequent toe occurrence, Fly rock generation. This system will allow only one hole i.e., a fraction of the total explosives to blast at a point of time. This will produce less vibration in the ground, avoid fly rocks during blasting, thus eliminating any hazard to structures nearby, if any.

The following mitigation measures will be followed to minimize the generation of ground vibrations and fly rock ejections:

- Charge per delay will be regulated. Each deep hole will require about 80 kg of explosives charge which will be provided with individual delay for each hole. At a distance of 500m, with 400 kg of explosive charge per delay the PPV is estimated as 4.88569 mm/sec say roughly 4.9 mm/sec. It is well within the limits of 10 mm/sec prescribed by the Directorate of Mines Safety. Therefore there will be no damage to any structure.
- Drill holes will be in “V” pattern to have better free face for subsequent rows during blasting.
- Holes will be charged and fired with the explosive like ANFO with millisecond delay detonation. Firing sequence will be such that each hole will have one delay. This will have minimum ground vibration and air blast causing less impact on nearby structures.
- Large boulders generated during blasting will be broken by rock breaker.
- Stemming column will be more than burden to avoid blown out shots. Stemming column with deck loading will be provided to reduce the noise levels & fly rock generation.

Fly rocks due to blasting can cause problems of throwing rock pieces over surrounding areas and causing injuries to people around the site. Adequate warning will be given to the villagers and precautions will be taken. There is no habitat within a distance of about 0.3 km from the mine, therefore, no damage to the village houses is anticipated.

Use of Explosives

Explosives by virtue of their nature have the potential for the most serious and catastrophic accidents in the mining industry yet the way they are used are an excellent example of how risk is properly maintained. No one will be allowed to use explosives without first having been properly qualified and trained in its handling and use. Only competent person as per MMR 1961 will be engaged to do this work.
CEMENT PLANT

Emergency scenarios for the purpose of this study is defined as an accident viz., Fire, Explosion, Release of Gases.

The storage of raw materials, products are shown in Table - 7.1

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Product</th>
<th>No. of tanks</th>
<th>Classification</th>
<th>Proposed Storage capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HFO</td>
<td>2</td>
<td>B</td>
<td>2 x 100 m³</td>
</tr>
<tr>
<td>2.</td>
<td>LDO</td>
<td>2</td>
<td>B</td>
<td>2 x 15 m³</td>
</tr>
</tbody>
</table>

Where
- A - Dangerous Petroleum
- B - Non Dangerous Petroleum
- C - Heavy Petroleum

HIGH CALORIFIC HAZARDOUS WASTES FROM ALL THE SOURCES IN KILN

[Industry TOR # 28]

Apart from the traditional kiln fuels like oil, the company is intending to utilize high calorific hazardous wastes like chemical wastes, distillation residues, refuse derived fuels etc. as an alternative fuels with known composition and availability. The proposed cement plant’s kiln will have a flexible fuel feeding system accordingly.

Proposed new cement plant will be designed for usage of Hazardous Wastes like Petcoke, Oil sludges, Cut Tyres, Cashew/Ground nut shells, etc. in the kiln. Proposed new Lines will be designed for usage High Calorific Hazardous Wastes in Kiln. Only problem anticipated is availability of adequate quantity of High Calorific Hazardous Wastes in Kiln.

Examples of high calorific hazardous waste

<table>
<thead>
<tr>
<th>Material</th>
<th>CV net (MJ/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure polyethylene</td>
<td>46</td>
</tr>
<tr>
<td>Tar (by product)</td>
<td>38</td>
</tr>
<tr>
<td>Animal fat</td>
<td>37</td>
</tr>
<tr>
<td>Pure rubber (without inert material)</td>
<td>36</td>
</tr>
<tr>
<td>Aluminum metal</td>
<td>31</td>
</tr>
<tr>
<td>Waste oils, various refinery wastes</td>
<td>30 to 40</td>
</tr>
<tr>
<td>Waste tires</td>
<td>28 to 32</td>
</tr>
<tr>
<td>Liquid mix (CSL from SCORIBEL or SYNFUEL of safety Kleen)</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Landfill gas</td>
<td>16 to 20 (MJ/Nm³)</td>
</tr>
<tr>
<td>Acid sludge, acid tar (from oil reprocessing)</td>
<td>16 to 22</td>
</tr>
<tr>
<td>Type of waste</td>
<td>Details</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Pot liners (from aluminum smelter)</td>
<td>20</td>
</tr>
<tr>
<td>PVC6</td>
<td>19</td>
</tr>
<tr>
<td>Palm nut shells (10% moisture)</td>
<td>19</td>
</tr>
<tr>
<td>Pressed olive cake</td>
<td>18</td>
</tr>
<tr>
<td>Dried wood, bark, saw dust (10% moisture)</td>
<td>16</td>
</tr>
<tr>
<td>Rice husks (10% moisture)</td>
<td>16</td>
</tr>
<tr>
<td>Car shredder wastes</td>
<td>15</td>
</tr>
<tr>
<td>RDF (from domestic refuse, 10% moisture)</td>
<td>15</td>
</tr>
<tr>
<td>Animal meal</td>
<td>15</td>
</tr>
<tr>
<td>Cardboard, paper (air dry)</td>
<td>15</td>
</tr>
<tr>
<td>Impregnated saw dust (25% moisture)</td>
<td>10 to 137</td>
</tr>
<tr>
<td>Dried sewage sludge (10% moisture)</td>
<td>10</td>
</tr>
<tr>
<td>Fuller’s earth (from oil purification, LD actual)</td>
<td>10</td>
</tr>
<tr>
<td>Domestic refuse (30% moisture)</td>
<td>8.5</td>
</tr>
<tr>
<td>Dried sewage sludge (30% moisture)</td>
<td>7.5</td>
</tr>
<tr>
<td>Pure iron</td>
<td>7.5</td>
</tr>
</tbody>
</table>

