CHAPTER – 7

ADDITIONAL STUDIES

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

(Std. TOR # 7 - xiii)

7.1 INTRODUCTION (Std. TOR # 3 - ix)

Risk analysis deals with the identification and quantification of risks, the plant equivalent and personnel are exposed to, due to accidents resulting from the hazards present in the factory. Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) Involved in the factory.

Both hazard and risk analysis very extensive studies, and require a very detailed design and engineering information.

The various hazard analysis techniques that may be applied are Hazard and Operability (HAZOP) studies, Fault – Tree Analysis (FTA), event –tree analysis and failure and effects mode analysis.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighbouring populations are exposed to as result of hazard present. This requires a through knowledge of failure probability, credible accident scenario, vulnerability of populations etc., much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum creditable accident studies.

7.2 SCOPE OF THE STUDY

The scope of work is to carry out risk analysis for the proposed plant covering all the hazardous chemicals to be handled and stored at the plant.
The risk assessment study will cover following aspects:

- Selection of credible scenarios
- Consequences Analysis of selected accidents scenarios both onsite and off-site

<u>On-site</u>

- ❖ Emission/spillage etc. from storage & handling
- ❖ Exposure to fugitive dust, noise, and other emissions
- ❖ Housekeeping practices requiring contact with solid and liquid wastes

Off-site

- ❖ Exposure to pollutants released from onsite/ storage/related activities
- ❖ Contamination due to accidental releases or normal release in combination with natural hazard
- ❖ Deposition of toxic pollutants in vegetation / other sinks and possible sudden releases due to accidental occurrences

- Review of Safety at the plant
- Risk Mitigation Measures

7. 3 STORAGE TANKS

Details of tank farms are shown in Table 7.1

TABLE - 7.1
Details of the Tank farms (after expansion)

Description of the Tank	Tank Capacity (m^3)	No. of Tanks	Total capacity (m^3)
ENA Daily Receivers	50	4	200
RS daily receiver	50	4	200
Ethanol Receiver	50	4	200
ENA Bulk Storage	400	10	4000
RS Bulk Storage	400	2	800
Ethanol Bulk Storage	400	4	1600
Impure Spirit Daily Receivers	9	2	18
Impure Spirit Bulk Storage	100& 200	100-2; 200-2	600
Fusel Oil Storage	20	1	20
Denatured Spirit	-	-	-
Total		**35**	**7638**

7.4 FIRE PROTECTION SYSTEMS

The following Fire Protection system will be provided in the plant

- Hydrant system covering the entire plant including all important auxiliaries and buildings. The system is complete with piping, valves instrumentation, hoses, nozzles and hydrants, valves etc.
- Portable extinguisher such as pressurized water type, carbon dioxide type and foam type are located at strategic locations throughout the plant.
- Modular type carbon dioxide panel injection fire extinguishing system has been provided in control equipment room, cable space below control room and at other unmanned electrical and electronic equipment room.
- Automatic Medium Velocity water Sprinkler system for cable galleries / vaults / spreader room, coal conveyors, crusher house, Transfer points.
- Foam injection system for fuel oil storage tanks consisting of foam concentration tanks, foam pumps, piping, instrumentation, valves etc.

- Automatic high velocity water spray system has been provided for all the transformers located in transformer yard, turbine generator lube oil equipment rooms, sets of Boiler burners, boiler feed pump, lube oil systems, diesel engine driven fire pump, etc.
- Fire water reservoir is part of the water storage tank.

The following pumps are provided in the fire protection system.

Fire water pumps.

a) AC motor driven fire water pumps for hydrant, medium velocity water spray system and foam system.
b) AC motor driven fire water pumps for high velocity water spray system.
c) Diesel engine driven pump as stand by for the above.
d) Jackey pump 1 no. (AC motor driven) for maintaining pressure.

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

- High velocity water spray system near storage tanks.
- Portable extinguisher such as pressurized water type, carbon dioxide type and foam type will be located at strategic locations through out the plant.

7.5 SAFETY PROVISIONS PROPOSED

The following safety provisions are made in the plant

- Flame arrestors on the top of all the storage tanks.
- Flame proof fitting to all the systems which handles the alcohol.
- Transfer of alcohol by pipes only.
- All the lightings are of flame proof.
- Water sump with a holding capacity of minimum 400 m^3.
- Foam Extinguishers inside the warehouse.

