7.0 ADDITIONAL STUDIES

7.1 Risk Assessment and Disaster Management Plan

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the plant. On the other hand, risk analysis deals with the identification and quantification of risks, the plant equipment and personnel are exposed to, due to accidents resulting from the hazards present in the plant.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population etc.

In the sections below, the identification of various hazards, probable risks in the proposed Copper smelter plant-II, maximum credible accident analysis, consequence analysis are addressed which gives a broad identification of risks involved in the plant. Based on the risk estimation for fuel and chemical storage Disaster Management Plan (DMP) has been prepared.

7.2 Approaches to the Study

Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas;
- Identification of representative failure cases;
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion;
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios;
- Assess the overall suitability of the site from hazard minimization and disaster mitigation points of view;
- Furnish specific recommendations on the minimization of the worst accident possibilities; and
- Preparation of broad Disaster Management Plan (DMP), On-site and Off-site Emergency Plan, including Occupational and Health Safety Plan.

7.3 Hazard Identification

Identification of hazards in the proposed Copper smelter plant-II is of primary significance in the analysis, quantification and cost effective control of accidents involving chemicals and process. A classical definition of hazard states that hazard is in fact the characteristic of system/plant/process that presents potential for an accident. Hence, all the components of a system/plant/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. The following two methods for hazard identification have been employed in the study:
Identification of major hazardous units based on Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 of Government of India (GOI Rules, 1989); and
- Identification of hazardous units and segments of plants and storage units based on relative ranking technique, viz. Fire-Explosion and Toxicity Index (FE&TI).

### 7.3.1 Classification of Major Hazardous Units

Hazardous substances may be classified into three main classes namely Flammable substances, unstable substances and Toxic substances. The ratings for a large number of chemicals based on flammability, reactivity and toxicity have been given in NFPA Codes 49 and 345. The fuel and chemical storage of proposed copper smelter plant-II are given in Table-7.1.

Hazardous characteristics of the major flammable materials as employed in different process units are listed in Table-7.2. The maximum quantity of Furnace oil, HSD and LPG are 1600 KL, 200KL and 100 MT respectively.

### Table-7.1

**CATEGORY WISE SCHEDULE OF STORAGE FACILITIES AFTER COPPER SMELTER PLANT-II OPERATION**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Material</th>
<th>No. of Tanks</th>
<th>Storage Capacity</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H₂SO₄ (***)</td>
<td>7</td>
<td>5 x 10000 = 50,000 MT, 2 x 5000 = 10,000 MT</td>
<td>Corrosive</td>
</tr>
<tr>
<td>2</td>
<td>Fuel Oil (Furnace Oil)</td>
<td>2</td>
<td>2 x 800 = 1600 KL</td>
<td>Flammable</td>
</tr>
<tr>
<td>3</td>
<td>HSD</td>
<td>2</td>
<td>2 x 100 = 200 KL</td>
<td>Flammable</td>
</tr>
<tr>
<td>4</td>
<td>LPG</td>
<td>2</td>
<td>2 x 50 = 100 MT</td>
<td>Flammable</td>
</tr>
<tr>
<td>5</td>
<td>Liquid Oxygen</td>
<td>4</td>
<td>2 x 220 MT LOX and 2 x 25 MT Lin</td>
<td>Flammable</td>
</tr>
<tr>
<td>6</td>
<td>Coke</td>
<td>1</td>
<td>2500 MT - open storage</td>
<td>Flammable</td>
</tr>
<tr>
<td>7</td>
<td>SO₂ Gases in the Duct leading to Sulphuric acid plant blower (*)</td>
<td>1</td>
<td>1 X 3 m Dia X 300 m length with 14% SO₂ Gases to the equivalent of 775 MT of 100% SO₂</td>
<td>Toxic</td>
</tr>
<tr>
<td>8</td>
<td>H₃PO₄</td>
<td>5</td>
<td>4 x 5000 = 2000 M³, 1 x 500 = 500 M³</td>
<td>Corrosive</td>
</tr>
<tr>
<td>9</td>
<td>H₂SiF₆</td>
<td>2</td>
<td>2 x 1000 = 2000 M³</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NaOH</td>
<td>3</td>
<td>1 x 20 = 20 MT, 2 x 15 = 30 MT</td>
<td>Corrosive</td>
</tr>
<tr>
<td>11</td>
<td>Na₂S</td>
<td>2</td>
<td>2 x 22 = 44 MT</td>
<td>Corrosive</td>
</tr>
<tr>
<td>12</td>
<td>Iso Propanal</td>
<td>1</td>
<td>1 x 23 = 23 MT</td>
<td>Flammable</td>
</tr>
</tbody>
</table>

**Note:**
1. (***) H₂SO₄ will be the by-product from the process.
2. Fuel Oil (Furnace Oil) will be used for Furnace fuel.
3. HSD will be used as start-up fuel for Sulphuric acid Plant preheater
4. LPG will be used in furnace for metal refining and launder heating.
5. Liquid Oxygen will be used as fuel for ISA Furnace along with fuel and air and oxy fuel burner of the settling furnace will also consume liquid oxygen.
6. Coke will be used to control the magnetite level in the ISA furnace.
7. (*) Release of SO₂ Gases in the duct to the atmosphere during sudden trip of Sulphuric acid plant suction blower.
8. H₃PO₄ will be the value added product from H₂SO₄.

---

VIMTA Labs Limited, Hyderabad  
C7-2
9 NaOH will be used in tail gas scrubber.
10 Na₂S will be used in WWTP.
11 Iso propanal will be used in CCR pickling and quenching.

### TABLE-7.2
**PROPERTIES OF FUELS USED AT THE PLANT**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Codes/Label</th>
<th>TLV</th>
<th>FBP</th>
<th>MP</th>
<th>FP</th>
<th>UEL</th>
<th>LEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil (Furnace Oil)</td>
<td>Flammable</td>
<td>5mg/m³</td>
<td>400</td>
<td>338</td>
<td>32.96</td>
<td>7.5</td>
<td>0.6</td>
</tr>
<tr>
<td>HSD</td>
<td>Flammable</td>
<td>5mg/m³</td>
<td>369</td>
<td>338</td>
<td>32.96</td>
<td>7.5</td>
<td>0.6</td>
</tr>
<tr>
<td>LPG</td>
<td>Flammable</td>
<td>1000ppm</td>
<td>-</td>
<td>-</td>
<td>104.4</td>
<td>9.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>

TLV: Threshold Limit Value
FBP: Final Boiling Point
MP: Melting Point
FP: Flash Point
UEL: Upper Explosive Limit
LEL: Lower Explosive Limit

7.3.2 Identification of Major Hazard Installations Based on GOI Rules, 1989

Following accidents in the chemical industry in India over a few decades, a specific legislation covering major hazard activities has been enforced by Govt. of India in 1989 in conjunction with Environment Protection Act, 1986. This is referred here as GOI rules 1989. For the purpose of identifying major hazard installations the rules employ certain criteria based on toxic, flammable and explosive properties of chemicals.

A systematic analysis of the fuels/chemicals and their quantities of storage has been carried out, to determine threshold quantities as notified by GOI Rules, 1989 and the applicable rules are identified. Applicability of storage rules is summarized in Table-7.3.

### TABLE-7.3
**APPLICABILITY OF GOI RULES TO FUEL STORAGE**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Chemical/ Fuel</th>
<th>Listed in Schedule</th>
<th>Total Quantity</th>
<th>Threshold Quantity (T) for Application of Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel Oil (Furnace Oil)</td>
<td>3(1)</td>
<td>1600 KL</td>
<td>25 MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200 MT</td>
</tr>
<tr>
<td>2</td>
<td>HSD</td>
<td>3(1)</td>
<td>200 KL</td>
<td>25 MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200 MT</td>
</tr>
<tr>
<td>3</td>
<td>LPG</td>
<td>3(1)</td>
<td>100 MT</td>
<td>25 MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200 MT</td>
</tr>
</tbody>
</table>

7.4 Hazard Assessment and Evaluation

7.4.1 Methodology

An assessment of the conceptual design is conducted for the purpose of identifying and examining hazards related to feed stock materials, major process components, utility and support systems, environmental factors, facilities, and safeguards.

7.4.2 Preliminary Hazard Analysis (PHA)

A preliminary hazard analysis is carried out initially to identify the major hazards associated with storages and the processes of the plant. This is followed by consequence analysis to quantify these hazards. Finally, the vulnerable zones are
plotted for which risk reducing measures are deduced and implemented. Preliminary hazard analysis for fuel storage area and whole plant is given in Table-7.4 and Table-7.5.

### Table-7.4
**Preliminary Hazard Analysis for Storage Areas**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Capacity</th>
<th>Hazard Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil (Furnace Oil)</td>
<td>1600 KL</td>
<td>Fire/Explosion</td>
</tr>
<tr>
<td>HSD</td>
<td>200 KL</td>
<td>Fire/Explosion</td>
</tr>
<tr>
<td>LPG</td>
<td>100 MT</td>
<td>Fire/Explosion</td>
</tr>
</tbody>
</table>

### Table-7.5
**Preliminary Hazard Analysis for the Proposed Plant in General**

<table>
<thead>
<tr>
<th>PHA Category</th>
<th>Description of Plausible Hazard</th>
<th>Recommendation</th>
<th>Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental factors</td>
<td>If there is any leakage and eventuality of source of ignition.</td>
<td>--</td>
<td>All electrical fittings and cables will be provided as per the specified standards. All motor starters will be flame proof.</td>
</tr>
<tr>
<td></td>
<td>Highly inflammable nature of the chemicals may cause fire hazard in the storage facility.</td>
<td>A well designed fire protection including AFFF foam, water sprinkler system, dry powder, CO₂ extinguisher will be provided.</td>
<td>Fire extinguisher of small size and big size will be provided at all potential fire hazard places. In addition to the above, fire hydrant network will also be provided.</td>
</tr>
<tr>
<td></td>
<td>If there is any leakage in the duct and eventuality of source of emission SO₂</td>
<td>Periodical check up of the wear and tear of the ducts and mechanical, Electrical and Instrumentation equipments.</td>
<td>If any sudden fall in suction draft to the Sulphuric acid plant main blower, trip interlock arrangement will stop Smelting.</td>
</tr>
<tr>
<td></td>
<td>If there is a sudden trip of Sulphuric acid plant main blower, the SO₂ gas in between smelter and SAP will become the eventuality of source of emission SO₂</td>
<td>Uninterrupted power supply.</td>
<td>SSL power division will ensure uninterrupted power supply even at sudden power down from TNEB grid. If there is a sudden trip of Sulphuric acid plant main blower, Smelting get stopped by trip interlock arrangement with sufficient back up arrangement to handle the gas trapped in the system.</td>
</tr>
</tbody>
</table>

- **Safety Measures in Storage Facilities**

Risk for storage units depends not on the extent of the consequence, but also on the probability of the failure of the safety measures and provisions provided. The safety measures to be provided in storage facilities in the proposed plant are given below:

<table>
<thead>
<tr>
<th>Substance Stored</th>
<th>Safe Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphuric acid</td>
<td>* Bund wall will be constructed around the storage tanks for acid/ alkali spillage containment.*</td>
</tr>
</tbody>
</table>
### Substance Stored

<table>
<thead>
<tr>
<th>Substance Stored</th>
<th>Safe Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric acid</td>
<td>• Collection pit / Neutralization pit with pumping arrangement.</td>
</tr>
<tr>
<td></td>
<td>• Buffer tank with equal capacity of Maximum capacity of one tank.</td>
</tr>
<tr>
<td></td>
<td>• Sufficient amount of Neutralization agent.</td>
</tr>
<tr>
<td>Furnace oil</td>
<td>Following Fire Fighting measures will be provided:</td>
</tr>
<tr>
<td></td>
<td>a) DCP Extinguisher;</td>
</tr>
<tr>
<td></td>
<td>b) AFFF Extinguisher;</td>
</tr>
<tr>
<td>High Speed Diesel (HSD)</td>
<td>c) Water cum Foam Monitor; and</td>
</tr>
<tr>
<td></td>
<td>d) Sand Bucket.</td>
</tr>
<tr>
<td>Iso Propanol</td>
<td>Following Fire Fighting measures will be provided:</td>
</tr>
<tr>
<td></td>
<td>a) DCP Extinguisher</td>
</tr>
<tr>
<td></td>
<td>b) Sand Bucket</td>
</tr>
<tr>
<td></td>
<td>c) Well laid fire hydrant system</td>
</tr>
<tr>
<td></td>
<td>d) During unloading, IPA tankers will be provided with extinguishers</td>
</tr>
<tr>
<td>Liquefied Petroleum Gas (LPG)</td>
<td>1. Hydrocarbon sensors will be provided for continuous monitoring of the flammable vapour in the atmosphere.</td>
</tr>
<tr>
<td></td>
<td>2. Medium pressure water sprinkler system will be provided with automatic detection and operation.</td>
</tr>
<tr>
<td></td>
<td>3. Water blanketing system will be installed to control outside fire</td>
</tr>
<tr>
<td></td>
<td>4. Following fire fighting facilities will be provided:</td>
</tr>
<tr>
<td></td>
<td>• DCP Extinguisher</td>
</tr>
<tr>
<td></td>
<td>• Sand bucket</td>
</tr>
<tr>
<td></td>
<td>• Water Monitor</td>
</tr>
<tr>
<td></td>
<td>4. LPG unloading area and in LPG tankers CO₂ extinguishers will be placed.</td>
</tr>
<tr>
<td>Copper Concentrate Ware house</td>
<td>• Well laid Fire Hydrant system</td>
</tr>
<tr>
<td></td>
<td>• Dust suppression system</td>
</tr>
<tr>
<td></td>
<td>• Mechanised operation</td>
</tr>
<tr>
<td></td>
<td>• Air conditioned operator cabin.</td>
</tr>
<tr>
<td></td>
<td>• 5 kg DCP extinguisher</td>
</tr>
<tr>
<td>Rock phosphate</td>
<td>• Well laid Fire Hydrant system</td>
</tr>
<tr>
<td></td>
<td>• Dust suppression /Extraction system</td>
</tr>
<tr>
<td></td>
<td>• Mechanized operation</td>
</tr>
<tr>
<td></td>
<td>• Air conditioned operator cabin.</td>
</tr>
</tbody>
</table>

#### 7.4.3 Fire Explosion and Toxicity Index (FE&TI) Approach

Fire, Explosion and Toxicity Indexing (FE & TI) is a rapid ranking method for identifying the degree of hazard. The application of FE & TI would help to make a quick assessment of the nature and quantification of the hazard in these areas. However, this does not provide precise information.