**Checklist for properties of high calorific hazardous waste**

<table>
<thead>
<tr>
<th>Physical state:</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>Size, form, grind ability, viscosity, impurities, mixing proportions</td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>Gaseous</td>
<td></td>
</tr>
<tr>
<td>Solid/liquid</td>
<td></td>
</tr>
<tr>
<td>Parameters</td>
<td>Unit of Measure</td>
</tr>
<tr>
<td>Density</td>
<td>Kg/m³</td>
</tr>
<tr>
<td>Calorific value (net)</td>
<td>MJ/Kg</td>
</tr>
<tr>
<td>Proximate analysis</td>
<td>Moisture, ash, volatiles, Cfix</td>
</tr>
<tr>
<td>Ultimate analysis C, H, O, N, S</td>
<td>Percentage</td>
</tr>
<tr>
<td>Halogens Cl, Br, F</td>
<td>Percentage</td>
</tr>
<tr>
<td>Ash composition CaO, SiO₂, Al₂O₃, FeO₃, K₂O, Na₂O, P₂O₅, etc</td>
<td>Percentage</td>
</tr>
<tr>
<td>Heavy metals Hg, Cd, Tl, Be, As, Co, Cr, Pb, Zn, V, etc</td>
<td>Percentage</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
</tr>
<tr>
<td>Explosive/ Non-explosive</td>
<td>safety precautions, warnings</td>
</tr>
<tr>
<td>Toxicity/ Non-toxic</td>
<td>safety precautions, warnings</td>
</tr>
</tbody>
</table>

**Legal restrictions containing transport & storage and the important aspects to be looked into**

<table>
<thead>
<tr>
<th>Storage</th>
<th>Chemical or natural degradation, putrefaction phenomena, segregations, precipitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosively</td>
<td>Construction materials required</td>
</tr>
<tr>
<td>Mixing possibilities</td>
<td>Mixing with oil, Water, Solvents</td>
</tr>
</tbody>
</table>
### Feed point for high calorific hazardous waste

<table>
<thead>
<tr>
<th>Alternative Fuel</th>
<th>Liquids</th>
<th>All feed points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid &lt; 5mm (3)</td>
<td>All feed points</td>
<td></td>
</tr>
<tr>
<td>Solid &lt; 50</td>
<td>Long Kiln 1</td>
<td>Main firing</td>
</tr>
<tr>
<td></td>
<td>Short Kiln 2</td>
<td>2nd firing</td>
</tr>
<tr>
<td></td>
<td>Long Kiln 1</td>
<td>Mid kiln</td>
</tr>
<tr>
<td></td>
<td>Short kiln 2</td>
<td>Kiln inlet</td>
</tr>
</tbody>
</table>

1: Long wet / dry kiln  2: Suspension grate preheater kiln  3: foil < 50

#### 7.1.7 FIRE & EXPLOSION AND TOXICITY INDEX

The role of Fire & Explosion Index (FEI) aids quantitative hazard identification. The FEI is calculated by evaluating the loss potential of all the units in the storage area and the hazardous areas were classified accordingly. The role of FEI is:

- Identification of the equipment/areas that could likely contribute to the occurrence or escalation of incident and relatively ranking the incidents
- Quantification of the expected damage of potential fire and explosion incidents
- Preparation of guidelines for mitigating fire hazards

The loss potential which could actually be experienced under the most adverse operating conditions is quantitatively evaluated. The FEI is used for any operation in which a flammable, combustible or reactive material is stored, handled or processed.

\[
\text{FEI} = \text{MF} \times \text{GPH} \times \text{SPH}
\]

Where
- **MF**: Material factor
- **GPH**: General Process Hazard
- **SPH**: Special Process Hazard
TOXICITY INDEX

The Toxicity Index is calculated using the Nh, Ts, GPH and SPH. Ti is calculated by the following formula.

\[
\text{TI} = \frac{(\text{Nh} + \text{Ts}) \times (1 + \text{GPH} + \text{SPH})}{100}
\]

Nh - NFPA Health factor
Ts - Penalty factor
GPH - General Process Hazard
SPH - Special Process Hazard

7.1.8 ASSESSMENT OF RISK

Based on the storage inventory the following areas have been identified as potential safety risk areas are shown in Table 7.2

**TABLE 7.2**

POSSIBLE RISKS FROM THE PLANT

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Area</th>
<th>Capacity / quantity</th>
<th>Hazards identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Turbo generator building</td>
<td>2 x 50 MW</td>
<td>Fires in&lt;br&gt; a) Lube oil system&lt;b) Short circuit in control room / switch gears&lt;br&gt;c) Cable galleries</td>
</tr>
<tr>
<td>2.</td>
<td>Transformer</td>
<td>-</td>
<td>Explosion &amp; fire</td>
</tr>
<tr>
<td>3.</td>
<td>Boiler</td>
<td>2 no.5 of 200 TPH</td>
<td>Fire (mainly near oil burners, steam explosion, fire explosion</td>
</tr>
<tr>
<td>4.</td>
<td>Coal handling plant</td>
<td>-</td>
<td>Fire and or dust explosion</td>
</tr>
<tr>
<td>5.</td>
<td>Coal storage</td>
<td>1,25,000 tons</td>
<td>Fire, spontaneous combustion</td>
</tr>
<tr>
<td>6.</td>
<td>HFO storage / LDO storage tanks</td>
<td>2 x 100 m³ / 2 x 15 m³</td>
<td>Fire</td>
</tr>
</tbody>
</table>