7.6 METHODOLOGY OF MCA ANALYSIS

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

- Preparation of an inventory of major storages and rank them on the basis of their hazard properties.
- Identification of potentially hazardous storage sections and representative failure cases from the vessels and the pipelines.
- Visualisation of chemical release scenarios.

- Effect and damage calculation from the release cases through mathematical modeling.
- Inventory Analysis and Fire & Explosion and Toxicity Index (FETI) are the two techniques employed for hazard identification process.

7.7 FIRE & EXPLOSION AND TOXICITY INDEX

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

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

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

FEI = MF * GPH * SPH

Where MF: Material factor

GPH: General Process Hazard

SPH: Special Process Hazard

TOXICITY INDEX

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

$$TI = \frac{(Nh + Ts) * (1 + GPH + SPH)}{100}$$

The degree of hazard is identified based on FEI & TI range as per the criteria given below.

FEI RANGE	DEGREE OF HAZARD
0 – 60	LIGHT
61 - 96	MODERATE
97 - 127	INTERMEDIATE
128 - 158	HEAVY
159 & Above	SEVERE

TI RANGE	DEGREE OF HAZARD
0 – 5	LIGHT
5 - 10	MODERATE

> 10 SEVERE

Depending on the category of hazard preventive and protective system will be recommended.

7.8 ASSESSMENT OF RISK AT M/s. EID PARRY (INDIA) LIMITED

Based on the storage inventory the following areas are identified as potential safety risk areas are shown below.

TABLE 7.2
POSSIBLE RISKS FROM THE EXISTING & EXPANSION PLANT

S.No.	Block / Areas	Quantity	Hazard Identified
1.	Boilers	94 TPH, 110 TPH & 25 TPH (3 Nos.)	Fire (mainly near oil burners steam explosion, fire explosion
2.	Transformer	-	Explosion & fire
3.	Coal handling plant	-	Fire and or dust explosion
4.	Chlorine Storage	2 Tonners	Vapor Release
5.	Coal storage	540 tons (15 days)	Fire, spontaneous combustion

CHLORINATION PLANT

To prevent the growth of algae in cooling water system, Chlorine dosing in the CW forebay is proposed. The system will be designed for 1ppm continuous dosing and 5ppm shock dosing. 2 x 100 % capacity vacuum type chlorinators (with evaporator) will be provided along with the 2 nos. of chlorine tonne containers As the chlorine storage at site is less than 10 tonnes, risk assessment for chlorine is not required. However to tackle any chlorine leakage, chlorine absorption system will be provided.

Chlorination Plant

Chlorine Storage System:

1. 2 nos. of Chlorine tonners each of 840 Kg capacity will be provided in the site.
2. The chlorination system is located in a detached building near the circulating water pump house.
3. Safety masks, showers and eyewash shall be provided.
4. Leak detection and hooter alarm shall be provided for quick evacuation of personnel.
5. The leaked chlorine will be absorbed automatically by the chlorine Absorption System.
6. Facilities in the form of water curtain will be provided for absorption of chlorine released during an emergency as chlorine is highly soluble in water.

7.9 RISK & CONSEQUENCE ANALYSIS OF FIRE

List of products and NFPA Ratings is given in Table 7.3

TABLE 7.3
List of products and NFPA Ratings

S.No.	Chemical	NFPA Ratings		
		Nh	NF	Nr
1.	Ethanol	0	3	0

Explanation of NFPA ratings is given in Table 7.4

TABLE 7.4

Explanation of NFPA Hazard Classifications

Health Hazard	Definition
4	Materials which on very short exposure could cause death or major residual injury even though prompt medical treatments were given.
3	Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatments were given.
2	Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.
1	Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given.
0	Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.
Flammability	**Definition**
4	Materials which will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and which will burn readily
3	Liquids and solids that can be ignited under almost all ambient temperature conditions.
2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
1	Materials that must be preheated before ignition can occur.
0	Materials that will not burn.
Reactivity	**Definition**
4	Materials which in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials which in themselves are capable of detonation or explosive reaction bur require a strong initiating source or which must be heated under confinement before initiation or which must be heated under confinement before initiation or which react explosively with water.
2	Materials which in themselves are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form potentially explosive mixtures with water.