The degree of hazard potential is identified based on the numerical value of F&EI as per the criteria given below:

<table>
<thead>
<tr>
<th>F&amp;EI Range</th>
<th>Degree of Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-60</td>
<td>Light</td>
</tr>
<tr>
<td>61-96</td>
<td>Moderate</td>
</tr>
<tr>
<td>97-127</td>
<td>Intermediate</td>
</tr>
<tr>
<td>128-158</td>
<td>Heavy</td>
</tr>
<tr>
<td>159-up</td>
<td>Severe</td>
</tr>
</tbody>
</table>
By comparing the indices F&EI and TI, the unit in question is classified into one of the following three categories established for the purpose (Table-7.6).

**TABLE-7.6**

**FIRE EXPLOSION AND TOXICITY INDEX**

<table>
<thead>
<tr>
<th>Category</th>
<th>Fire and Explosion Index (F&amp;EI)</th>
<th>Toxicity Index (TI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>F&amp;EI &lt; 65</td>
<td>TI &lt; 6</td>
</tr>
<tr>
<td>II</td>
<td>65 ≤ F&amp;EI &lt; 95</td>
<td>6 ≤ TI &lt; 10</td>
</tr>
<tr>
<td>III</td>
<td>F&amp;EI ≥ 95</td>
<td>TI ≥ 10</td>
</tr>
</tbody>
</table>

Certain basic minimum preventive and protective measures are recommended for the three hazard categories.

7.4.3.1 Results of FE and TI for Storage/Process Units

Based on the GOI Rules 1989, the hazardous fuels and chemicals to be used by the proposed Copper smelter plant-II were identified. Fire, Explosion and Gas release are the likely hazards, which may occur due to the fuel and chemical storage. Hence, Fire and Explosion index has been calculated for plant storage. Detailed estimates of FE&TI are given in Table-7.7.

**TABLE-7.7**

**FIRE EXPLOSION AND TOXICITY INDEX FOR STORAGE FACILITIES**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Chemical/ Fuel</th>
<th>Total Quantity</th>
<th>F&amp;EI</th>
<th>Category</th>
<th>TI</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H₂SO₄</td>
<td>60,000 MT</td>
<td>-</td>
<td>-</td>
<td>5.8</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>Fuel Oil (Furnace Oil)</td>
<td>1600 KL</td>
<td>20.5</td>
<td>light</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>HSD</td>
<td>200 KL</td>
<td>10.3</td>
<td>light</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>LPG</td>
<td>100 MT</td>
<td>30</td>
<td>light</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

7.4.4 Conclusion

Results of FE&I analysis show that the storage of HSD, FO and LPG falls in light category of fire and explosion index with a nil toxicity index.

7.4.5 Maximum Credible Accident Analysis (MCAA)

Hazardous substances may be released as a result of failures or catastrophes, causing possible damage to the surrounding area. This section deals with the question of how the consequences of the release of such substances and the damage to the surrounding area can be determined by means of models. Major hazards posed by flammable storage can be identified taking recourse to MCA analysis. MCA analysis encompasses certain techniques to identify the hazards and calculate the consequent effects in terms of damage distances of heat radiation, toxic releases, vapour cloud explosion, etc. A host of probable or potential accidents of the major units in the complex arising due to use, storage and handling of the hazardous materials are examined to establish their credibility. Depending upon the effective hazardous attributes and their impact on the event, the maximum effect on the surrounding environment and the respective damage caused can be assessed. The reason and purpose of consequence analysis are many folds like:
Environmental Impact Assessment for the Proposed Copper Smelter Plant-II (1200 TPD Copper/ 4.38 LTPA Copper) in the SEZ at SIPCOT Industrial Complex, Therkku Veerapandiapuram Village, Ottapidaram Taluka, Thoothukudi District, Tamilnadu

Chapter 7

Additional Studies

- Part of risk assessment;
- Plant layout/code requirements;
- Protection of other plants;
- Protection of the public;
- Emergency planning; and
- Design criteria.

The results of consequence analysis are useful for getting information about all known and unknown effects that are of importance when some failure scenario occurs in the plant and also to get information as how to deal with the possible catastrophic events. It also gives the workers in the plant and people living in the vicinity of the area, an understanding of their personal situation.

- Selected Failure Cases

The purpose of this listing is to examine consequences of such failure individually or in combination. It will be seen from the list that failure cases related to storage of Fuel Oil (Furnace Oil), LPG and HSD have been identified.

7.4.5.1 Damage Criteria

The fuel storage and unloading at the storage facility may lead to fire and explosion hazards. The damage criteria due to an accidental release of any hydrocarbon arise from fire and explosion. The vapors of these fuels are not toxic and hence no effects of toxicity are expected.

Tank fire would occur if the radiation intensity is high on the peripheral surface of the tank leading to increase in internal tank pressure. Pool fire would occur when fuels collected in the dyke due to leakage gets ignited.

- Fire Damage

A flammable liquid in a pool will burn with a large turbulent diffusion flame. This releases heat based on the heat of combustion and the burning rate of the liquid. A part of the heat is radiated while the rest is convected away by rising hot air and combustion products. The radiations can heat the contents of a nearby storage or process unit to above its ignition temperature and thus result in a spread of fire. The radiations can also cause severe burns or fatalities of workers or fire fighters located within a certain distance. Hence, it will be important to know beforehand the damage potential of a flammable liquid pool likely to be created due to leakage or catastrophic failure of a storage or process vessel. This will help to decide the location of other storage/process vessels, decide the type of protective clothing the workers/fire fighters need, the duration of time for which they can be in the zone, the fire extinguishing measures needed and the protection methods needed for the nearby storage/process vessels. Table-7.8 tabulates the damage effect on equipment and people due to thermal radiation intensity.
### TABLE-7.8
**DAMAGE DUE TO INCIDENT RADIATION INTENSITIES**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Incident Radiation (kW/m²)</th>
<th>Type of Damage Intensity</th>
<th>Damage to Equipment</th>
<th>Damage to People</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37.5</td>
<td>Damage to process equipment</td>
<td>100% lethality in 1 min. 1% lethality in 10 sec.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>25.0</td>
<td>Minimum energy required to ignite wood at indefinitely long exposure without a flame</td>
<td>50% Lethality in 1 min. Significant injury in 10 sec.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>19.0</td>
<td>Maximum thermal radiation intensity allowed on thermally unprotected adjoining equipment</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12.5</td>
<td>Minimum energy to ignite with a flame; melts plastic tubing</td>
<td>1% lethality in 1 min.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4.5</td>
<td>--</td>
<td>Causes pain if duration is longer than 20 sec, however blistering is un-likely (First degree burns)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.6</td>
<td>--</td>
<td>Causes no discomfort on long exposures</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Techniques for Assessing Industrial Hazards by World Bank.*

The effect of incident radiation intensity and exposure time on lethality is given in Table-7.9.

#### TABLE-7.9
**RADIATION EXPOSURE AND LETHALITY**

<table>
<thead>
<tr>
<th>Radiation Intensity (kW/m²)</th>
<th>Exposure Time (seconds)</th>
<th>Lethality (%)</th>
<th>Degree of Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>--</td>
<td>0</td>
<td>No Discomfort even after long exposure</td>
</tr>
<tr>
<td>4.5</td>
<td>20</td>
<td>0</td>
<td>1st</td>
</tr>
<tr>
<td>4.5</td>
<td>50</td>
<td>0</td>
<td>1st</td>
</tr>
<tr>
<td>8.0</td>
<td>20</td>
<td>0</td>
<td>1st</td>
</tr>
<tr>
<td>8.0</td>
<td>50</td>
<td>&lt;1</td>
<td>3rd</td>
</tr>
<tr>
<td>8.0</td>
<td>60</td>
<td>&lt;1</td>
<td>3rd</td>
</tr>
<tr>
<td>12.0</td>
<td>20</td>
<td>&lt;1</td>
<td>2nd</td>
</tr>
<tr>
<td>12.0</td>
<td>50</td>
<td>8</td>
<td>3rd</td>
</tr>
<tr>
<td>12.5</td>
<td>--</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>25.0</td>
<td>--</td>
<td>50</td>
<td>--</td>
</tr>
<tr>
<td>37.5</td>
<td>--</td>
<td>100</td>
<td>--</td>
</tr>
</tbody>
</table>

### 7.5 Visualization of MCA Scenarios

#### 7.5.1 Scenarios Considered for MCA Analysis

#### 7.5.1.1 Fuel Storage

The details of storages are given in Table-7.1. In case of fuel released in the area catching fire, a steady state fire will ensue. Failures in pipeline may occur due to corrosion and mechanical defect. Failure of pipeline due to external interference is not considered as this area is licensed area and all the work within this area is closely supervised with trained personnel.
7.5.1.2 Modeling Scenarios

Based on the storage and consumption of various fuels and chemicals the following failure scenarios for the proposed Copper smelter-II project have been identified for MCA analysis and the scenarios are discussed in Tables-7.10.

**TABLE-7.10**  
SCENARIOS CONSIDERED FOR MCA ANALYSIS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Fuel/Chemical</th>
<th>Total Quantity</th>
<th>Scenarios considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Failure of FO tank</td>
<td>1600 KL</td>
<td>Pool fire</td>
</tr>
<tr>
<td>2</td>
<td>Failure of HSD tank</td>
<td>200 KL</td>
<td>Pool fire</td>
</tr>
<tr>
<td>3</td>
<td>Failure of LPG Bullet</td>
<td>100 metric ton</td>
<td>ALOHA</td>
</tr>
</tbody>
</table>

The fuel properties considered for modeling are given in Table-7.11.

**TABLE-7.11**  
PROPERTIES OF FUELS CONSIDERED FOR MODELING

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Fuel</th>
<th>Molecular Weight kg/kg.mol</th>
<th>Boiling Point °F</th>
<th>Density Kg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel Oil (Furnace Oil)</td>
<td>135</td>
<td>350</td>
<td>900</td>
</tr>
<tr>
<td>2</td>
<td>HSD</td>
<td>114.2</td>
<td>360</td>
<td>860</td>
</tr>
<tr>
<td>3</td>
<td>LPG</td>
<td>44.1</td>
<td>18.0</td>
<td>-</td>
</tr>
</tbody>
</table>

7.5.2 Model Computations

- **Results and Discussion - Pool Fire**

The results of MCA analysis are tabulated indicating the distances for various damages identified by the damage criteria, as explained earlier. Calculations are done for radiation intensities levels of 37.5, 25, 12.5, 4.5 and 1.6 kW/m², which are presented in Table-7.12. The distances computed for various scenarios are given in meters and are from the center of the pool fire.

**TABLE-7.12**  
OCURRENCE OF VARIOUS RADIATION INTENSITIES- POOL FIRE

<table>
<thead>
<tr>
<th>Radiation and Effect</th>
<th>Radiation Intensities (kW/m²)/ Distances (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37.5</td>
</tr>
<tr>
<td>Failure of one Furnace Oil Tank (800KL)</td>
<td>34.5</td>
</tr>
<tr>
<td>Failure of one HSD Tank (100 KL)</td>
<td>12.2</td>
</tr>
</tbody>
</table>

- **Pool Fire Due to Failure of Furnace Oil Storage tank (2 x 800 KL)**

The maximum quantity of storage of Furnace Oil is 1600 KL (2x800). The most credible failure is the rupture of the largest pipe connecting the storage tank. As the worst case, it is assumed that the entire contents leak out into the dyke forming a pool, which may catch fire on finding a source of ignition.
A perusal of the above table clearly indicates that 37.5 kW/m² (100% lethality) occurs within the radius of the pool which is computed at 34.5 m in case of Furnace Oil tank on pool fire. This vulnerable zone will damage fuel storage all equipment falling within the pool radius.

The threshold limit for 50% and 1% lethality is 25.0 and 12.5 kW/m². From the results, it can be concluded that the vulnerable zone in which the thermal fluxes above the threshold limit for 50% and 1% lethality is restricted to 43.4 m and 64.5 m.

Similarly, the threshold limit for first degree burns is 4.5 kW/m², this vulnerable zone in which the thermal fluxes above the threshold limit for first degree is restricted to 115.5 m in case of furnace oil tank on pool fire. The contour map showing the pool fire due to failure of Furnace oil storage tank (2x800 KL) given in Figure-7.1.

7.5.2.1 Results and Discussion: ALOHA

LPG release is modeled for its gaseous dispersion after its release (which is likely to result in flash boiling) using the model ALOHA – “Area Locations of Hazardous Atmospheres” a model developed by NOAA and USEPA. Aloha predicts the rate at which chemical vapors may escape into the atmosphere from broken gas pipes, leaking tanks and evaporating puddles.

Since the worst-case release scenario of LPG release are Boiling Liquid Expanding Vapor Explosion (BLEVE) and unconfined Vapor Cloud Explosion (VCE), the impact factors considered are radiation intensity and explosion overpressure. The three heat radiation levels of 37.5 kW/m², 12.5 kW/m² and 4.5 kW/m² and three explosion overpressure levels of 7 psi, 3psi and 1 psi corresponding to severe moderate and low damage levels have been considered respectively.
Maximum affected downwind distances (in meter) due to heat radiation and explosion over pressure level of LPG (stability class: D and wind speed =2.0 m/s) BLEVE/Fire ball scenarios are given in Table-7.13 and Figure-7.3.