7.1.8.1 THERMAL RADIATION

Thermal radiation effects on inanimate objects like piping, equipment or vegetation also need to be evaluated to assess their impact. Table 7.3 presents the damage effects due to thermal radiation intensities.
### TABLE 7.3
DAMAGE DUE TO INCIDENT RADIATION INTENSITIES

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Incident Radiation (Kw/m²)</th>
<th>Type of Damage intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>62.0</td>
<td>Spontaneous ignition of wood</td>
</tr>
<tr>
<td>2.</td>
<td>37.5</td>
<td>Sufficient to cause damage to process equipment</td>
</tr>
<tr>
<td>3.</td>
<td>32.0</td>
<td>Maximum thermal radiation intensity allowed on thermally protected adjoining equipment</td>
</tr>
<tr>
<td>4.</td>
<td>25.0</td>
<td>Minimum energy required to ignite wood at infinitely long exposure (non-piloted)</td>
</tr>
<tr>
<td>5.</td>
<td>12.5</td>
<td>Minimum energy required for piloted ignition of wood, melting of plastic</td>
</tr>
<tr>
<td>6.</td>
<td>8.0</td>
<td>Maximum thermal radiation intensity allowed on thermally unprotected adjoining equipment</td>
</tr>
<tr>
<td>7.</td>
<td>4.5</td>
<td>Sufficient to cause pain to personnel if unable to reach cover within 20 seconds, however blistering of skin (1st degree burns). Causes no discomfort on long exposures</td>
</tr>
<tr>
<td>8.</td>
<td>1.6</td>
<td>Causes no discomfort on long exposures</td>
</tr>
<tr>
<td>9.</td>
<td>0.7</td>
<td>Equivalent to solar radiation</td>
</tr>
</tbody>
</table>

#### 7.1.8.2 COAL HANDLING PLANT - DUST EXPLOSION

Coal dust will explode, when it is dispersed in air and gets ignited. Crusher houses and conveyor systems are most susceptible to this hazard. The minimum of explosive concentration of coal dust (33% volatiles) is 50 grams/m³. Failure of dust extraction & suppression systems will lead to abnormal conditions and increasing the concentration of coal dust to the explosive limits. The sources of ignition are incandescent bulbs, electric equipment & cables, friction & spontaneous combustion in accumulated dust. Dust explosion may occur without any warning with maximum explosion pressure upto 6.4 bars. Another dangerous characteristic of dust explosions is that it sets off secondary explosions after the occurrence of initial dust explosion. Maintaining of dust extraction and dust suppression in good working conditions and cleaning of coal dust getting deposited on the floor, equipment and any surface will help to avoid coal dust explosion.

Stock pile area will be provided with automatic sprinklers for dust suppression as well as to reduce spontaneous ignition of Coal stock piles, necessary water distribution net work will be provided for distributing water at all transfer points, crusher house, etc.
A centralized control room with microprocessor based control system has been envisaged for operation of the coal handling plant. All necessary inter local control panels will be provided for safe and reliable operation of the Coal handling plant.

**Control measures for Coal storage yard**

The entire quantity of coal will be stored in separate stock piles, with proper drains around to collect washouts during the monsoon. Garland drains will be provided all around the storage area. Water sprinkling system will be installed on stocks of pile to prevent spontaneous combustion and consequent fire hazards. The stack geometry will be adopted to maintain minimum exposure of stock pile areas towards predominant wind direction. Temperature will be monitored in the stock piles regularly to detect any abnormal rise in temperature inside the stock pile to enable to control the same.

### 7.1.9 RISK & CONSEQUENCE ANALYSIS OF FIRE

The principle objective of this study is to identify the potential hazards and estimate the effects of hazards on employees and visitors

- Identification of possible failure cases of the facilities which might affect the employees and property within the plant boundary.
- Assessment of consequential effect due to onset of such failures.
- Suggest recommendations based on consequence analysis relevant to the situations.

#### 7.1.9.1 EMERGENCY SCENARIOS

After identification of major hazard locations at the Project site, emergency scenarios for each installation are described as below.

**CEMENT PLANT**

The hazards expected from this plant include the pool fire situation due to the leakage of HFO from the storage tank. The tanks will be made of Mild steel and will be provided with dyke around the tanks. The most credible failure will be due to the rupture of the pipe connecting the storage tank. The worst case can be assumed as one in which the entire contents leak out into the dyke forming a pool, which may catch fire on finding source of ignition.
HFO STORAGE TANK - POOL FIRE SCENARIO

In the event of tank spilling its contents through a small leakage or due to rupture of pipeline connecting the tank and on ignition fire will ensue. As the tanks are provided with dyke, the fire will be confined within the dyke. Threshold limit for first degree burns is 4.5 kw/m². Based on these results it may be concluded that the vulnerable zone in which the thermal fluxes above the threshold limit for first degree burns (4.5 kw/m²) is restricted to 20 m.