Health Hazard	Definition
1	Materials which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.

METEOROLOGICAL DATA

The atmosphere acts like a large non-homogeneous reactor with several accompanying complimentary phenomena. Meteorological information plays an important role in the risk analysis. The atmospheric stability conditions, wind speed, wind directions, humidity etc. are necessary to find the damage potential due to any chemical release.

Atmospheric stability is important with regard to the extent to which it suppresses or enhances the vertical movement in the air's turbulent motion. This is most strongly a function of vertical temperature profile in the atmosphere. If a volume of air rises, it would normally be expected to coal as it expands. If the rate of cooling with height by this process equals the vertical temperature profile then turbulence is neither suppressed nor enhanced. Such conditions are termed neutral. If the vertical temperature profile is more marked then turbulence is enhanced and if the profile is less marked then turbulence is suppressed. Neutral conditions correspond to a rate of decrease in temperature with height of about 1^0 C per 100 meters.

Atmospheric stability is a very important factor for predicting the dispersion characteristics of gases/vapors of the surrounding environment. Change in atmospheric stability is due to the direct consequence of its vertical temperature structure.

For a given location, this tends to vary from season to season. Wind speed and stability conditions/ should be obtained from local meteorological records whenever possible. Where these stability data are not available, the stability effects are mathematically represented through pasquill parameters.

In Pasquill stability categorisation, class A is the one having most unstable and class F is the most stable weather condition. An unstable weather condition promotes better dispersion, a high wind speed and high incoming solar radiation favour the formation of unstable weather condition. Turbulence induced by buoyancy forces in the atmosphere is closely related to the vertical temperature structure. The magnitude of atmospheric temperature gradient is compared against the Adiabatic Lapse Rate (ALR=0.98^0C/100m), which is the rate of temperature change with height for a parcel of dry air rising adiabatically. In neutral stability the gradient is equal to the ALR. Stable conditions refer to a gradient less than the ALR (ultimately to a temperature inversion) and unstable conditions to greater than the ALR.

Stability Class	Atmospheric Condition
A	Very Unstable
B	Unstable
C	Slightly Unstable
D	Neutral
E	Stable
F	Very Stable

Condition of atmospheric stability is estimated by a suitable method that uses dispersion parameters viz., vertical temperature gradient, and wind profile and roughness factor. The roughness factor for the area is small since it mainly comprises of plain land. In general, very stable and stable conditions are highly favourable for evaporation and dispersion of gases and hence for maximum credible accident calculations, only these stability conditions will be assumed.

7.10 RESULTS OF CONSEQUENCE ANALYSIS

Maximum Credible Accident and Consequence **(MCAC)** Analysis aims at identifying the unwanted hazardous events which can cause damage to human beings and the environment in and around E.I.D. Parry (India) Limited alcohol storage facilities at Nagaral & Nainegali Village. For this purpose a host of probable or potential accident scenarios have been visualized, examined, screened and the credibility of the most probable events established.

The following steps have been followed for the analysis:

- A detailed study of the storage and handling information
- Identification of representative failure cases of the tanks.
- Consequence analysis of the release cases and shortlisting of the most hazardous events.

The release scenarios are selected based on hazard identification, past accident data and engineering judgement. Chemicals handled in this transfer operation are basically non-boiling in nature. Spillage of these chemicals may lead to heat radiation effects.

7.10.1 IDENTIFICATION OF POTENTIAL HAZARD AREAS

The facilities are examined along with the terminal layout. An inventory of the amount of various chemicals to be stored is made. The consequence in terms of heat radiation due to release of chemicals are broadly analyzed.

7.10.2 RELEASE SCENARIOS

The release of chemical from the pipe line over the ground from the land point to the storage terminal, storage tank failure are all the possible scenarios. Failure of underground pipe line has not been considered credible. Even in case of such a failure, the released material will be confined underground and is unlikely to find an ignition source.