**TABLE-7.13 (A)**
**THERMAL RADIATION LEVELS DUE TO FAILURE OF LPG BULLET**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Thermal Radiation Intensities in kW/m$^2$/Distance in m</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLEVE due to catastrophic failure of one LPG Bullet (50 metric tonne)</td>
<td>37.5 kW/m$^2$</td>
</tr>
<tr>
<td></td>
<td>165</td>
</tr>
</tbody>
</table>

**TABLE-7.13 (B)**
**EXPLOSIVE OVER PRESSURE LEVELS DUE TO FAILURE OF LPG BULLET**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Explosion Overpressure Level in psi/Distance in m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapour cloud explosion due to catastrophic rupture of one LPG Bullet (50 metric tonne)</td>
<td>1 psi</td>
</tr>
<tr>
<td></td>
<td>Never exceeded LOC</td>
</tr>
</tbody>
</table>
FIGURE-7.1
RADIATION CONTOUR LAYOUT FOR FURNACE OIL STORAGE TANKS
FIGURE 7.2
RADIATION CONTOUR LAYOUT FOR HSD STORAGE TANKS
FIGURE-7.3
RADIATION CONTOUR LAYOUT FOR LPG BULLET
7.6 Disaster Management Plan

7.6.1 Disasters

A disaster is a 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 can be divided into two main groups. In the first, the disasters are resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, avalanches, landslides, and forest fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are armed conflict, industrial accidents, radiation accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents and can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster in the abstract since this depends to a large extent on the physical, economic and social environment in which it occurs. What would be consider a major disaster in a developing country, ill equipped to cope with the problems involved, may not mean more than a 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 re-establishment of essential services.

SSL has a well defined Disaster Management Plan (DMP) for the copper smelter plant-I located adjacent to the proposed plant. The same will be implemented for the proposed copper smelter plant-II.

7.6.2 Objectives of Disaster Management Plan [DMP]

The Disaster Management 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 the Disaster Management Plan, it should be widely circulated and personnel training through rehearsals/drills.

The Disaster Management Plan shall reflect the probable consequential severalties of the undesired event due to deteriorating conditions or through 'Knock on' effects. Further the management shall be able to demonstrate that their assessment of the consequences uses good supporting evidence and is based on currently available and reliable information, incident data from internal and external sources and if necessary the reports of out side agencies.
To tackle the consequences of a major emergency inside the factory or immediate vicinity of the factory, a Disaster Management Plan has to be formulated and this planned emergency document is called "Disaster Management Plan". The objective of the Industrial Disaster Management Plan is to make use of the combined resources of the plant and the outside services to achieve the following:

1. Effect the rescue and medical treatment of causalities;
2. Safeguard other people;
3. Minimize damage to property and the environment;
4. Initially contain and ultimately bring the incident under control;
5. Identify any dead;
6. Provide for the needs of relatives;
7. Provide authoritative information to the news media;
8. Secure the safe rehabilitation of affected area; and
9. Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the Emergency.

In effect, it is to optimize operational efficiency to rescue, rehabilitation and render medical help and to restore normalcy.

7.6.3 Emergencies

7.6.3.1 General and Industrial Emergencies

The emergencies that could be envisaged in the plant and tank farm are as follows:

1. A situation of fire at the tank farm of all storages;
2. Slow isolated fires;
3. Fast spreading fires;
4. Structural failures;
5. Contamination of food/water; and

7.6.3.2 Specific Emergencies Anticipated

- **Fire and Explosion**

Fire consequences can be disastrous, since they involve huge quantities of fuel either stored or in dynamic inventory in pipe lines or in nearby areas. Toxic releases can affect persons working around. Preliminary hazard Analysis has provided a basis for consequence estimation. Estimation can be made by using various pool fire, tank fire consequence calculations. During the study of risk assessment, the nature of damages is worked out and probability of occurrence of such hazards is also drawn up. Therefore, the risk assessment report is to be essentially studied in conjunction with disaster management plan.

7.6.4 Emergency Organization

The SSL will 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. As per the General Organization chart, Chief Operating Officer will be the Site Controller. The General Managers will be the designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller.

All the department heads, fire & security officer, communication officer and personal manager will be reporting to the Incident Controller. This team will be responsible for controlling the incidence with the personnel under their control. Shift In charge will be the reporting officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller. The team co-ordinates during eventualities and responsible for fire fighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, security in charge, personnel department, and essential services personnel are engaged. All these personnel will be designated as key personnel.

In each shift, electrical supervisor, electrical fitters, pump house in charge and other maintenance staff will be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the office/plant offices will be drafted and their services would be utilized as messengers for quick passing of communications.

7.6.4.1 Emergency Communication

Whoever notices an emergency situation such as fire, growth of fire, leakage etc. informs his immediate superior and emergency control center. The person on duty in the emergency control center will appraise the site controller. Site controller verifies the situation from the incident controller of that area or the shift in charge and takes a decision about an impending on site emergency. This would be communicated to all the incident controllers, emergency co-ordinators. Simultaneously, the emergency warning system would be activated on the instructions of the site controller.

7.6.5 Onsite Emergency Preparedness and Response for Accidents

7.6.5.1 Anticipated Accident Scenarios

Considering the impact, potential situations are identified and Preparedness & response are listed given in Table-7.14.

**TABLE-7.14**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Department / Section</th>
<th>Type of Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smelter and CCR</td>
<td>• Fall of person</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fall of object</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hot metal splash / spill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Electrocution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Caught between</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Collision with truck/Fork lift</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fainting due to Suffocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Drowning in water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Steam leak</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire in LPG/FO/IPA lines</td>
</tr>
</tbody>
</table>
### Additional Studies

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Department / Section</th>
<th>Type of Accidents</th>
</tr>
</thead>
</table>
| 2       | Sulphuric Acid Plant | • Fall of person  
• Fall of object  
• Acid splash  
• Electrocution  
• Caught between  
• Collision with acid tanker  
• Fainting due to suffocation |
| 3       | Wastewater Treatment Plant | • Spillage of ETP cake outside the cell while disposing  
• Flying of dust from ETP due to heavy wind  
• Runoff beyond the cell area at the time of heavy rains |
| 4       | Phosphoric Acid Plant | • Fall of person  
• Fall of object  
• Acid splash  
• Electrocution  
• Caught between  
• Contact with hot water  
• Collision with acid tanker  
• Fainting due to suffocation  
• Drowning in water |
| 5       | Refinery and Precious Metal Recovery plant | • Fall of Person  
• Fall of Object  
• Electrocution  
• Caught Between  
• Collision with Forklift  
• Acid Splash  
• Contact with Electrolyte  
• Steam leak |
| 6       | Utilities | • Cold burns  
• Fall of person  
• Fall of objects  
• Electrocution  
• Caught between  
• Drowning in water |
| 7       | Maintenance | • Fall of person  
• Fall of object  
• Hot Metal splash  
• Acid splash  
• Electrocution  
• Caught between  
• Contact with hot water  
• Collision with truck  
• Fainting due to suffocation  
• Drowning in water |
| 8       | Projects | • Fall of person  
• Fall of object  
• Electrocution  
• Collision with truck  
• Struck by  
• Struck against  
• Caught in  
• Fire in acetylene cylinder |
7.6.5.2 Emergency Actions for Accidents

**Responsibilities**

- The person who will see the accident or present during accident, shall try to revive the person and if needed shout and call for assistance;
- Inform to shift in-charge immediately;
- On getting information shift in-charge shall rush to the spot and arrange for first aid by trained person;
- Inform HOD and safety department;
- Depending on severity of accident, the person shall be sent to occupational health centre immediately. If needed ask for ambulance from occupational health centre and intimate about the accident;
- Depending on severity he may call security officer and ensure there is no over crowding; and
- If need arises call firemen for rescuing the person such as bringing the person from height, rescuing person from gaseous atmosphere.

**Response**

- HOD shall rush to spot and assess the situation and make arrangement to send the victim to occupational health centre;
- Shift in charge shall ensure that there is no over crowding; and
- Security officer shall rush to the spot and cordoned off the area and ensure speedy evacuation of patient.

7.6.5.3 Occupational Health Centre (OHC)

- Male nursing assistants in OHC, on getting the information & request send ambulance to the accident spot and make arrangement to receive the patient;
- Inform head (HSE) regarding the accident;
- Receive the patient and examine the patient thoroughly and provide necessary medical relief; and
- Depending on severity send the patient to hospital/nursing home and inform head (HSE)/manager (HSE).

7.6.5.4 Safety Department

- Chief medical officer shall inform Hospital and make necessary arrangement for further treatment;
- Head (HSE) shall initiate investigation of accident by appropriate committee;
- Head (HSE) shall inform HR department for his regularization of leave;
- Head (HSE) shall inform finance department for providing financial assistance for the treatment, if so required;
- Head (HSE) shall notify any reportable accident in form 18 of Tamilnadu factories rules – 1950 to Inspector of Factories, Tuticorin and maintain a register through HR;
- Chief medical officer shall forward fitness certificate to HRD, once the person returned back to duty; and
- In case of fatal accidents inform industrial safety & health department within
12 hours from occurrence of accident and inform director-industrial safety & health, district magistrate or sub divisional officer and in-charge of near by police station.

7.6.5.5 *Injured Employee*

- While joining duty employee shall come with fitness certificate from the hospital and meet chief medical officer; and
- After the concurrence from chief medical officer, he/she shall report to duty.

7.6.6 *Anticipated Emergencies*

Emergency preparedness and response plan is prepared considering the activities carried out in SSL, based on storage facilities, raw materials and products & by products and processes involved. Anticipated emergency situations are tabulated are given in Table-7.15.

**TABLE-7.15**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Activity</th>
<th>Explosion</th>
<th>Fire</th>
<th>Toxic release</th>
<th>Spill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Storage of LPG</td>
<td>Explosion of LPG bullet</td>
<td>Fire hazard due to Leakage of LPG-BLEVE</td>
<td>LPG Release</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Storage of FO, HSD &amp; LSHS</td>
<td>-</td>
<td>Fire hazard due to leakage of oil</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Storage of Iso Propanal</td>
<td>-</td>
<td>Fire hazard due to leakage of iso propanal</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Storage of Sulphuric acid</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Major spills of acid in to bund will result in localised formation of Acid mist/fumes</td>
</tr>
<tr>
<td>5</td>
<td>Storage of Phosphoric acid</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Major spills of acid in to bund will result in localised formation of Acid mist/fumes</td>
</tr>
<tr>
<td>6</td>
<td>Transfer of SO$_2$ gas from Smelter to Sulphuric acid plant</td>
<td>-</td>
<td>-</td>
<td>Sudden and heavy release of SO$_2$ gas cloud leads to suffocation</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Escape of Fluorine from Phosphoric acid plant</td>
<td>-</td>
<td>-</td>
<td>Excessive fluorine release leads to suffocation</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Transformer fire</td>
<td>Explosion of breakers, transformers or capacitor</td>
<td>Possibility of fire due to over heating of transformer oil</td>
<td>Aerosols, Smoke and CO</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Fire in Cable</td>
<td>-</td>
<td>Fire</td>
<td>PVC cables</td>
<td>-</td>
</tr>
</tbody>
</table>
## Additional Studies

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Activity</th>
<th>Explosion</th>
<th>Fire</th>
<th>Toxic release</th>
<th>Spill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cellar room</td>
<td></td>
<td></td>
<td>emits toxic gases</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ISA furnace foam over</td>
<td>Explosion possibility due to cooling water leak</td>
<td>Foam over leads to fire due to process deviation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Storage of Liquid Oxygen</td>
<td>Explosion possibility due to poor process control</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>WHRB</td>
<td>Steam explosion due to poor process control</td>
<td>- -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Storage of hazardous waste</td>
<td></td>
<td></td>
<td>Fire &amp; explosion, Land &amp; water contamination</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Transport of hazardous waste</td>
<td></td>
<td></td>
<td>Spill hazard, Fire &amp; explosion, Land &amp; water contamination</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Barge Loading of sulphuric acid &amp; phosphoric acid</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Burn injury may occur due to acid splash, tank overflow and acid line leak. Injury may occur while shifting heavy materials. Injury may occur due to tanker movement.</td>
</tr>
<tr>
<td>16</td>
<td>Transportation of sulphuric acid and phosphoric acid</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Burn injury may occur due to acid splash, tank overflow and acid line leak. Injury may occur while shifting heavy materials. Injury may occur due to tanker movement.</td>
</tr>
<tr>
<td>17</td>
<td>WWTP – Sudden release of H₂S</td>
<td>-</td>
<td>-</td>
<td>Excessive H₂S release leads to suffocation</td>
<td>Health Hazard</td>
</tr>
<tr>
<td>18</td>
<td>Over exposure to a source of ionizing radiation</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7.6.7 Roles and Responsibilities

#### 7.6.7.1 Responsibilities of Site Emergency Controller

- Decide the level of emergency and if required inform Off site Emergency Coordinator (District Collector);
Ensure emergency services and key persons are put in service;
Direct the shutting down of plants and guide the course of action;
Direct evacuation of persons;
Ensure causalities are given proper medical aid;
Assess continuously all possible developments;
Liaise with Inspectorate of Factories/ Govt/ Police/ Fire and other statutory authorities;
Control the traffic movement with in the plant;
Issue authorized statements to media and outside agencies; and
In case of an odd hours, SIC will act as Site emergency controller and shall follow the roles mentioned above till SEC reaches ECC.

7.6.7.2 Responsibilities of Incident Controller

On hearing Information, rush to the spot with all PPE and initiate emergency actions;
Direct all operations with in the affected area;
Declare emergency by raising the siren from ISA control Room;
Direct rescue and fire fighting operations till safety and fire co-ordinator reaches the spot;
Ensure that all persons are evacuated;
Guide the rescue team in search of/evacuate the carnalities;
Advice fire personnel in fighting the fire;
Take charge of responsibilities of site emergency controller till he arrives;
Report all significant developments to site emergency controller;
Arrange for enquiry; and
In case of an odd hours, SIC will act as Incident controller and shall follow the roles mentioned above till incident controller reaches the site.

7.6.7.3 Responsibilities of Shut down Co-coordinator

Contact incident controller/HOD at site;
Decide about the plant to be shutdown in the absence of site emergency controller;
Give instructions to respective plants for shut down and follow up the actions taken;
Ensure proper shut down of the plant;
Inform about the status of plant to the site emergency controller frequently; and
Any other work assigned by the site emergency controller.

7.6.7.4 Responsibilities of Transport & Security Co-coordinator:

Arrange transport for the injured personnel;
Arrange vehicle to bring the key personnel from their residence; and
Arrange transport for shifting of necessary equipment and materials to the emergency location.
7.6.7.5 Security Aspects

- Immediately send some of the guards to the affected area to restrict unauthorized entry;
- Main gate and labour gate should be closed to restrict further entry of visitors/vehicles. Fire tender and ambulance from mutual aid industries shall be allowed inside;
- Prepare a report on Number of labours & visitors admitted inside the company at the point of time and sent it to emergency control centre with in 15 minutes;
- Post security personnel in SAP loading station, PAP loading station, LPG Yard, gypsum pond, concentrate unloading, Anode dispatch to stop the movement of vehicles and direct the drivers & assistants to reach safe assembly point/Emergency shelters;
- Allow emergency co-ordinators and emergency team members to reach affected area and to the emergency control centre;
- Post one of the security personnel to go round the plant to guide the security staff and to regulate the movement of visitors/labours/vehicles; and
- Send some of the guards to the affected area to assist the fire fighting team.