The hazard distances for various radiation intensities are shown in Table 7.4

**TABLE 7.4**

HAZARD DISTANCES (All Tanks on fire - scenario)

<table>
<thead>
<tr>
<th>Radiation Intensity</th>
<th>Hazard Distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 kw/m²</td>
<td>(100% lethality)</td>
</tr>
<tr>
<td>25.0 kw/m²</td>
<td>(50% lethality)</td>
</tr>
<tr>
<td>12.5 kw/m²</td>
<td>(1% lethality)</td>
</tr>
<tr>
<td>4.5 kw/m²</td>
<td>(1st degree burns)</td>
</tr>
</tbody>
</table>

The hazard distances for Thermal radiation due to storage of HFO/LDO are confined to the plant premises only. Hence there will not be any thermal radiation impact on outside the population due to the pool fire scenario. The thick green belt to be developed will help to further mitigate the radiation intensity level outside plant boundary.

**7.1.9.2 EFFECTIVE CONTROLS**

- Avoiding ignition sources in the vicinity
- Pressurization of buildings not having explosion - proof fittings
- Switching off power supply from a central place
- Blanket ban on smoking
- Proper maintenance of flame proof fittings

**7.2 EMERGENCY PREPARDNESS & RESPONSE PLAN**

**7.2.1 OBJECTIVES OF EMERGENCY PREPAREDNESS & RESPONSE PLAN**

The Emergency preparedness and Response Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of Emergency preparedness and Response Plan, it will be widely circulated and personnel will be trained through mock drills.
The Emergency preparedness and Response Plan will reflect the probable consequential severity of undesired event due to deteriorating conditions or through knock on effects. Further the management will be able to demonstrate that their assessment of the consequences is based on good supporting evidence currently available and incident data from internal sources only if an effective Emergency preparedness and Response Plan is in place.

To tackle the consequences of a major emergency inside the factory, an Emergency Preparedness and Response Plan has to be formulated.

The objective of the Emergency preparedness and Response Plan is to make use of the combined resources of the plant and the outside services to achieve the following:

- Control and bring the emergency situation to a safe condition
- Safeguard employees
- Effect the rescue and medical treatment of causalities
- Minimize damage to property and the environment.
- Secure the affected areas.
- Provide authoritative information to news media.

Initially contain and then ultimately bring the situation under the control.

Preserve subsequent records and equipment for subsequent enquiry to identify the cause and circumstances leading to emergency.

7.2.3 EMERGENCIES

7.2.3.1 GENERAL, INDUSTRIAL, EMERGENCIES

The emergencies that could be envisaged in the Plant are as follows:

- Fire scenario at HFO/LDO storage tank
- Contamination of food / water.
- Sabotage / social disorder.
- Structural failures.
- Slow isolated fires.
7.2.3.2 SPECIFIC EMERGENCIES ANTICIPATED

During the study of risk assessment, the probability of occurrence of hazards will be worked out.

7.2.3.3 EMERGENCY ORGANIZATION

It is recommended to setup an Emergency Organization. A senior executive who has control over the affairs of the Plant will be heading the Emergency Organization. He will be designated as Site Controller. There will be an Emergency Control Centre, which will be the location of the Site Controller during emergency. In the case of stores, utilities, open areas which are the not under the control of production heads, executive responsible for maintenance of utilities will be designated as Incident Controller. All the Incident Controllers will be reporting to the Site Controller.

Each Incident Controller, for himself, organizes a team responsible for controlling the incident with the personnel under his control. Shift in-charge will be the reporting Officer, who will bring the incident to the notice of the Incident Controller and the Site Controller.

Emergency Coordinators will be appointed who will undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and support services. For this purposes, Security in-charge, Personal Department, Essential services personnel will be engaged. All these personnel will be designated as key personnel.

In each shift, electrical supervisor, electrical fitters, pump house incharge and other maintenance staff will be Finaled for emergency operations. In the event of Power communication system failure, some of staff members in the office/ Plant offices will be Finaled and their services will be utilized as messengers for quick passing of communications. All these personnel will be declared as essential personnel.

7.2.3.4 EMERGENCY COMMUNICATION

Whoever notices an emergency situation such as fire, growth of fire, leakage etc. will inform his immediate superior and Emergency Control Centre. The person on duty in the Emergency Control Centre will appraise the Site Controller. Site Controller will verify the situation from the Incident Controller of that area or the shift incharge and will take a decision about implementing on Site Emergency. This will be communicated to all the Incident Controllers, Emergency
Coordinators. Simultaneously, the emergency warning system will be activated on the instructions of the Site Controller.

7.2.3.5. EMERGENCY RESPONSIBILITIES

The responsibilities of the key personnel are given below

7.2.3.5.1 SITE CONTROLLER RESPONSIBILITIES

On receiving information about emergency the Site Controller will rush to Emergency Control Centre (ECC) and will take charge of ECC and the situation and will assess the magnitude of the situation on the advice of incident controller and will decide on.

- Whether affected area needs to be evacuated
- Whether personnel who are at assembly points need to be evacuated.
- Declaration of Emergency and operation of emergency siren.
- Announcement by public address system about location of emergency.
- Assessment of areas which are likely to be affected, or need to be evacuated.
- Continuous review of possible development and assessment of the situation in consultation with Incident Controller and other key personnel whether shutting down the Plant or any section of the Plant is required and if evacuation of persons is required.
- Deployment of personnel of rescue, rehabilitation, transport, fire brigade, medical and other designated mutual support systems locally available for meeting emergencies.
- Evacuation from affected areas, if the situation is likely to go out of control informs to District Emergency Authority, Police, and Hospital and seeks their intervention and help.
- Communication to Inspector of factories, Deputy Chief Inspector of Factories, KSPCB and other statutory authorities.
- Making a public statement if necessary.
- Maintaining record of events in chronological order and preparing an investigation report and preserving evidences.

On completion of on site Emergency and restoration of normalcy, declares all clear and orders for all clear signal.