7.10.3 SOURCE STRENGTH ESTIMATION

Mathematical models are employed to estimate the outflow the liquids. In general, liquid release can be expected from pipe failures as the pipe line extends over a long distance. The released liquid will form the pool which can spread. The most vulnerable section of the piping network will be near flanges, valves and other fittings. It may be worthwhile for **E.I.D. Parry (India) Limited** to provide some sort of collecting mechanism to hold any unexpected release near the loading area and isolation valves. Major failures of pipe line will lead to pool formation which on ignition can lead to pool fire.

7.10.4 CONSEQUENCE ANALYSIS

Consequence Analysis is a tool to estimate the potential damage due to accidental release of a hazardous chemical. A large number of failure cases can lead to the same type of consequences hence representative failure cases are selected for this analysis.

The release scenarios are selected based on hazard identification, past accident data and engineering judgment. Alcohol, which is proposed to be handled in this storage and transfer operation, is basically non-boiling in nature. Spillage of the alcohol, if it finds any ignition source, may lead to heat radiation effects.

7.10.5 HEAT RADIATION EFFECTS DUE TO POOL FIRE

E.I.D. Parry (India) Limited handles alcohol which is basically non-boiling liquid; it can cause heat radiation effects due to pool fires. The release of combustible liquid can take place due to catastrophic rupture of the tank itself or rupture of a transfer line. In case of a transfer line, the spillage can be stopped through isolation valves. However, in case of rupture of tanks or the line close to the tank (before isolation valve), the release can be large enough to fill the bund. This may likely to result in a pool fire in case of immediate ignition. This could be the worst possible scenario in the storage area as far as the heat radiation effects are concerned.

It is found that pool fires generally tend to have localized effects and are mainly of concern in establishing the potential for cascade effects and employee safety zones rather than for any off-site problem. The estimation of damage distance can help in solving issues connected with inter tank spacing, thermal insulation, fire/wall barrier specification etc.

The estimation of heat radiation depends on the bund size (which is same as pool volume in the case of catastrophic rupture of the tank leading to spillage of large quantity of the chemical), burning rate (a property which depends on the heat of combustion and latent heat of vaporization), surface emitted power (which takes into consideration the radiated fraction of total combustion power),

besides the atmospheric transmissivity and geometric view factor. However, the following points are to be noted:

- Duration of burning varies with the quantity spilled. However, it does not have any direct of effect on the radiation levels.
- Burning rate is independent of the meteorological conditions so long as sufficient oxygen is available in the atmosphere. We assume complete combustion in our calculation.
- The pool fire doesn't depend on the material of construction of bund and bund floor. However, the surface emitted power by the chemical is included in the mathematical calculation.

It should be noted that the damage distances due to heat radiation is independent of the quantity spilled. It depends on the area exposed. However, the quantity will determine the duration of the fire.

Release of flammable liquid followed by ignition may lead to pool fire. The transfer lines of **E.I.D. Parry (India) Limited** mostly will go over the ground all over the storage terminal. Release and spreading of chemicals at the storage tank area is quite possible.

In case of leak / rupture of transfer line at the storage terminal may spill and spread the chemical. On immediate ignition the scenario will be spreading of burning pool. Delayed ignition may also lead to spreading of burning pool or confined pool fire if there are bunds. Spreading burning pools cause less damage than the pool fire resulting after spreading as the spreading area is less due to loss of chemicals in the burning. In case of leak of underground lines, released chemicals will diffuse from the ground and form a pool on the ground but quantity in the pool will be low as the ground itself acts as an obstruction. On ignition, this will damage pipeline due to heating which leads to catastrophic failure of transfer line. Nevertheless, this situation has remote probability.

The thermal radiation effects due to pool fires at the storage terminal are calculated and the results are presented in **Table 7.5.**

TABLE 7.5

THERMAL RADIATION EFFECTES DUE TO FIRE

S.No.	Thermal radiation intensity (KW/m^2)	Hazard distance (m)
1	37.5	5
2	12.5	11
3	4.0	22

4 KW/m^2 thermal radiation intensity occurs at a distance of 21m and will be within the premises. Hence no outside population would be affected due to the pool fire scenario. There will be no effect on any structure related to the plant.