7.6.7.6 Responsibilities of Safety & Fire Co-ordinator

- Ensure the availability of all safety equipment;
- Arrange for the search of the missing person;
- Ensure preservation of evidences for the investigation of the incident;
- Investigate the accident to find out the causes;
- Ensure that the on site emergency operations are carried out safely;
- Guide the fire officer/Fire fighting team to control the spread of fire;
- Arrange for further equipment/assistance for fire fighting if necessary;
- Arrange for containment/diversion of spills and chemicals, draining of wastewater generation during fire fighting, emergency operation etc; and
- Any other work assigned by the site emergency controller.

7.6.7.7 Responsibilities of Medical Co-ordinator

- Inform the hospitals to be ready for receiving the injured persons.
- Ensure safe transport of persons to the hospitals.
- Ensure proper first aid treatment for injuries in the first aid centre.
- Mobilize additional medical facilities if needed.
- Guide the medical team members and involve them in giving First aid to the injured persons and
- Any other work assigned by the site emergency controller.

7.6.7.8 Responsibilities of Facilities Co-ordinator

- Arrange additional transport if required.
- Arrange for needed financial support for the emergency operations.
- Arrange for Rehabilitation of persons.
- Any other work assigned by Site emergency controller.
7.6.7.9 Responsibilities of Communication co-coordinator

- Inform mutual aid members to get ambulance, fire tenders etc;
- Request help from fire services;
- Inform the hospitals to be ready for receiving the injured persons;
- Answer phone calls from outside, as instructed by site emergency controller;
- Provide information to inmates and relatives;
- Guide communication team members;
- Prepare a report on number of SSL employees working inside the company at the point of time and send it to emergency control centre within 15 minutes;
- Inform site emergency controller about the status of emergency shelters and assembly points;
- Inform emergency call off by paging throughout the plant;
- Any other work assigned by site emergency controller;

7.6.7.10 Responsibilities of Public Relations co-coordinator

- Maintain good relation with nearby industries/village.
- Ensure that the local emergency in the plant does not get adverse publicity.
- Request help from police if necessary.
- Establish & maintain good rapport with the Government agencies, large-scale industries in the area and media.
- Give report to press and public with the concurrence of site emergency controller and
- Any other work assigned by site emergency controller.

7.6.7.11 Responsibilities of Power co-coordinator

- Ensure availability of power for the emergency operations.
- Arrange for safe electrical circuits needed by the incident controller/shut down controller.
- Ensure power supply without interruption for the critical equipment and their functions as advised by shutdown controller/site emergency controller.
- Arrange for emergency maintenance of electrical equipment/ services needed by the co-ordinator, and
- Any other work assigned by site emergency controller.

7.6.8 Proposed Facilities

The following facilities will be provided for the copper smelter plant-II.

7.6.8.1 Emergency Control Centre

The emergency centres will be provided with

- Site plan/plant layout;
- List of key persons and their telephone nos.;
- Safe shut down procedure of the plant;
- MSDS of all the chemical substances used, stored, handled & manufactured;
- Details of stored quantities of all the chemical substances;
- Meteorological information;
● Communication systems;
● PPE minimum items;
● Emergency light;
● Hand operated siren;
● Mega Phone; and
● Explosive meter.

Depending on situations such as location calls for emergency/ wind direction, emergency control centre will be chosen.

7.6.8.2 Built in safety system for fire and explosion:

To avoid major fire & explosion in LPG bullet and fire in HSD and FO tanks, the following facilities will be available to tackle the situation:

● LPG bullets and HSD& FO tanks are constructed at the remote place and adequate clearance provided from near by plants and buildings;
● Good layout for easy approach from all the directions;
● Frequent checks will be made by multidisciplinary team;
● Good maintenance practice will be followed;
● Round the clock posting of security personnel who is trained in firefighting;
● Ensured round the clock checking by operators;
● Well laid fire hydrant system with adequate water;
● Manual & automatic sprinkler system provided for LPG bullets;
● Water monitors will be provided in LPG yard and sufficient DCP extinguisher;
● Foam monitors will be provided at HSD yard;
● Well-trained fire brigade, security Force and auxiliary firefighting team will be made available; and
● Mutual aid industry’s assistance can be obtained;

To avoid fire in plant premises and to control the fire, fire extinguishers will be kept all over the plant and well-laid fire hydrant line will be made available. Fire personnel shall check fire hydrant pumps, fire hydrant line and fire extinguishers regularly. One fire tender with all facilities will be made available.

7.6.8.3 Preparedness to Control Toxic Release:

1. Regular maintenance and monitoring of all equipment and ducts/pipe lines handling toxic gases/ hazardous chemicals;
2. All concerned employees will be provided with SO₂ respirator, which comes into use during any accidental release;
3. Minimum inventory of 25 SO₂ respirators will be maintained always;
4. Adequate numbers of safe assembly points and emergency shelters will be identified all over the plant;
5. All personnel will be well trained in Emergency procedures;
6. Full-fledged first aid centre with all basic medicines & rescue kit available and it is manned round the clock;
7. Critical care Ambulance with stretchers will be made available in first aid centre to take care of any emergency situation;
8. Self contained breathing apparatuses available; and
9. Well trained rescue team and medical team available.
7.6.8.4 Emergency Shelters & Safe Assembly Points

To provide safe shelter for the employees in case of emergency safe assembly points and emergency shelters will be provided.

7.6.8.5 Mutual Aid Scheme

Effective management of any emergency requires adequate resources in the form of equipment and expert manpower. The magnitude of the emergency cannot be assessed fully before it occurs and also the resources required handling the same. SSL is located in the industrial town where large industries with adequate infrastructure facilities, to handle the emergency, are available. SSL is in agreement with nearby industries to extend the facilities on reciprocation basis, in case of need, during emergencies.

7.6.8.6 Fire fighting system

The following facilities will be provided

- Hydrant system;
- High velocity spray system for transformers;
- Medium velocity spray system for LPG; and
- Portable fire extinguishers.

7.6.8.7 Responsibility of Emergency Team

Responsibilities of Fire Fighting Team

1. On hearing emergency siren all team members shall report to Safety & Fire co-ordinator with all PPE;
2. In the absence of safety co-ordinator, team members shall report to Site Emergency controller and enquire for location and move accordingly;
3. They will take the identification scarf (RED colour) and move to the site;
4. They will be joined with fire crew in fighting fire; and
5. If required they will be deputed for Rescue team also.

Responsibilities of Rescue Team

1. On hearing emergency siren team members shall report to safety & fire co-ordinator with all PPE;
2. In the absence of Safety co-ordinator the team members shall report to site emergency controller and enquire for location and move accordingly;
3. They will take the identification scarf (ORANGE colour) and move to the site;
4. Get the advice of the safety & fire co-ordinator and rescue the endangered personnel;
5. Guide the people in reaching emergency shelters and assembly points; and
6. If required they will be deputed for firefighting also.

Responsibilities of Medical Team

1. On hearing emergency siren team members shall report at Medical centre and get advice from Medical co-ordinator;
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2. As per his advice some of them will go to the spot in the ambulance and give medical aid for the victims along with medical assistants;
3. Others remain in medical centre and treat the victims coming to medical centre;
4. If required they will be deputed for communication team also;

Responsibilities of Communication Team

1. On hearing emergency siren all team members shall report to communication co-ordinator;
2. Out of them one will take care of contacting mutual aid members;
3. Two will take care of local communication (Intercom & Paging);
4. One will take care of emergency shelters and safe assembly points;
5. In case of power failure the team members shall take the available vehicle and go round the plant and announce that emergency has been declared;
6. If required they will be deputed for medical team also; and
7. The CRO’s and DCS operators may remain in the DCS room if they are in that job only.

7.6.8.8 Main Stages of Emergency

Major emergency goes through following main stages:

1. Communication during Emergency;
2. Declaration of Emergency by Raising the alarm;
3. Implementation of the Emergency; and
4. Rescue.

Communication during Emergency

The person first noticing an emergency has to inform to Shift in charge of the respective section. On assessing the situation shift incharge will inform to all the concerned as per the guidelines given in the communication network.

Declaration of Emergency

On receipt of information, Incident controller rushes to the site assess the situation and advice them to tackle emergency/ fight fire. Then he informs to central control room to raise the Siren in short wailing tone for 3 minutes.

Electrical sirens are provided in seven places inside the plant including Pump House. In case of emergency the siren will be raised in short wailing tone. On hearing it, all personnel will assemble at assembly points. The personnel connected with emergency duty will report to the respective key personnel at the emergency control centre and take orders.

Implementation of Emergency

On hearing the siren/information over phone, all key personnel should assemble at emergency control centre and take orders from site Emergency Controller and play their role as defined.
In connection with that the following teams are formed to assist the co-ordinators to restore normalcy at the earliest. For identification team members are provided with scarfs in different colours

1. Rescue team - (Orange)
2. Fire fighting team - (Red)
3. Medical team - (White)
4. Communication team - (Green)

All others will remain at assembly points and in Emergency shelters until the emergency is over which is indicated by long all clear siren.

Depending on the wind direction & incident spot all employees (including SSL & Contractor employees) and visitors should choose evacuation route to reach the assembly points. Incase of need a Head count will be taken at assembly point to ascertain that no one is trapped in the plant area.

**Rescue and Rehabilitation**

In order to ensure that all the persons are safe, Head count will be taken. In case of any difference in count rescue team will press in service to rescue the victims.

- **Head Count System**

Number of persons sheltered in Emergency Shelters/Assembly points should be informed to Site emergency controller by communication co-ordinator. Theumber of SSL employees, contractor employees & visitors inside the plant at that point of time will be informed to Site emergency controller with in 15 Minutes by HRD & Security officer respectively. Site emergency controller will match the figures and if needed advice safety and fire co-ordinator to search.

**Emergency Call off**

Site emergency controller will checkup the area along with Incident controller and safety & fire co-ordinator and declare Emergency call off by raising continuous siren for 3 minutes.

Communication co-ordinator will arrange to make announcement with paging system.

**Training**

SSL believes that, any job or task can be performed efficiently through good training. A full-fledged Human Resources Development takes care of the training needs of the SSL. The emergency control is also a task connected with the industrial activity, which requires the training of connected persons for effective management of the task. The training and re-training will be imparted in two stages.
Induction training are given to the facilitators and other members of the emergency team. The role of each facilitator and the team will be perfected through a mock drill on a given emergency situation.

All employees are trained in fire fighting. First Aid training are also given for more than 30% of the employees.

Mock Drill

Mock drills shall be conducted as per the schedule (Half yearly) with the purpose of familiarising the key persons and all employees in emergency preparedness & response. Mock drills shall be conducted at different times (Office / non-office hours) to know the emergency response and review the plan accordingly.

Any shortcoming observed in the drill will be discussed and necessary action will be taken. This findings/follow up will be recorded in emergency mock drill register.

7.6.9 Fire Emergency Control Procedure - LPG Yard

7.6.9.1 Actions to be Taken by Area Operator incase of Emergency

- Inform fire station about the incident with specific mention of location.
- Inform HOD/shift in-charge promptly.
- Switch off electrical supply to all electrical systems (cut off supply to & from vaporiser);
- Start sprinkler system by opening the valve;
- In case of LPG unloading, stop unloading and ask truck driver to move from the area. don’t try to disturb the tanker;
- Try to close all the manual valves in the LPG yard to cut off LPG transfer;
- Inform A/F control room to initiate actions at their end;
- Inform ISA control room to initiate actions at their end.
- Ensure security guard stops the movement of vehicle and persons from either side;
- Guide / assist fire crew in fighting fire and isolating valve; and
- Guide rescue team.

7.6.9.2 Actions to be taken by HOD

- Inform incident controller about the situation;
- Inform site emergency controller;
- Inform shut down coordinator and discuss about the shutdown procedure;
- Inform communication coordinator and arrange to inform other plants and coordinators; and
- On receipt of information rush to the LPG yard and assess the situation, coordinate fire fighting activity along with incident controller.

7.6.9.3 Role of Shift Engineer

On hearing information about the emergency, shift engineer should assess the severity of situation and if necessary shut down the plant properly. The following action to be initiated
• Inform Safety & Fire co-ordinator with brief description of fire and location;
• Inform HOD/ incident controller in detail;
• Inform first aid centre/ medical co-ordinator and call ambulance;
• Inform transport and security co-ordinator;
• Coordinate firefighting activities till incident controller/safety & fire co-
  ordinator reach the site; and
• Alert and evacuate the people working in the area.

7.6.9.4 Role of Fire Officer/Firemen

On receipt of information send the fire men with fire tender and all PPE (SCBA,
fire proximity suit, mask) to the LPG yard.

• Inform Head (HSE)/ Manager(HSE) about the incident and location;
• Inform other plants and get the fire fighting team (auxiliary);
• Inform pump house to start the pump;
• Inform chief of security and send security guards to the LPG yard. Involve
  security guards in fighting fire; and
• Rush to the spot and coordinate fire fighting activities.

7.6.9.5 Role of Chief of Security

• Immediately send some of the guards to the LPG yard to block both ends of
  the road;
• Main gate and labour gate should be closed to restrict further entry of
  visitors/vehicles. Fire tender and ambulance from mutual aid industries shall
  be allowed inside;
• Prepare a report on number of labours & visitors allowed inside the company
  at the point of time and sent it to emergency control centre with in 15
  minutes;
• Post security personnel in sap loading station, pap loading station, gypsum
  pond, concentrate unloading, anode despatch to stop the movement of
  vehicles and direct the drivers & assistants to reach safe assembly
  point/emergency shelters;
• Allow emergency co-ordinators and emergency team members to reach LPG
  yard;
• Post one of the security person to go round the plant to guide the security
  staff and to regulate the movement of visitors/labours/vehicles; and
• Send some of the guards to LPG station to assist the fire fighting team.