7.2.3.5.2 INCIDENT CONTROLLER RESPONSIBILITIES

- Assembling the incident control team.
• Directing operations within the affected areas with the priorities for safety of personnel, minimizing damage to the Plant, Property and Environment and loss of materials.
• Directing the shutting down of the Plant and evacuation of employees from the areas likely to be adversely affected by the emergency.
• Ensuring that all-key personnel help is sought.
• Providing advice and information to the Fire and Security officer and the local Fire Services as and when they arrive.
• Ensuring that all non-essential workers / staff of the effected areas evacuated to the appropriate assembly points and the areas are searched for causalities.
• Preservation of evidence so as to facilitate any enquiry into the cause and circumstances, which caused or escalated the emergency.
• Coordination with emergency services at the site.
• Providing tools and safety equipments to the team members.
• Keeping in touch with all the teams and advice them regarding the method of control to be used.
• Keeping the site Controller of Emergency informed of the progress being made.

7.2.3.5.3 EMERGENCY COORDINATOR (RESCUE, FIRE FIGHTING) RESPONSIBILITIES
• On knowing about emergency, rushing to Emergency Control Centre.
• Helping the incident controller in containment of the emergency.
• Ensuring fire pumps are in operating conditions and instructing pump house operator
• Guiding the fire fighting crew i.e. Firemen trained Plant personnel and security staff.
• Organizing shifting of the firefighting facilities to the emergency site, if required.
• Taking guidance of the Incident Controller for fire fighting as well as assessing the requirements of outside help.
• Arranging to control the traffic at the gate and the incident area / directing the security staff to the incident site to take part in the emergency operations under his guidance and supervision.
• Evacuating the people in the Plant or in the near by areas as advised by Site Controller.
• Searching for casualties and arranging proper aid for them.
• Assembling search and evacuation teams.
• Deciding which paths the evacuated workers should follow.
• Maintaining law and order in the area, and if necessary seeks the help of police.
7.2.3.5.4 **EMERGENCY COORDINATOR (MEDICAL, MUTUAL AID, REHABILITATION, TRANSPORT AND COMMUNICATION) RESPONSIBILITIES**

- Arranging for safety equipments for the members of his team.
- **In the event of failure of electric supply and there by internal telephone, setting up communication point and establishing contact with the Emergency Control Center (ECC).**
- Organizing medical treatment to the injured and if necessary shifting of the injured to nearby hospitals.
- Mobilizing extra medical help from outside, if necessary
- Keeping a list of qualified first aiders of the factory and seeking their assistance.
- Maintaining first aid and medical emergency requirements.
- Making sure that all safety equipments are made available to the emergency team.
- Assisting Site Controller with necessary data and coordinating the emergency activities.
- Assisting Site Controller in updating emergency plan.
- Maintaining liaison with Civil Administration.
- Ensuring availability of canteen facilities and maintenance of rehabilitation centre.
- Liaising with Site Controller / Incident Controller.
- Ensuring availability of necessary cash for rescue / rehabilitation and emergency expenditure.
- Controlling rehabilitation of affected areas after emergency.
- Making available diesel, petrol for transport vehicles engaged in emergency operation.

7.2.3.5.5 **EMERGENCY COORDINATOR (ESSENTIAL SERVICES) RESPONSIBILITIES**

- Assisting Site Controller and Incident Controller
- Planning alternate facilities in the event of Power failure, to maintain essential services such as lighting, etc.
- Organizing separate electrical connections for all utilities during emergency and ensuring that the essential services and utilities are not affected.
- Giving necessary instructions regarding emergency electrical supply, isolation of certain sections etc to shift incharge and electricians.
- Ensuring availability of adequate quantities of protective equipment and other emergency materials, spares etc.
7.2.3.6 GENERAL RESPONSIBILITIES OF EMPLOYEES DURING AN EMERGENCY

During an emergency:

a. If the worker is in charge of process equipment, he should adopt safe and emergency shutdown.

b. If the worker is an essential employee, he should attend any prescribed duty

c. If no such responsibility is assigned to a worker he should adopt a safe course to assembly point and await instructions, not resort to spread panic.

7.2.3.6. EMERGENCY FACILITIES

7.2.3.6.1 EMERGENCY CONTROL CENTRE

For the time being office block is identified as Emergency control centre. It will have external Telephone & Fax facility. All the Incident controller officers, senior personnel will be located here.

The following information and equipment are to be provided at the Emergency control centre (ECC).

- Intercom, telephone
- P&T telephone
- Fire suit / gas tight goggles / gloves / helmets
- Factory layout, site plan
- Emergency lamp / torchlight
- Plan indicating locations of hazard inventories, Plant control room, sources of safety equipment, work road plan, assembly points, rescue location vulnerable zones, escape routes.
- Hazard chart
- Safe contained breathing apparatus
- Hand tools, wind direction, wind velocity indications
- Public Address Megaphone, Hand bell, Telephone directories (Internal, P&T).
- Address with telephone numbers and key personnel, Emergency coordinator.
- Important addresses, telephone numbers such as experts from outside, government agencies neighboring industries etc.
- Emergency shutdown procedures.
- Nominal roll of employees.
7.2.3.6.2 EMERGENCY POWER SUPPLY

Plant facilities will be connected to Diesel Generator and will be placed in auto mode.

7.2.3.6.3 FIRE FIGHTING FACILITIES

First Aid Fire fighting equipment suitable for emergency will be maintained as per TAC Regulations. Fire hydrant line converting major areas will be laid. It will be maintained as 6 kg/sq.cm. pressure.