7.6.9.6 Role of shift in-charge in A/F

• On receipt of information from LPG yard, inform HOD;
• Stop LPG reduction, if any forecasting; and
• Close all LPG valves in service at that point of time.

7.6.9.7 Role of shift in-charge in Holding Furnace

• Inform HOD on receipt of information from LPG operator; and
• Close all LPG valves in service at that period of time.
7.6.9.8 Role of shut down co-ordinator

- Contact incident controller/HOD at site;
- Decide on subsequent shutdowns to be made in consultation with incident controller; and
- Give suitable instructions to respective plants for shutdown and follow up the actions taken.

7.6.10 Fire Emergency Control Procedure

- Area operator/Any one on seeing the fire should try to put out the fire in the incipient stage using fire extinguisher;
- If fire is uncontrollable he should inform shift in charge and to control room;
- Shift in charge should inform Fire Dept, HOD and Incident controller and rush to spot to assess the situation. Depending on severity he should isolate the area or shutdown the entire plant;
- On receipt of information Fire officer should send firemen with Fire tender and inform Safety & Fire co-ordinator. Depending on wind direction fire crew along with auxiliary fire team will start fire fighting from up wind direction;
- On receipt of information Incident controller rush to the site, assess the situation and if required declare emergency by rising siren from ISA control Room;
- On hearing the alarm fire fighting team from other areas rush to the site and join with fire crew;
- Till Safety & Fire co-ordinator arrives, Incident controller will direct and guide the fire fighting team to control the fire;
- In addition to the initiation of siren by incident controller, telephonic communication network will be followed by all concerned;
- Key personnel should report at emergency control room and take advice of Site emergency controller and act according to the procedure; and
- All the employees should reach the safe assembly point or emergency shelter and stay there till emergency call off is given.

7.6.10.1 Role of Shift Engineer

On hearing information about the emergency shift engineer should assess the severity of situation and if necessary shut down the plant properly. The following action to be initiated

- Shut down the plant properly;
- Inform fire station with brief description of fire and location;
- Inform HOD/Incident controller in detail;
- Inform first aid centre/medical co-ordinator and call ambulance, if required;
- Inform Transport and security co-ordinator;
- Inform other plants which are likely to be affected;
- Coordinate firefighting activities till incident controller/Safety & Fire co-ordinator reach the site;
- Alert and evacuate the people working in the plant;
- Continuous announcement through paging system in Tamil & English about fire and evacuation procedure to be followed;
- Stop all work/maintenance activities by checking permits and ensure
evacuation of working group; and
- He should guide the people in the area to reach safe shelters/Assembly points.

7.6.10.2 Role of Fire officer/Fire men

- On receipt of information send the firemen with fire tender and all PPE (SCBA, fire proximity suit, Mask) to the spot;
- Inform Head (HSE)/Manager (HSE) about the incident and location;
- Inform other plants and get the fire fighting team (Auxiliary);
- Inform pump house to start the pump;
- Inform Chief of security and send security guards to the spot. Involve security guards in fighting fire; and
- Rush to the spot and coordinate Fire fighting activities.

7.6.11 Emergency Action Procedure for Gas Release (SO₂/ SO₃)

7.6.11.1 Responsibilities

- In case of anode skim/blister slag returning to converter/duct failure or Accidental release of SO₂ and SO₃, Incident should be immediately conveyed to Smelter Incharges (primary & Secondary) & shift in charge(SAP);
- Shift in charge will assess the situation and shut down the plant. He should ask the DCS/control room operator to inform Incident controller/HOD/Safety and fire co-ordinator; and
- Depending on situation Incident controller will declare emergency by raising the siren. In addition to the initiation of siren, a telephone communication network will be followed.

7.6.11.2 Response

- On receipt of call, all key personnel should assemble at Emergency control room to get advice from Site emergency controller and act accordingly;
- On receipt of information all personnel shall rush to near by emergency shelters;
- Shift in charge should announce continuously through paging system in Tamil & English about evacuation procedure;
- Maintenance in charge should rush to the spot along with his team with all PPE and initiate actions to control/arrest the leak;
- Security personnel on receipt of call should stop the vehicles & visitors entering inside. Some of the security personnel should be sent to the spot with all PPE to regulate the movements of people and vehicle; and
- Safety and fire co-ordinator will ensure the availability of the safety equipment and arrange for rescue of missing person.

7.6.11.3 Rescue

- Fire crew rushes to spot with all PPE, SCBA and rescue endangered people;
- Rescue team should involve in removing the person along with fire crew and hand over the victim to first aid team;
7.6.11.4 Utilities and Support system

- The power co-ordinator will ensure the availability of power for rescue operations;
- Transport co-ordinator will arrange for transport for the victims to the hospitals and to mobilise resources;
- Security co-ordinator will ensure that there is no over crowding and regulate the movement of all the personnel and vehicles;
- Medical co-ordinator will ensure proper first aid treatment and notify the hospital to be ready to receive the victims;
- Safety and fire co-ordinator will ensure preservation of evidence for the investigation of the incident and ensure emergency operation is carried out safely; and
- Site emergency controller will decide and arrange for external agency services based on information from the incident controller.

7.6.11.5 Emergency call off:

Site emergency controller will give all clear signal only after the leak is arrested and the surrounding area checked for safe concentration level.

7.6.12 Emergency Action Procedure for Gas Release (Fluorine)

7.6.12.1 Responsibilities

- In case of duct failure or Accidental release of Fluorine, Incident should be immediately conveyed to SAP by shift in charge(PAP);
- Shift in charge will assess the situation and shut down the plant. He should ask the DCS / Control room operator to inform Incident controller/HOD/Safety and Fire co-ordinator; and
- Depending on situation Incident controller will declare emergency by raising the siren. In addition to the initiation of siren, a telephone communication network will be followed.

7.6.12.2 Response:

- On receipt of call, all key personnel should assemble at Emergency control room to get advice from Site emergency controller and act accordingly;
- On receipt of information all personnel shall rush to near by emergency shelters;
- Shift in charge should announce continuously through paging system in Tamil & English about evacuation procedure;
- Maintenance in charge should rush to the spot along with his team with all PPE and initiate actions to control/arrest the leak;
- Security personnel on receipt of call should stop the vehicles & visitors entering inside. Some of the security personnel should be sent to the spot with all PPE to regulate the movements of people and vehicle; and
- Safety and fire co-ordinator will ensure the availability of the safety equipment and arrange for rescue of missing person
7.6.12.3 Rescue

- Fire crew rushes to spot with all PPE, SCBA and rescue endangered people;
- Rescue team should involve in removing the person along with fire crew and hand over the victim to first aid team;
- Administer first aid to the victims; and
- Shut co-ordinator will decide the shut down of plants.

7.6.12.4 Utilities and Support System

- The power co-ordinator will ensure the availability of power for rescue operations;
- Transport co-ordinator will arrange for transport for the victims to the hospitals and to mobilise resources;
- Security co-ordinator will ensure that there is no over crowding and regulate the movement of all the personnel and vehicles;
- Medical co-ordinator will ensure proper first aid treatment and notify the hospital to be ready to receive the victims;
- Safety and fire co-ordinator will ensure preservation of evidence for the investigation of the incident and ensure emergency operation is carried out safely; and
- Site emergency controller will decide and arrange for external agency services based on information from the incident controller.

7.6.12.5 Emergency Call off

Site emergency controller will give all clear signal only after the leak is arrested and the surrounding area checked for safe concentration level.

7.6.13 Emergency Actions to be taken in Case of Acid Leak/Tank Rupture

7.6.13.1 Responsibilities

- On receiving information regarding leak / rupture of tanks, shift incharge will take charge immediately;
- Inform to HOD, Incident controller, Maintenance incharge and safety & fire co-ordinator immediately;
- In case of Acid leak stop the pump immediately and depending upon extent of leak stop the plant;
- Cordon off the area;
- Evacuate people from the location;
- Spillage should be restricted to a small bund and is to be routed to waste acid tank;
- In case of rupture/leak in a tank, drain the acid to other tanks; and
- Depending on the situation, Incident controller will declare emergency.

7.6.13.2 Response

On hearing siren all personnel shall rush to near by emergency shelters.
**Duties of Maintenance Squad:**

Maintenance squad wearing all protective clothing will move towards the leak area to arrest leak

7.6.13.3 Precautions

- Do not put lime/water immediately to the large quantity as it gives dense fumes/irritant vapour will, spread to other areas and produce large quantity of heat;
- Residual acid in the bund should be neutralised with lime and washed with water; and
- All the personnel engaged in emergency activities should wear all PPE(PVC suit, gum boot, PVC hood/ Splash goggles and mask)

7.6.13.4 First Aid

Move the affected person from the hazardous area. In case of acid splash, remove the cloth and wash with copious amount of water and take him to first aid centre.

7.6.13.5 Emergency Call Off

Site emergency controller will give all clear signals only after the leak is arrested or the spill is brought under control and the surrounding area checked for safety.

7.6.14 Emergency actions during acid leak / tank rupture in Sesa Sterlite’s barge loading at Tuticorin Port Trust

7.6.14.1 Responsibilities

Barging loading in-charge will report the emergency to the Port Trust Fire & Safety Concerned in charge, Acid Plant Process Head and Head (HSE).

- On receiving information regarding leak / rupture of tanks, Head (Safety) and process head rush to the spot immediately.
- They will control and normalization the emergency along with Port Trust Fire and Safety representative, Concerned Port Trust Officers, Ship Captain etc.
- In case of Acid leak stop the pump immediately and depending upon extent of leak stop the plant.
- Cordon off the area.
- Evacuate people from the location.
- Spillage should be restricted to a small bund and is to be routed to waste acid tank.
- In case of rupture/leak in a tank, drain the acid to other tanks.
- Depending on the situation, Incident controller will declare emergency.
7.6.14.2 Response

On receiving the emergency call, the concerned Sesa Sterlite Representative / Port Trust Officials and all personnel will rush to nearby safe place. Maintenance squad wearing all protective clothing will move towards the leak area to arrest leak.

7.6.14.3 Precautions

- Do not put lime/water immediately to the large quantity as it gives dense fumes/irritant vapour will, spread to other areas and produce large quantity of heat.
- Residual acid in the bund should be neutralized with lime and washed with water.
- All the personnel engaged in emergency activities should wear all PPE(PVC suit, gum boot, PVC hood/ Splash goggles and mask)

7.6.14.4 First aid

Move the affected person from the hazardous area. In case of acid splash, remove the cloth and wash with copious amount of water and take him to first aid centre.

7.6.14.5 Emergency call off

Site emergency controller will give all clear signals only after the leak is arrested or the spill is brought under control and the surrounding area checked for safety.

7.6.15 Emergency actions during acid leak / tank rupture while transportation of acid through road at outside the plant premises

7.6.15.1 Responsibilities

1. In case of Acid leak stop the Vehicle (Acid Tanker) immediately at Safer Place depending upon available space and traffic.
2. Cordon off the area with available resource (Barrication Tape, Stones, etc)
3. Evacuate people from the location.
4. Spillage should be restricted to a small bund and is to be routed such a way that it should not affect the people, infrastructure and Environment.
5. In case of rupture/leak in a tank, drain the acid to other tanks.
6. Depending on the situation, the driver should give the Incident details to Logistic In charge, nearby Police Station and Fire Station.
7. On receiving information regarding leak / rupture of tanks, the logistic in charge will take charge immediately and inform to Head (HSE), Product Plant Manager.
8. As per the instruction from Head (HSE) / Product Plant Head, the logistic head should normalize the emergency situation.
7.6.15.2 Duties of Logistic In charge

Logistics in charge should arrange necessary manpower and tools and tackles, maintenance team for repair, process team for neutralizing the acid concentration, spare tanker for acid transfer and adequate personal protective equipments for workers.

7.6.15.3 Precautions

1. Do not put lime/water immediately to the large quantity as it gives dense fumes/irritant vapour will, spread to other areas and produce large quantity of heat.

2. Residual acid in the bund should be neutralized with lime and washed with water.

3. All the personnel engaged in emergency activities should wear all PPE (PVC suit, gum boot, PVC hood/ Splash goggles and mask)

7.6.15.4 First aid

Move the affected person from the hazardous area. In case of acid splash, remove the cloth and wash with copious amount of water and take him to first aid centre.

7.6.15.5 Emergency call off

Site emergency controller will give all clear signals only after the leak is arrested or the spill is brought under control and the surrounding area checked for safety.

7.6.16 Emergency Action during Transformer Fire

7.6.16.1 Responsibility

- On noticing the fire, Shift in-charge shall ensure starting of automatic sprinkler system and inform to HOD/ Incident controller/ fire station;
- In case of fire ensure that the circuit is dead;
- The power co-ordinator will ensure the availability of power, safe electrical circuits, and uninterrupted power supply for critical equipment and services needed for emergency operations;
- Shut down co-ordinator will initiate shut down procedures based on the situation; and
- Depending on the situation, Incident controller will declare emergency.

7.6.16.2 Response

- Fire fighting squad should reach the place immediately on receipt of information; and
- On hearing siren all personnel should rush to near by emergency shelter.
7.6.16.3 Fire Fighting

- Foam and water streams may be used with great care, keeping in consideration the danger of live wire;
- Keep safe distance of at least 2 metres. Know the actual nozzle size and KV rating to obtain safe distance;
- Wheeled DCP Extinguishers shall be used;
- All metal works near by must be properly earthed to prevent them from becoming live;
- Firemen must expect danger from electricity in the dark or smoke and well trained to recognize the hazards in advance; and
- Adequate protection must be ensuring from accidental spraying of burning oil resulting from rupture of transformer casing.

7.6.16.4 Emergency Call Off

Site emergency controller will give all clear signals only after the fire is put out and the surrounding area checked for safety.

7.6.17 Emergency Action during Cable Cellar Fire

7.6.17.1 Responsibility

- On receipt of warning/ information through smoke detector or person inform HOD, Electrical dept, Incident controller and fire station;
- On receipt of information, incident controller will rush to the spot, assess the situation and declare emergency;
- The power co-ordinator will ensure the availability of power, safe electrical circuits, and uninterrupted power supply for critical equipment and services needed for emergency operations; and
- Shut down co-ordinator will initiate shut down procedures based on the situation.

7.6.17.2 Response

- On receipt of information fire squad shall rush to the location; and
- On hearing the siren all personal should rush to near by Emergency shelter.

7.6.17.3 Fire Fighting

- Foam and water streams may be used with great care, keeping in consideration the danger of live wire;
- Keep safe distance of at least 2 metres;
- Wheeled DCP Extinguishers shall be used;
- Regulate the use of firewater, as the absorption of HCL can cause corrosion and damage;
- PVC Cables emits toxic gases. Adequate protection shall be taken;
- All metal works near by must be properly earthed to prevent them from becoming live; and
- Firemen must expect danger from electricity in the dark or smoke and will trained to recognize the hazards in advance.
7.6.17.4 Emergency Call Off

Site emergency controller will give all clear signal only after the fire is put out and the surrounding area checked for safety.

7.6.18 Emergency Action during Foam over at ISA Furnace

7.6.18.1 Responsibilities

- On detection of foam over Shift in-charge should inform HOD/Incident controller and fire station;
- Feed to be stopped immediately;
- Shift in-charge shall initiate action to remove the people and cordoned the area;
- On receiving the information, incident controller will rush to the spot, assess the situation and declare emergency;
- Shut down co-ordinator will decide whether the plant needs to be shut down and sequence of shut down;
- Inform LPG station, oxygen plant and SAP to initiate necessary action; and
- Depending on the situation, Incident controller will declare emergency.

7.6.18.2 Response

- On hearing the siren, all personnel should rush to near by emergency shelter; and
- The affected area shall be cordoned off and unauthorised entry to be restricted.

7.6.18.3 Rescue

- Rescue team with necessary Personal protective equipment shall reach the place and move the victim from the place and hand over to medical team;
- Medical team will administer medicines to the victims; and
- Fire squad shall cool the metal.

7.6.18.4 Utilities and Support System

- The power co-ordinator will ensure the availability of power for rescue operations;
- Transport co-ordinator will arrange for transport for the victims to the hospitals and to mobilise resources;
- Security co-ordinator will ensure that there is no over crowding and regulate the movement of all the personnel and vehicles;
- Medical co-ordinator will ensure proper first aid treatment and notify the hospital to be ready to receive the victims;
- Safety and fire co-ordinator will ensure preservation of evidence for the investigation of the incident and ensure emergency operation are carried out safely; and
- Site emergency controller will decide and arrange for external agency services based on information from the incident controller.
7.6.18.5 Emergency Call Off

Site emergency controller will give all clear signals only after the fire is put out and the surrounding area checked for safety.

7.6.19 Emergency Action during Liquid Oxygen Tank Explosion

7.6.19.1 Responsibility

- On seeing the accident, inform HOD, Incident controller and fire station;
- On receipt of information, incident controller will rush to the spot, assess the situation and declare emergency;
- The shift incharge shall arrange for the containment of the liquid spilled so that it does affect the persons nearby the vicinity;
- The power co-ordinator will ensure the availability of power, safe electrical circuits, and uninterrupted power supply for critical equipment and services needed for emergency operations;
- Shut down co-ordinator will initiate shut down procedures based on the situation; and
- Depending on the situation, Incident controller will declare emergency.

7.6.19.2 Response

- On receipt of information fire & rescue squad shall rush to the location; and
- On hearing the siren all personnel should rush to near by Emergency shelter.

7.6.19.3 Precautions

- Water streams may be used with great care;
- Keep safe distance of at least 2 metres;
- Regulate the use of firewater;
- Adequate protection shall be taken for nearing the area;
- Cold burns may occur due to lower temperature of Liquid Oxygen; and
- Firemen & Rescue team should be able to recognize the hazards in advance.

7.6.19.4 Emergency Call Off

Site emergency controller will give all clear signal only after the area is brought to normalcy and the surrounding area checked for safety.

7.6.20 Emergency Action during Steam Explosion in WHRB

7.6.20.1 Responsibilities

- On seeing incident person should inform Shift in-charge and inturn he will inform HOD/Incident controller and fire station;
- Feed to be stopped immediately. Lance will be taken out and guard to be positioned;
- Sliding gate to be placed as per SOP;
- Shift in-charge shall initiate action to remove the people and cordoned the area;
7.6.20.2 Response

- On hearing the siren, all personnel should rush to nearby emergency shelter; and
- The affected area shall be cordoned off and unauthorised entry to be restricted.

7.6.20.3 Rescue

- Rescue team with necessary Personal protective equipment shall reach the place and move the victim from the place and hand over to medical team;
- Medical team will administer medicines to the victims; and
- Fire squad shall cool the metal.

7.6.20.4 Utilities and Support System

- The power co-ordinator will ensure the availability of power for rescue operations;
- Transport co-ordinator will arrange for transport for the victims to the hospitals and to mobilise resources;
- Security co-ordinator will ensure that there is no over crowding and regulate the movement of all personnel and vehicles;
- Medical co-ordinator will ensure proper first aid treatment and notify the hospital to be ready to receive the victims;
- Safety and fire co-ordinator will ensure preservation of evidence for the investigation of the incident and ensure emergency operation are carried out safely; and
- Site emergency controller will decide and arrange for external agency services based on information from the incident controller.

7.6.20.5 Emergency Call Off

Site emergency controller will give all clear signal only after the fire is put out and the surrounding area checked for safety.

7.6.21 Emergency arising from Bomb Threat Preparedness

7.6.21.1 Detection & Early Warning

- Increased surveillance, metal detectors are included to detect explosive...
devises by security personnel;
- Surveillance to keep vigil on sensitive areas, such as LPG bullet, HSD & FO and Central stores;
- Strict procedures will be established for control and inspection of all incoming packages and material entering in the plant;
- All security and maintenance personnel will be trained and alerted to look for suspicious appearing or unfamiliar persons or objects; and
- Security persons and maintenance personnel are instructed to make periodic checks to make certain that unauthorised person is not hiding, by reconnoitering the area.

7.6.21.2 Information regarding Bomb Threats

- Bomb threats received over the telephone will be considered as warning;
- The person receiving the call shall take as much information as possible from the threatening caller to give the experts and the emergency management team more facts to decide on a response plan;
- This information must be passed on to the emergency team (Incident controller and site emergency controller) for analysis and data banks for preventive measures;
- Every possible effort shall be taken to retain evidence such as fingerprints, handwriting or type writing, paper and postal markings, which are essential to tracing the threat and identifying the writer; and
- All bomb threats must be considered valid until proven otherwise.

7.6.21.3 Responsibility

- On receiving information of possible bomb threat, the incident controller will verify and assess the scale of incident, declare emergency and initiate control procedures such as sounding siren;
- Incident controller shall identify the nearest assembly point/Emergency shelters and the safest evacuation route based on the information regarding location of bomb;
- On receiving information all coordinators shall assemble at emergency control center and take orders from site emergency controller; and
- Shut down coordinator shall decide whether the plant need to be shut down, if required shut down sequence to be initiated.

7.6.21.4 Identification of the Location of Bomb and Time before Explosion

- Accurate identification of the time and location gives a better chance of avoiding casualties; and
- Expert shall call for detection and removal of bomb/ disposable of bomb.

7.6.21.5 Evacuation & Safety of Personnel

- Bomber warnings can force an evacuation. The decision to evacuate will be based on calculated risks with prime consideration to safety of people;
- In this case of hoaxes, such a decision could prove costly and resulting in stoppage of activity & down time loss; and
• If dangerous condition exist, the numbers of personnel will be kept to the minimum. All personnel will of course be evacuated and the main emergency squads kept at readiness as near as in considered safe.

**Precautions**

**Over Pressures & Fires from Explosion**

Terrorist bombings involve chemical explosions. The detonation of a bomb can cause blast pressure, incendiary effects and fragmentation effects.

• The minimum safe distance of 100m will be maintained strictly in event of an explosion; and
• Bomb blasts in the plant will not by themselves, normally start a fire. Fires that follow bombings usually result from broken electrical circuits or ruptured oil or gas lines.

7.6.21.6 Disposal of Device & External Help

• The company must contact the police, fire department or other local govt. agencies for bomb disposal; and
• Off site emergency shall decide to have security specialists and police and fire personnel to inspect the areas where explosives are most likely to be placed.

**In Case of Bomb Explodes**

It is possible that the casualties can occur or fire can break out. The same procedure for fire and explosion will be followed.

7.6.21.7 General Precautions

• No one shall ever touch a strange object;
• In event of any object being noticed, its location and description shall be inform to chief of security;
• When danger zone is located, the area will be blocked off or barricaded until the object has been removed or disarmed. The clear zone will extend at least 100 m in all directions from the object;
• Alternative evacuation route to be identified, the route should not pass through the object;
• Suspicious area to be cordoned off and warning signs to be put;
• People shall be evacuated to a safe distance in order to protect them against flying object;
• Keep people away from glass objects that could shatter if a bomb were to go off;
• If the plant is evacuated, all critical lines (carries gas, oil, acids) to be turned off; and
• In case of switching off of electrical power, alternative arrangements to be made considering the lighting requirements of search teams; and
• Medical personnel will be alerted to stand by in case of an accident or explosion.
7.6.21.8 Precautions to follow when Searching the Area

- Searching for a bomb is major job and also highly critical;
- Detailed searches have to be conducted by a separate evacuation unit who are all familiar with the area;
- Evacuate the area and remove all personal property;
- Check the area for unusual packages, wires evidences of tampering;
- Be alert for small charges placed to cut the control cables;
- Pay special attention to refuse disposal containers and check food preparation and service area;
- Listen for sound of any clock work devices; Frequently clock work mechanism can be detected even without the special equipment;
- The searchers can use electronic or medical stethoscopes on walls, furniture items, floors etc;
- When area is searched and nothing is found, a sign or other marker indicating “search completed” will be posted in conspicuous locations;
- After the room is searched, and if any potential bombs are found anywhere in the course of search, all windows and doors in the area shall be opened; This will allow dispersion of any blast wave and reduce structural damage;
- Sandbags or mattress, but not metal plates can be put around any suspicious article. But that will be done by experienced bomb squad;
- Whenever suspicious material is located, accurate description has to be reported immediately to the emergency control centre;
- If suspicious object has bee found, search team will get out of the area immediately. There is nothing further it can safely do in that location. The search team will guide the bomb squad experts to the suspected area;
- The findings of one explosive device, or bomb, do not mean that there are no other explosives. The emergency team acting on the best available information it has at the time has to determine whether the search should be continued or completed; and
- Decision about disposal of bomb will be made only by bomb squad;

7.6.21.9 Follow-Up

- The investigation will continue till answers to questions such as the following are obtained to prevent further attacks:
  - Who did it?
  - Why was it done?
  - How it was done?

7.6.21.10 Communicating to the Public through the Media

- Such incidents create adverse impact on the business; It is there fore the responsibility of the plant top to communicate to the public through the press the various actions and steps take by emergency team to defuse or mitigate the threat or disaster;
- All queries to be answer only by public relations coordinator in consultation with site emergency controller;
- All other people shall be instructed not to discuss the situation with outsiders; and
Most questions will be speculative and Public relation coordinator will keep that word in mind when declining to answer questions.

7.6.22 Emergency Action against Natural Calamities

7.6.22.1 Response

- Communication coordinator will confirm the Information about the Natural Calamity with the Offsite Emergency Controller and he will inform to the Site Emergency Controller;
- Communication coordinator will inform to all emergency coordinators;
- Communication coordinator will inform to all employees in the plant in consultation with the Site emergency controller to assemble them in nearby Emergency shelters and Safe Assembly Points;
- Communication coordinator will inform the number of persons inside the plant to the Facilities Coordinator, Transport Coordinator and Medical coordinator;
- Facilities coordinator will arrange the additional facilities required for the number of persons in the plant and he will inform the status to the Site emergency controller;
- Transport coordinator will arrange adequate Transport Facilities to evacuate the persons in the plant at that time and he will inform the status to the Site emergency controller;
- Medical coordinator will arrange adequate medical facilities to tackle the situation and he will inform the status to the Site emergency controller;
- Requirement to be evolved by the Transport coordinator and Facilities coordinator for additional transport and other facilities;
- Additional facilities will be arranged by the Transport coordinator and Facilities coordinator from the industries in Mutual Aid;
- Shutdown coordinator will ensure adequate number of Technical persons in plant for Safe Shutdown and he will inform the status to the Site emergency controller;
- Power coordinator will ensure the availability of Power for Safe shutdown and Safe evacuation;
- Incident controller and Security coordinator will ensure that all Hazardous storage facilities and Installations are rendered safe and secured;
- Communication coordinator will have liaison with the Offsite Emergency controller to monitor the status continuously and will inform to the site emergency controller;
- Requirement of the shutdown of the plant will be decided by the incident controller in consultation with the offsite Emergency controller through communication coordinator;
- If required safe shutdown of the plant will be ensured by the shutdown coordinator;
- Location of the Safe assemble point and escape route for safe evacuation will be decided by the Transport and Security coordinator in consultation with the Site Emergency controller; and
- Safe evacuation of the people will be ensured by the Transport coordinator and security coordinator as per the Priority and Importance.
7.6.23 Emergency Action Procedure High Fly over of Dust

7.6.23.1 Responsibilities

In case of High fly loss of dust in ware house, Incident should be immediately conveyed to Smelter Incharges (primary).

- Shift in charge will assess the situation and shut down the plant. He should ask the DCS / Control room operator to inform Incident controller/HOD/Safety and Fire co-ordinator; and
- Depending on situation Incident controller will declare emergency by raising the siren. In addition to the initiation of siren, a telephone communication network will be followed.

7.6.23.2 Response

- On receipt of call, all key personnel should assemble at Emergency control room to get advice from Site emergency controller and act accordingly;
- On receipt of information all personnel shall rush to near by emergency shelters;
- Shift in charge should announce continuously through paging system in Tamil & English about evacuation procedure;
- Maintenance in charge should rush to the spot along with his team with all PPE and initiate actions to control/arrest the leak;
- Security personnel on receipt of call should stop the vehicles & visitors entering inside; Some of the security personnel should be sent to the spot with all PPE to regulate the movements of people and vehicle; and
- Safety and fire co-ordinator will ensure the availability of the safety equipment and arrange for rescue of missing person

7.6.23.3 Rescue

- Fire crew rushes to spot with all PPE, SCBA and rescue endangered people;
- Rescue team should involve in removing the person along with fire crew and hand over the victim to first aid team;
- Administer first aid to the victims; and
- Shut down co-ordinator will decide the shut down of plants.