7.2.3.6.4 LOCATION OF WIND SOCK

On the top of production block and on the top of administrative block wind socks will be installed to indicate direction of wind during emergency period.

7.2.3.6.5 EMERGENCY MEDICAL FACILITIES

Gas masks and general first aid materials for dealing with chemical burns, fire burns etc. will be maintained in the medical centre as well as in the emergency control room. Private medical practitioners help will be sought or Government hospital will be approached for emergency help, if required.

Apart from Plant first aid facilities, external facilities will be augmented. Names of Medical Personnel, Medical facilities in Dachepalli will be prepared and updated. Necessary specific medicines for emergency treatment of Burns patients will be maintained.

Breathing apparatus and other emergency medical equipment will be provided and maintained. The help of nearby industrial managements in this regard will be taken on mutual support basis.

7.2.3.7 EMERGENCY ACTIONS

7.2.3.7.1 EMERGENCY WARNING

Communication of emergency will be made familiar to the personnel inside the plant. An emergency warning system will be established.

7.2.3.7.2 EMERGENCY SHUTDOWN

There are number of facilities which will be provided to help in dealing with emergency conditions. The suggested arrangements are

- Stop feed
- Deluge contents
- Remove heat
- Transfer contents

### 7.2.3.7.3 EVACUATION OF PERSONNEL

The area will have adequate number of exits and staircases. In the event of an emergency, unconnected personnel will have to escape to assembly point. Operators will have to take emergency shutdown procedure and escape. Time office will maintain a copy of deployment of employees in each shift at Emergency Communication Centre. If necessary, persons will be evacuated by rescue teams.

### 7.2.3.7.4 ALL CLEAR SIGNAL

At the end of emergency, after discussing with Incident Controllers and Emergency Coordinators, the Site Controller will order an all clear signal.

### DISASTERS

A disaster is catastrophic situation in which suddenly, people are plunged into helplessness and suffering and as a result, need protection, clothing, shelter, medical and social care and other necessities of life. Disasters from natural phenomena like earthquakes, volcanic eruptions, cyclones, tropical storms, floods, avalanches, landslides etc. are considered here

There can be no set criteria for assessing the gravity of a disaster in the abstract it depends to a large extent on the physical, economic and social environment in which it occurs. What would be considered a major disaster in developing country, will be equipped to cope with the problems involved, may not mean more than temporary emergency elsewhere. However all disasters bring in their wake similar consequences that call for immediate action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured, medical and social care, removal of the debris, the provision of temporary shelter for the homeless food, clothing and medical supplies, and the rapid reestablishment of essential services.

The disasters due to natural phenomena will be handled in a proper manner with the help of local administration immediately on occurrence. Further support required, depending upon the severity, will be provided by District/State/National level Authorities. The resources available in the Plant will be extended to the maximum possible extent by the project proponent in the event
of occurrence of any such natural disasters to provide rescue, first aid, ambulance service, medicines, shelter & food, to the affected people.

7.3 **OCCUPATIONAL HEALTH AND SURVEILLANCE [Mine TOR # 34]**

There is no report on prevalent diseases existing in the locality. The area has good medical facilities. M/s CCCL will provide an Occupational Health Centre at the plant. Ambulance and first aid facility along with doctor and staff nurse will be available. Dispensary will be provided with all needy equipment and medicines at Pedagarlapadu and Kesanupalli villages. The doctor will visit nearby villages through fortnightly medical camps for treatment of patients especially the senior citizen and children. Company will adopt some of the existing PHC & hospitals in nearby villages to ensure free medical aid. Company Worker’s Medical facilities will be extended to the villagers also. Awareness programme for the villagers on sanitation, improvement in health standards, birth control. Malaria eradication, HIV prevention etc. will be conducted.

The primary data on the existing prevalent diseases and on the occupational disease will be collected through survey.

Project authorities will arrange medical examinations for pre-entry level workmen and staff and provide for periodic examination of target groups.

The principal Health and Occupational risks are likely incidence of tuberculosis, silicosis, hearing loss, accidents due to inundation of workings, fires and slope failure.

The order of severity on health status of workers in mining is tuberculosis, silicosis, respiratory diseases and hearing loss. Respiratory diseases may occur due to inhalation of dust. This is suppressed by sprinkling of water on the haul roads and working places. The machinery and equipment used will be maintained as per the manufacture specifications to control the dust and noise. Wide green belt proposed will act as filter to attenuate the spread of dust and the noise generated from mining/plant activities. Main approach roads will be black topped, with green belt on both sides.

Impact of mining on health is assessed by the trained doctor in occupational health who is recognized for this purpose.

The tests conducted will be general health checkup, spirometry, audiometry and vision test in addition to X-ray and ECG examination.

Awareness programme for the workers on work related health hazard. Malaria eradication, HIV prevention etc will be conducted.
All the workmen and staff working in the mine will be provided with personal protective equipment like respiratory masks, earplugs/earmuffs

**Proposed mitigating measures:**

**Measures to communicate the risks before starting mining to people and steps for prevention & control**

In order to evaluate the impacts on mining on the health of workers, baseline health studies will be carried out on every worker before joining their duties. The baseline health status, their habits will be recorded and a log book will be maintained and the same will be updated every quarter. Safety and security of the workers will be ensured by strictly following the provisions of Metalliferrous Mines Regulations 1961 and the circulars made. Further all the workers will be given Initial Vocational training as per the statute to make them familiar with their jobs and the safety precautions to be taken while doing their jobs. They will be also given refresher training as per statute after completing one year of service.