7.6.23.4 Utilities and Support System

- The power co-ordinator will ensure the availability of power for rescue operations;
- Transport co-ordinator will arrange for transport for the victims to the hospitals and to mobilise resources;
- Security co-ordinator will ensure that there is no over crowding and regulate the movement of all the personnel and vehicles;
- Medical co-ordinator will ensure proper first aid treatment and notify the hospital to be ready to receive the victims;
- Safety and fire co-ordinator will ensure preservation of evidence for the investigation of the incident and ensure emergency operation is carried out safely; and
• Site emergency controller will decide and arrange for external agency services based on information from the incident controller;

7.6.23.5 Emergency Call Off

Site emergency controller will give all clear signal only after the leak is arrested and the surrounding area checked for safe concentration level.

Mitigatory Measures:
Fire:

<table>
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<tr>
<th>Location</th>
<th>Emergency situation</th>
<th>Containment / Mitigatory measures</th>
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</thead>
</table>
| Storage of LPG                | Fire in the LPG pipeline/storage bullet | • Try to isolate the vicinity of fire from the source of fuel (LPG) wearing the fire proximity suit and allow the fire to continue till the fuel is consumed.  
• Cool the adjacent storage bullet or pipelines with spray of water from Medium velocity spray system or from water monitor.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |
| Storage of FO, HSD & LSHS     | Fire in the storage vessel or in the pipelines | • Put out the fire by using Foam monitor / foam extinguisher.  
• Cool the adjacent storage tanks or pipelines with spray of water.  
• Use fire proximity suit to enter into the fire area for any isolation if possible.  
• After fire is put out remove the debris to Secured landfill.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |
| SS1 Cable cellar              | Fire in the cables                       | • Isolate the power supply in all the power cables running inside the cable cellar.  
• Use CO₂ or DCP trolley type or portable DCP type fire extinguishers to put out the fire.  
• Put sand at the other end of fire (if accessible) so that fire does not spread throughout the length.  
• Dispose of the DCP powder waste to the secured landfill. |
| 230 kVA / 6.6 kVA Transformer | Fire in the transformer oil tank         | • Isolate the transformer under fire.  
• Use water **ONLY from** the high velocity water spray system to put out the fire.  
• Fire extinguishers (DCP or CO₂) can also be used if the area is accessible.  
• Use fire proximity suit.  
• Dispose of the DCP powder waste to the secured landfill.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |
| ISA furnace                   | Fire in the underlying structures, materials due to ISA foam over | • Use DCP extinguisher to put out the fire.  
• Water can be used as a spray only for cooling purpose not for fire fighting.  
• Lay metal sheets if possible in the floors below to avoid metal spillage on the other floors.  
• Dispose of the DCP powder waste to the secured landfill.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |
Environmental Impact Assessment for the Proposed Copper Smelter Plant-II (1200 TPD Copper / 4.38 LTPA Copper) in the SEZ at SIPCOT Industrial Complex, Therkku Veerapandiapuram Village, Ottagidaram Taluka, Thoothukudi District, Tamilnadu

## Chapter 7
### Additional Studies

### Explosion:

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<tr>
<th>Location</th>
<th>Emergency situation</th>
<th>Containment / Mitigatory measures</th>
</tr>
</thead>
</table>
| WHRB super heater | Fire in Day oil tank | • Use foam type extinguisher to put out the oil fire.  
• If fire spreads in the other combustible material then use DCP extinguisher to put out the fire.  
• Dispose of the DCP powder / Foam waste to the secured landfill. |

<table>
<thead>
<tr>
<th>Location</th>
<th>Emergency situation</th>
<th>Containment / Mitigatory measures</th>
</tr>
</thead>
</table>
| Storage of LPG | Explosion of the storage bullet | • Cool the adjacent storage bullet or pipelines if intact with spray of water from Medium velocity spray system or from water monitor after wearing fire proximity suit.  
• Allow the fire to burn out completely all the excess fuel.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |

<table>
<thead>
<tr>
<th>Location</th>
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</table>
| 230 kVA / 6.6 kVA Transformer area | Explosion of breakers, transformers or capacitor | • Isolate the transformer / breaker / capacitor which has exploded from electric supply.  
• Use water **ONLY from** the high velocity water spray system to put out the fire.  
• Fire extinguishers (DCP or CO₂) can also be used if the area of fire is accessible.  
• Use fire proximity suit.  
• Dispose of the DCP powder waste to the secured landfill.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |

<table>
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| ISA furnace | Explosion due to cooling water ingress into the furnace | • Cool the hot metal splashed with spray of water.  
• Use DCP/CO₂ fire extinguisher to put out fire in the adjacent structures.  
• Do not allow other people to enter as metal may be splashed all over.  
• Dispose of the DCP powder waste to the secured landfill.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |

<table>
<thead>
<tr>
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</table>
| Liquid Oxygen storage | Explosion | • Make containment for the spilled liquid oxygen so that it does not affect others.  
• Do not allow other people to enter as exploded pieces may cause cold burn injury.  
• Pour plenty of water over the liquid spilled to allow faster evaporation.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |

<table>
<thead>
<tr>
<th>Location</th>
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</tr>
</thead>
</table>
| WHRB | Steam Explosion | • Use DCP / CO₂ fire extinguishers to put out fire in the adjacent structures.  
• ISA feed to be stopped and lance to be taken out  
• Sliding gate to be positioned as per procedure  
• Do not allow other people to enter as exploded pieces may cause burn injury.  
• The wastewater will reach the storm water drain and it will be collected in the water collection pit for further action. |
### Toxic Release:

<table>
<thead>
<tr>
<th>Location</th>
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<th>Containment / Mitigatory Measures</th>
</tr>
</thead>
</table>
| Smelter to Sulphuric acid plant SO₂ transfer line | Toxic release of Sulphur dioxide | • Shut down the smelting process immediately if not tripped.  
• Subsequently shut down the Sulphuric acid plant.  
• With the Self-contained breathing apparatus (SCBA) on, try to arrest the leak. |
| Phosphoric acid plant | Release of fluorine | • Shut down the plant immediately.  
• With SCBA on, try to arrest the leak. |
| 230 kVA Transformer area | Release of aerosols, smoke & Carbon monoxide due to fire in the transformer oil tank | • Use water ONLY from the high velocity water spray system to put out the fire.  
• Fire extinguishers (DCP or CO₂) can also be used if the area is accessible.  
• Use Self contained breathing apparatus if excessive smoke is there.  
• Dispose of the DCP powder waste to the secured landfill. |
| SS1 Cable cellar | Release of Toxic gases from PVC insulated cables | • Use Self contained breathing apparatus as the chlorine smoke generated is very dangerous.  
• Do not allow any other person inside as they may get suffocated.  
• Use CO₂ or DCP trolley type or portable DCP type fire extinguishers to put out the fire and hence the smoke.  
• Put sand at the other end of fire (if accessible) so that fire does not spread throughout the length.  
• Dispose of the DCP powder waste to the secured landfill. |

### Spill:

<table>
<thead>
<tr>
<th>Location</th>
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<th>Containment / Mitigatory measures</th>
</tr>
</thead>
</table>
| Storage of Sulphuric acid bund | Major spills of acid into bund, that will result in localized formation of acid mist / fumes | Shut down the Sulphuric acid plant and the smelting process immediately.  
Wear the Self-contained breathing apparatus or airline respirator on and full PVC suit with PVC gloves.  
Start the pumping arrangement in the collection pit and transfer the spilled acid to another storage tank or suitable location.  
After the acid recovery is over to the extent possible, spread lime over the acid for neutralization with care so that acid does not splash.  
After the neutralization is over, clean the area by taking off all the residues and transfer it to the Effluent treatment plant. |
| Sulphuric acid & Phosphoric acid Barge Loading | Major spills of acid into ship bearth and sea water, that will result in localized formation of acid mist / fumes and sea water contamination. | Shut down the Barge Loading in coordination with Ship representative and Acid Tanker drivers immediately.  
After ensuring the required PPE like respirator, full PVC suit with PVC gloves and Face shield with helmet etc, the required valve will be closed to avoid further spill / leak.  
After Isolation of acid spill and leak, spread lime over the acid for neutralization with care so that acid does not splash.  
After the neutralization is over, clean the area |
### Additional Studies

**Environmental Impact Assessment for the Proposed Copper Smelter Plant-II (1200 TPD Copper/ 4.38 LTPA Copper) in the SEZ at SIPCOT Industrial Complex, Therkku Veerapandiapuram Village, Ottapidaram Taluka, Thoothukudi District, Tamilnadu**

**Chapter 7**

#### Location

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<th>Location</th>
<th>Emergency situation</th>
<th>Containment / Mitigatory measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphuric acid and Phosphoric acid Road Transportation through Acid Tanker</td>
<td>Major spills of acid into Road, land and water that will result in localized formation of acid mist / fumes and water contamination.</td>
<td>Park the Acid tanker at nearer safe place. After ensuring the required PPE like respirator, full PVC suit with PVC gloves and Face shield with helmet etc, the required safety precaution will be taken to eliminate / control the hazard. After Isolation of acid spill and leak , spread lime over the acid for neutralization with care so that acid does not splash. After the neutralization is over, clean the area by taking off all the residues and transfer it to the Effluent treatment plant.</td>
</tr>
<tr>
<td>Storage of Sulphuric acid</td>
<td>Major spills of acid into bund, that will result in localized formation of acid mist / fumes</td>
<td>Shut down the Phosphoric acid plant. Wear the Self-contained breathing apparatus or airline respirator on and full PVC suit with PVC gloves. Start the pumping arrangement in the collection pit and transfer the spilled acid to another storage tank or suitable location. After the acid recovery is over to the extent possible, spread lime over the acid for neutralization with care so that acid does not splash. After the neutralization is over, clean the area by taking off all the residues and transfer it to the Effluent treatment plant.</td>
</tr>
<tr>
<td>WWTP</td>
<td>Spill of Effluent when there is a damage to SLF due to sudden rupture of bunds during Flood</td>
<td>Stop further loading of SLF. Wear the Self-contained breathing apparatus and full PVC suit with PVC gloves. Collect the spills and store it in a temporary area, whci is adequately covered. After collecting the spill completely, Civil activities to rectify the damage to be done. Clean the area with top layer of sand.</td>
</tr>
</tbody>
</table>

#### Accident:

<table>
<thead>
<tr>
<th>Emergency Situation</th>
<th>Impact</th>
<th>Containment / Mitigatory Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall of person</td>
<td>Injury with or without fracture, loss of body parts due to non-adherence to safe practices.</td>
<td>Bring down the victim (if he is working at height) without panic. Administer the first aid for any injury on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td>Fall of object</td>
<td>Injury with or without fracture, loss of body parts due to non-adherence to safe practices.</td>
<td>Bring down the victim (if he is working at height) without panic. Administer the first aid on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td>Hot metal splash</td>
<td>Burn injury due to non-adherence to safe practices.</td>
<td>Administer first aid to the victim by putting copious amount of water. Remove any cloth pieces if any and if it can be removed easily. Apply Burnol on the spot of wound. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td>Electrocution</td>
<td>Electrocution, burn injury, muscle</td>
<td>Cut off the supply If it is not possible to isolate to electrical supply,</td>
</tr>
</tbody>
</table>
## Environmental Impact Assessment for the Proposed Copper Smelter Plant-II (1200 TPD Copper/ 4.38 LTPA Copper) in the SEZ at SIPCOT Industrial Complex, Therkku Veerapandiapuram Village, Ottapidaram Taluka, Thoothukudi District, Tamilnadu

### Chapter-7

#### Additional Studies

<table>
<thead>
<tr>
<th>Emergency Situation</th>
<th>Impact</th>
<th>Containment / Mitigatory Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caught between</strong></td>
<td>Injury with or without fracture, loss of body parts due to non-adherence to safe practices.</td>
<td>Stop the machine in which the victim is trapped. Disengage the victim from the nip point of the machine. Administer the first aid on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Collision with truck / acid tanker</strong></td>
<td>Injury with or without fracture, loss of body parts due to non-adherence to safe practices.</td>
<td>Remove the victim from the accident spot. Administer the first aid on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Fainting due to suffocation</strong></td>
<td>Fainting due to release of gas in the area due to poor maintenance.</td>
<td>Remove the victim from the accident spot. Administer the first aid (Mouth to Mouth respiration) on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Drowning in water</strong></td>
<td>Falling into water ponds.</td>
<td>Remove the victim with the help of personnel available who can swim. If required wear necessary protective clothing such as PVC suits, Acid splash goggles, etc. Use of long rope available with maintenance department is advisable. Dewater the victim if he/she has swallowed water. Administer first aid (Mouth to Mouth respiration, if required) on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Acid splash</strong></td>
<td>Acid burn injury due to non-adherence to safe practices.</td>
<td>Administer the first aid with plenty of water for 15 minutes on the spot. Apply safety gels if Sulphuric acid burn injury. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Contact with hot water</strong></td>
<td>Burn injury due to non-adherence to safe practices.</td>
<td>Administer the first aid with plenty of water for 15 minutes on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Cold burns</strong></td>
<td>Burn injury from sub zero temperature liquid, due to non-adherence to safe practices.</td>
<td>Administer the first aid with plenty of warm water for 15 minutes on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Steam burns</strong></td>
<td>Burn injury due to steam leak</td>
<td>Administer the first aid with plenty of water for 15 minutes on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Handling of ESP dust if fly loss is high</strong></td>
<td>Fainting due to inhalation of toxic dust</td>
<td>Remove the victim from the accident spot. Administer the first aid on the spot. Shift the victim to the Occupational health centre at the earliest.</td>
</tr>
<tr>
<td><strong>Steam Leak</strong></td>
<td>Noise Pollution</td>
<td>Information to be passed to the boiler operator. Personal should not be allowed until leak is arrested</td>
</tr>
</tbody>
</table>
Environmental Impact Assessment for the Proposed Copper Smelter Plant-II (1200 TPD Copper/ 4.38 LTPA Copper) in the SEZ at SIPCOT Industrial Complex, Therkku Veerapandiapuram Village, Ottapidaram Taluka, Thoothukudi District, Tamilnadu

Chapter 7
Additional Studies

<table>
<thead>
<tr>
<th>Emergency Situation</th>
<th>Impact</th>
<th>Containment / Mitigatory Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica dust fly - Loading from the heap to hopper by loader</td>
<td>Air Pollution</td>
<td>Dust Extraction system to be implemented.</td>
</tr>
<tr>
<td>Evolution of acid mists - electro winning</td>
<td>Exposure to acid mist</td>
<td>Respirator usage should be adhered.</td>
</tr>
<tr>
<td>Evolution of acid mist during electro-refining</td>
<td>Exposure to acid mist</td>
<td>Respirator usage should be adhered.</td>
</tr>
<tr>
<td>Failure of Tuyere flab ball during converter blowing operation</td>
<td>Noise Pollution</td>
<td>Information to be passed to the shift incharge (Secondary Smelter) Shift in charge (Secondary Smelter) will inform DCS operator to stop the Converter Blow. Personal should not be allowed till situation normalizes.</td>
</tr>
</tbody>
</table>

7.6.25 Emergency situation due to public unrest

Emergency situation envisaged due to public unrest like strike by workers or villagers or any such activities of social origin. Threat to employees, workers or villagers by terrorists/anti-social elements may also be considered.

Situations envisaged due to public unrest are given in table below.

7.6.25.1 Emergency Situation due to Social Reasons

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Situation</th>
<th>Effect/ Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unrest in surrounding villages</td>
<td>Disturbance of work due to road blockages</td>
</tr>
<tr>
<td>2</td>
<td>Civil commotion</td>
<td>Demonstration and stoppage of work and blockage of entry gates Injury or death to human being Property damage</td>
</tr>
</tbody>
</table>

7.6.24.2 Preparedness for emergencies due to Public Unrest

- Thorough & Effective checking of all employees and sub contractor employees at all the entrances to the plant.
- Nearby police stations with telephone numbers identified for reporting such emergency.
- Continuous monitoring by the security personnel.

7.6.24.3 Response Requirement for Public Unrest

- The person noticing the emergency will inform Security department who will further inform to Site emergency controller.
- If required information will be given by the Chief of Security to local police station about the situation and ask for protection.
Mitigatory Measures:

<table>
<thead>
<tr>
<th>Emergency Situation</th>
<th>Impact</th>
<th>Containment / Mitigatory Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil commotion</td>
<td>Injury or death to human being</td>
<td>Cordon off the affected area. Administer the first aid on the spot.</td>
</tr>
<tr>
<td></td>
<td>Property damage and intense fire of vehicle/property may pollute environment.</td>
<td>Shift the victim to the occupational health centre at the earliest.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Call police/Fire brigade for help.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clear debris from the site.</td>
</tr>
</tbody>
</table>

7.6.25 Off-Site Emergency Preparedness Plan

Specific information on the incident which has potential to affect areas outside the plant premises need to the informed to the district authorities who will be responsible for preparation and implementation of the off-site disaster plan. The plan would be prepared with the assistance from neighboring industries so that resources can be pooled to face any disaster scenario.

The measures that may be taken into account may embrace the following fields:

- Allocation of duties among the plant fire brigade, City/District fire brigade, police auxiliary forces;
- Co-operation between plant and city fire brigade;
- Setting up of control stations;
- Use of air monitoring vehicles;
- Establishment of danger e.g. determination of extent of a gas cloud;
- Warning of population with sirens, by radio, television or lour speaker;
- Evacuation (only in special cases);
- Setting-up of road-blocks, diversion, direction of traffic;
- Keeping roads clear for operational and rescue vehicles; and
- Arrangement of medical treatment facilities and transport arrangements.

7.6.25.1 Introduction

Off-site emergency plan follows the on-site emergency plan. When the consequences of an emergency situation go beyond the plant boundaries, it becomes an off-site emergency. Off-site emergency is essentially the responsibility of the public administration. However, the factory management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighboring population.

The off-site plan in detail will be based on those events, which are most likely to occur, but other less likely events, which have severe consequence will also be considered. Incidents, which have very severe consequences yet have a small probability of occurrence, shall also be considered during the preparation of the plan. However, the key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan.
The roles of the various parties who will be involved in the implementation of an off-site plan are described below. Depending on local arrangements, the responsibility for the off-site plan shall be either rest with the works management or, with the local authority. Either way, the plan shall identify an emergency co-ordinating officer, who would take the overall command of the off-site activities. As with the on-site plan, an emergency control center shall be setup within which the emergency co-ordinating officer can operate.

An early decision will be required in many cases on the advice to be given to people living "within range" of the accident - in particular whether they shall be evacuated or told to go indoors. In the latter case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors:

a. In the case of a major fire but without explosion risk (e.g. LPG storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically;

b. If a fire is escalating and in turn threatening a store of hazardous material, it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people shall be advised to stay indoors and shield themselves from the fire. This latter case particularly applies if the installation at risk could produce a fireball with vary severe thermal radiation effects (e.g.LPG storage);

c. For release or potential release of toxic materials, limited evacuation may be appropriate down wind if there is time. The decision would depend partly on the type of housing "at risk". Conventional housing of solid construction with windows closed offers substantial protection from the effects of a toxic cloud, while shanty house, which can exist close to factories, offer little or no protection.

The major difference between releases of toxic and flammable materials is that toxic clouds are generally hazardous down to much lower concentrations and therefore hazardous over greater distances. Also, a toxic cloud drifting at, say 300 m per minute covers a large area of land very quickly. Any consideration of evacuation shall take this into account. Although the plan will have sufficient flexibility built in to cover the consequences of the range of accidents identified for the on-site plan, it will cover in some detail the handling of the emergency to a particular distance from each major hazard works.

7.6.25.2 Aspects considered in the Off-Site Emergency Plan

The main aspects, which shall be included in the emergency plan are:

- **Organization**

  Details of command structure, warning systems, implementation procedures, emergency control centers.
Names and appointments of incident controller, site main controller, their deputies and other key personnel.

- **Communications**
  Identification of personnel involved, communication center, call signs, network, lists of telephone numbers.

- **Specialized knowledge**
  Details of specialist bodies, firms and people upon whom it may be necessary to call e.g. those with specialized chemical knowledge, laboratories.

- **Voluntary Organizations**
  Details of organizers, telephone numbers, resources etc.

- **Chemical Information**
  Details of the hazardous substances stored or procedure on each site and a summary of the risk associated with them.

- **Meteorological Information**
  Arrangements for obtaining details of whether conditions prevailing at the time and whether forecasts.

- **Humanitarian Arrangements**
  Transport, evacuation centers, emergency feeding treatment of injured, first aid, ambulances, temporary mortuaries.

- **Public Information**
  Arrangements for a] dealing with the media press office; b] informing relatives, etc.

- **Assessment**
  Arrangements for: (a) collecting information on the causes of the emergency; (b) reviewing the efficiency and effectiveness of all aspects of the emergency plan.

7.6.25.3 **Role of the Emergency Co-ordinating Officer**

The various emergency services shall be co-ordinated by an emergency co-ordinating officer (ECO), who will be designated by the District Collector. The ECO shall liaise closely with the site main controller. Again depending on local arrangements, for very severe incidents with major or prolonged off-site consequences, the external control shall be passed to a senior local authority administrator or even an administrator appointed by the central or state government.
7.6.25.4 Role of the Local Authority

The duty to prepare the off-site plan lies with the local authorities. The emergency planning officer (EPO) appointed shall carry out his duty in preparing for a whole range of different emergencies within the local authority area. The EPO shall liaise with the works, to obtain the information to provide the basis for the plan. This liaison shall ensure that the plan is continually kept up to date.

It will be the responsibility of the EPO to ensure that all those organizations, which will be involved off site in handling the emergency, know of their role and are able to accept it by having for example, sufficient staff and appropriate equipment to cover their particular responsibilities. Rehearsals for off-site plans shall be organized by the EPO.

7.6.25.5 Role of Police

Formal duties of the police during an emergency include protecting life and property and controlling traffic movements.

Their functions shall include controlling bystanders evacuating the public, identifying the dead and dealing with casualties, and informing relatives of death or injury.

7.6.25.6 Role of Fire Authorities

The control of a fire shall be normally the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer shall also have a similar responsibility for other events, such as explosions and toxic release. Fire authorities in the region shall be apprised about the location of all stores of flammable materials, water and foam supply points and fire-fighting equipment. They shall be involved in on-site emergency rehearsals both as participants and, on occasion, as observers of exercises involving only site personnel.

7.6.25.7 Role of Health Authorities

Health authorities, including doctors, surgeons, hospitals, ambulances, and so on, shall have a vital part to play following a major accident, and they shall form an integral part of the emergency plan.

For major fires, injuries shall be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle this in all but extreme cases may be generally available in most hospitals. For major toxic releases, the effects vary according to the chemical in question, and the health authorities shall be apprised about the likely toxic releases from the plant which will enable them in dealing with the aftermath of a toxic release with treatment appropriate to such casualties.

Major off-site incidents are likely to require medical equipment and facilities additional to those available locally, and a medical "mutual aid" scheme shall exist to enable the assistance of neighboring authorities to be obtained in the event of an emergency.
7.6.25.8 Role of Government Safety Authority

This will be the factory inspectorate available in the region. Deputy Chief Inspector of Factories are likely to want to satisfy themselves that the organization responsible for producing the off-site plan has made adequate arrangements for handling emergencies of all types including major emergencies. They may wish to see well documented procedures and evidence of exercise undertaken to test the plan.

In the event of an accident, local arrangements regarding the role of the Deputy Chief Inspector of Factories will apply. These may vary from keeping a watching brief to a close involvement in advising on operations in case involvement in advising on operations. In cases where toxic gases may have been released, the industrial safety & health department may be the only external agency with equipment and resources to carry out tests.

The action plan for handling of Off-site emergencies has been prepared by SSL. The same action plan will be implemented during emergency in future. The action plan are given in Table-7.16.

**TABLE-7.16**

**OFF-SITE ACTION PLAN**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Action required to be taken to mitigate disaster by aid giving agency</th>
<th>Responsible agencies for taking action</th>
<th>Equipments/material facilities required at site to mitigate emergency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Arrangements for evacuation/rescue of persons from zone of influence to predetermined camps</td>
<td>Police Department</td>
<td>● Self Breathing apparatus with spare cylinder</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Chemical gas mask with spare canister</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Vehicle with PA system</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Transportation for evacuation of people</td>
</tr>
<tr>
<td>2</td>
<td>Caution to public by announcement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Traffic and Mob control by cordoning of the area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Law &amp; order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Request to Thoothukudi, Vanchi Maniachi and Meelavittan railway authorities to stop the up &amp; down trains at the nearest railway station</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Control of fire</td>
<td>District Fire Brigade</td>
<td>● Self breathing apparatus with spare cylinders</td>
</tr>
<tr>
<td>2</td>
<td>Containment of spilled chlorine and its neutralization</td>
<td></td>
<td>● Foam/water fire tenders</td>
</tr>
<tr>
<td>3</td>
<td>Scrubbing of the flashed of gas cloud with water curtain</td>
<td></td>
<td>● Gas mask with spare canisters</td>
</tr>
<tr>
<td>4</td>
<td>To rescue trapped persons</td>
<td></td>
<td>● Lime</td>
</tr>
<tr>
<td>5</td>
<td>If fire is big due to LPG, keep surrounding area cool by spraying water</td>
<td></td>
<td>● Neck to toe complete asbestos suit, PVC hand gloves, gumboots, safety goggles</td>
</tr>
<tr>
<td>6</td>
<td>Communication to TNEB / SSL Power Division to continue or cut off electric supply</td>
<td></td>
<td>● Mobile scrubbing system along with suction arrangement.</td>
</tr>
<tr>
<td>7</td>
<td>Communication to water supply department for supplying water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Action required to be taken to mitigate disaster by aid giving agency</td>
<td>Responsible agencies for taking action</td>
<td>Equipments/material facilities required at site to mitigate emergency</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>C1</td>
<td>Medical facilities for affected persons (first aid and treatment)</td>
<td>Hospital and public health</td>
<td>Ambulance with onboard resuscitation unit first aid, antidotes for toxicity, stretchers.</td>
</tr>
<tr>
<td>D1</td>
<td>Identification of concentration of gas in zone of influence</td>
<td>Pollution control board</td>
<td>Gas detector</td>
</tr>
<tr>
<td>2</td>
<td>Communication to DPH, TWAD, Thoothukudi for decontamination of affected water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>Removal of debris and damaged structures</td>
<td>Municipal corporation</td>
<td>Provide bulldozers, cranes</td>
</tr>
<tr>
<td>F1</td>
<td>Monitor the incoming and outgoing transports</td>
<td>Transport department</td>
<td>Provide traffic police at site, Provide emergency shifting vehicles at site, Provide stock of fuel for vehicles</td>
</tr>
<tr>
<td>02</td>
<td>Arrange emergency shifting of affected persons and non affected person to specified area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Arrange diesel/petrol for needed vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>Give all information related to meteorological for safe handling of affected area for living beings</td>
<td>Meteorological Department</td>
<td>Provide wind direction and velocity instruments with temperature measure, Mobile van for meteorological parameter measurements</td>
</tr>
<tr>
<td>02</td>
<td>Forecast if any important weather change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1</td>
<td>Representative of all department are in local crisis group therefore it is expected to ender services available with them since it is a group of experts and authority, the mitigating measures can be implemented in speed upway. The representative from locals are also there so communication with local people is easy and fast</td>
<td></td>
<td>Must have all resources at hand, specially disaster management plan and is implementation method, All relevant information related to hazardous chemical industry are generally available with crisis group, News paper editor is a part of the group so right and timely media released can be done</td>
</tr>
<tr>
<td>02</td>
<td>The district emergency or disaster control officer is the president and he is used to mock drill etc. so action can be taken in right direction in time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>Collector is the President of District Crisis Group therefore all district infrastructure facilities are diverted to affected zone</td>
<td>District Crisis group</td>
<td>All necessary facilities available at district can be made available at affected zone, Control of law and order situation</td>
</tr>
<tr>
<td>02</td>
<td>All other functions as mentioned in local crisis group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SSL DMP Plan

The off-site emergency organization chart for major disaster is shown in Figure-7.4.
FIGURE-7.4
OFF-SITE EMERGENCY PLAN