**Arrangement for induction training for workers on health and safety and first aid facility**

All the workers before induction to work will be given Vocational training as per the statute to make them familiar with their jobs and the safety precautions to be taken while doing their jobs and refresher training will also be provided as per statute.

**Arrangement for first aid facility**

First Aid boxes will be provided at appropriate places and employees will be trained in first aid by authorized agency.

**Education and training to the workers about their safety and the risk**

Education and training to the workers on the importance of use of personal protective equipment will be done at the time of induction Vocational training, refresher training and also during the annual safety weeks. Any person found not using the safety equipment provided will not be allowed for the work.

**Adequate budget for environmental and occupational health activities**

An annual budget of Rs.65.0 lakhs will be allocated for environmental safety and occupational health activities.

**Breakup of the budgetary provision for every activity proposed to be undertaken**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Expenditure (Rs. In lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance</td>
<td>15.00</td>
</tr>
<tr>
<td>Doctor &amp; staff</td>
<td>15.00</td>
</tr>
<tr>
<td>Health Check up</td>
<td>10.00</td>
</tr>
<tr>
<td>Medicines</td>
<td>20.00</td>
</tr>
</tbody>
</table>
Constitution of a safety committee and its members including the head of the committee

The safety committee headed by Mines Manager will be constituted comprising the following persons:

- Mines Manager - 1
- Mine Foreman - 1
- Electrical/ Mechanical Engineer - 1
- Mining Engineer/Environmental officer - 1
- Company Doctor - 1
- Workers representatives - 2

Proper delineation of the function of the safety committee

Safety committee will be headed by Mines Manager and have the following functions as per the recommendation of Conference of Safety in Mines:

- To discuss remedial measures against the unsafe conditions and practices in the mine as pointed out by the workmen, or Inspectors or otherwise brought to the notice of the committee and take appropriate steps/action to remove the hazards.
- To consider, before commencement of any new section of the mine or commissioning of electrical or mechanical installation or introduction of any new mining technique, the proposed safety and health measures including related codes of practice and to make appropriate recommendations.
- To discuss the report of enquiry into accident and make appropriate recommendations.
- To formulate & implement appropriate safety campaign based on analysis of accidents.
- To meet at least once in 30 days to consider the matter placed before it and any other matter that may be raised by the members and make such recommendations as it may deem fit.
- To serve as a forum of communication on safety and occupational health matters.

Agency to pay for the tests and the treatment of non-occupational illness

The proponent will bear all the costs for health impairment due to injury or illness to workmen & staff as per the Workmen Compensation Act.

Duration for which the records of health checkup be kept and maintaining the records

A copy of the health report will be given to the employee. All the health-checkup records of the workman will be computerized. A workman’s health status will be checked after one year of
superannuation and if found to have contacted any occupational disease, he will be compensated.

Records will be maintained for a period of 5 years after closure of the mine.

Nomination of a person to identity occupational disease early to prevent serious damage

Doctors from District Headquarters Hospital, Guntur trained for Occupational Diseases.

Measures to be undertaken for following:

i. **Preventing heat stress** - Not applicable

ii. **Preventing noise exposure** - Workmen and staff exposed to higher sound levels (90 dBA) will be provided with ear plugs/mufflers of approved type by DGMS to guard them against any hearing impairment and

iii. **Preventing injuries** - Proper on job training to workmen.

Strictly following the Metalliferrous Mines Regulation 1961 and the circulars made under by the Directorate of Mines Safety

**Designating a person to undertake administration of personal protective equipments**

The qualified First Class Mine Manager appointed as per statute will administer issue and proper usage of the safety equipment provided.

**For Cement Plant [Industry TOR # 60]**

Large industries where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs. Along with the booms, the industrialization generally brings several problems like occupational health and safety.

**Anticipated Occupational & Safety Hazards**

✓ Heat Stress
  - Physical activity
  - Extremes of age, poor physical condition, fatigue
  - Excessive clothing
  - Dehydration

✓ Dust Exposure

✓ Noise

✓ Burns and shocks due electricity

**Note:** The air and water samples at the site revealed that Arsenic is Below Detectable Level. Hence Arsenicosis Management Plan is not envisaged.
Occupational Safety & Health Plan

The health of workers will be protected by adopting the following measures:

- Proper Designing of building, work area.
- Relaxation facilities to workers in working in hot areas in separate rooms with good ventilation & air circulation. This will help in relieving of thermal stress.
- Good Housekeeping practices
- Well engineered ventilation & exhaust system
- Enclosure
- Isolation of specific areas
- Enforcement of usage of Personal Protective Equipment
- Regular Work Environment Monitoring
- Statistical Monitoring
- Working hours
- Rotation of employees in specific areas to avoid continuous exposure

7.3.1 OCCUPATIONAL HEALTH

Occupational health needs attention both during construction and operation phases. However the problem varies both in magnitude and variety in the above phases.

7.3.2 CONSTRUCTION & ERECTION

The occupational health problems envisaged at this stage will mainly be due to dust and noise. To overcome these hazards, in addition to arrangements required to reduce it within TLVs, personnel protective equipments will also be provided to employees.

7.3.3 OPERATION & MAINTENANCE

In order to ensure safety during the operation and maintenance the following will be ensured

- Training (Induction, Awareness, Special & Refresher)
- Work Permit to execute the jobs
- Use of appropriate Personal Protective Equipment
- Identification of hazards and removal
- Safety Meeting/Pep Talk/Group Discussion on safety
- Safety Projects
- Employee Participation in safety related activities (safety day celebration/safety circles)
Personal Protective Equipment (PPE)

The employees will be given the following appropriate Personal Protective Equipment (PPE).

- Industrial Safety helmets
- Crash helmets
- Face shield with replacement acrylic vision
- Zero power plain goggles with cut type filters on both ends
- Zero power goggles with cut type filters on both sides and blue colour glasses
- Welders safety equipment for eye and face protection
- Cylindrical type earplug
- Earmuffs
- Canister gas masks
- Self contained breathing apparatus
- Leather apron
- Boiler suit
- Safety belt / line man’s safety belt
- Leather hand gloves
- Canvas cum leather hand gloves with leather palm
- Industrial safety shoes with steel toe
- Electrical safety shoes without steel toe and gum boots

7.3.4 OCCUPATIONAL HEALTH & MONITORING

The occupational health monitoring scheme is detailed below.

✓ Pre employment check up will be made mandatory and following test will be conducted:

- Chest x rays
- Audiometry
- Spirometry
- Vision testing (Far & Near vision, color vision and any other ocular defect)
- ECG
- Haemogram (examination of the blood)
- Urine (Routine and Microscopic)
- Complete physical examination
- Musculo-skeletal disorders (MSD)
- Backache
- Pain in minor and major joints
- Fatigue, etc.

✓ Primary health facilities will be made available round the clock for attending emergency arising out of accidents, if any.
✓ Medical records of each employ will be maintained separately and will be updated as per finding during monitoring.
✓ Medical records of the employee at the end of his / her term will be updated.
✓ Health checkups will be conducted periodically.
✓ Medical examinations will be conducted for employees every year

7.4 SAFETY PLAN

Safety of both men and materials during construction and operation phases are very important. The preparedness of an industry for the occurrence of possible emergencies is known as emergency plan. The emergency at a Project is possible due to collapse of structures and fire / explosion etc. The details of fire fighting equipments to be installed are given below:

- Carbon dioxide
- Foam type
- DCP
- Soda acid type
- Fire buckets
- Fire hydrants

Keeping in view the safety requirement during construction, operation and maintenance phases, Chettinad Cement Corporation Limited has formulated safety policy with the following regulations.

- To take steps to ensure that all known safety factors are taken into account in the design, construction, operation and maintenance of plant & machinery.
- To allocate sufficient resources to maintain safe and healthy conditions at work place.
- To ensure that adequate safety instructions are given to all employees.
- To provide wherever necessary protective equipment, safety appliances and clothing and to ensure their proper use.
- To inform employees about materials, equipments or processes used in their work which are known to be potentially hazardous to health and safety and train them to take preventive steps in a proactive manner and execute the work safely
• To keep all operations and methods of work under regular review for making necessary changes from the safety point of view in the light of experience and up to date knowledge.
• To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work.
• To provide appropriate instructions, training and supervision to employee’s health and safety, first aid and to ensure that adequate publicity is given to these matters.
• To ensure proper implementation of fire preventive methods and an appropriate fire fighting service along with training facilities for personnel involved in this service.
• To publish / notify regulations, instructions and notices in the common language employees.
• To prepare separate safety rules for each type of process involved.
• To ensure regular safety inspection by a competent person at regular intervals of all buildings, equipments, work places and operations.

7.4.1 SAFETY ORGANISATION

7.4.1.1 CONSTRUCTION AND ERECTION PHASE

A highly qualified and experienced safety officer will be appointed. The responsibilities of the safety officers include identification of the hazardous conditions and unsafe acts of workers and advice on corrective actions, conduct safety audit, organize training programmes and provide professional expert advice on various issues related to occupational safety and health.

In addition to employment of safety officer, every contractor, who employees more than 250 workers, should also employ one safety officer to ensure safety of the workers in accordance with the conditions of the contract.

7.4.1.2 OPERATION & MAINTENANCE PHASE

Appointment of of safety officers will be in accordance with the requirement of Factories Act and their duties and responsibilities will be as defined thereof.

7.4.1.3 SAFETY CIRCLE

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles will be constituted in each area of work. The circle
will consist of 5-6 employees from that area. The circle normally will meet for about an hour every week.

7.4.2 SAFETY TRAINING
A full fledged training centre will be established at M/s. Chettinad Cement Corporation Limited. Safety training will be provided by the safety officers with the assistance of faculty members called from professional safety institutions and universities. In addition to regular employees, contractor labours will also given safety training.
To create safety awareness safety films will be shown to workers and leaflets etc. will be distributed.
Information about safe work practice in local language with attractive slogans & pictures will be displayed.

7.4.3 HEALTH AND SAFETY MONITORING PLAN
All the potential occupational hazardous work places will be monitored regularly. The health of employees working in these areas will be monitored once in a year.

7.5 SOCIAL IMPACT ASSESSMENT
The local areas will be benefited by way of generation of employment opportunities, increased demand for local products and services. There will be an overall improvement in the income level of the local people.
This mine and cement plant will provide employment for around 700 people by both direct employment which include officials, skilled and semi-skilled and indirect employment, in contractual works & transport. Priority will be given to locals for Semi-Skilled and Unskilled workers. With the development of this Plant there will be lot of scope for more industrial investments which in turn will benefit the nation.
There will be an enhancement of educational and medical standards of people in the study area.
There will be generally positive and beneficial impacts by way of economic improvements, transportation, and business generation. There will be an overall upliftment of socio-economic status of people in the area.

7.6 R & R ACTION PLAN
There is no habitation in the proposed site. Hence no Rehabilitation & Resettlement Action Plan will be required.