A heat radiation effect of 37.5 KW/m^2 can cause sufficient damage to adjacent units and fatality rates will be 100%. 12.5 KW/m^2 level can cause ignition of wood, melt plastic tubing etc., while 4.0 KW/m^2 can cause pain to personnel if unable to reach cover within 20s. However, blistering of the skin (second degree burns) is likely but the lethality level will be zero. The firemen with protective clothing can handle the fire without discomfort under this heat radiation level.

If a tank ruptures and results in a pool fire, this will spread to other tanks in the same enclosure. If the other tanks/bunds also catch fire because of the cascade effects, the difference will mainly be that the total heat flux will remain the same but the fire will last for a longer duration. This is because the scenario chosen covers the chemical with maximum radiation intensity and maximum quantity.

7.11 FREQUENCY / PROBABILITY ESTIMATION

The reliability data of pipelines and atmospheric storage tanks are presented here from the international database. These cannot be taken as absolute values as there is no information available for Indian conditions. Therefore, these can be taken indicative values

The probability of tank failures, pipe ruptures and ignition are presented below:

Atmospheric storage tank failure rate	1 x 10^{-5}/yr
Pipe line failure (pipe lengths between connections)	
25 mm $ or less	30 x 10^{-6}/yr
50 mm $	7.5 x 10^{-6}/yr
100 mm $	4 x 10^{-6}/yr
150 mm $ or greater	3 x 10^{-6}/yr

7.12 RECOMMENDATIONS

I. General Recommendations to Combat Liquid Pool Fires

The major hazard in a flammable storage may arise from pool fire of combustible liquid. Removal of all ignition sources and maintaining sterile conditions in and all around the plant area.

II. Measures for Containing Liquid Pool Fires

Pool fire in one part of the installation may spread to another unless it is adequately contained. It is essential to provide spill-impounding areas popularly known as bunds to prevent

Spread of liquid from the immediate spill area to other sections and if the liquid from the immediate spill is ignited despite safety precautions, impounding areas will serve to control the fire hazard by

- Minimizing the fire size thus reducing radiant heat exposure to the surroundings
- Localizing the need for fire protection.

III. General Recommendations

- Joints in piping should be kept to a minimum. Piping more than 50 mm outside diameter should have welded or welded flanged joints except when connecting to equipment fitted with screwed connections. Piping 50 mm diameter and less may have screwed joints. Where piping has screwed joints, which may be subjected to vibration, consideration should be given to tack welding them to prevent them from coming loose.
- To prevent the accumulation of static electricity metal piping should be electrically continuous so that the resistance to earth of the installation does not exceed 10^6 ohms. Reference should be made to BIS 5958: Part 1:1980 for further information.

IV. Specific Recommendations

i. Hydrocarbon sensors may be provided at the vulnerable areas and in case of any alcohol vapor release, immediate action to be taken to dilute the alcohol vapor concentration by suitable vapor dispersal mechanism.

ii. The entire area has to be kept free from the sources of ignition and made sterile during the storage, handling and transfer operation of all flammable chemicals.

iii. The piping design should conform to the codes and regulations.

iv. In case of a spill, mobile foam dispending system can be effective in reducing vapor generation by minimizing surface area exposed to atmosphere in addition to providing containment.

v. Other protective gadgets like gloves, DCP, CO_2 Extinguishers should be made available.

The thick green belt already developed will help to mitigate the radiation intensity level outside plant boundary.

7. 13 DISASTER MANAGEMENT PLAN

7.13.1 DISASTERS

A disaster is catastrophic situation in which suddenly, people are plunged into helplessness and suffering and as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

Disasters can be divided into two main groups. In the first, are Disasters resulting from natural phenomena like earthquakes, volcanic eruptions, cyclones, tropical storms, floods, avalanches, landslides etc. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are 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 depends to a large extent on the physical, economic and social environment in which it occurs. What would be considered a major disaster in developing country, will be equipped to cope with the problems involved, may not mean more than temporary emergency elsewhere. However all disasters bring in their wake similar consequences that call for immediate action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured, medical and social care, removal of the debris, the provision of temporary shelter for the homeless food, clothing and medical supplies, and the rapid reestablishment of essential services.

7.13.2 OBJECTIVES OF DISASTER MANAGEMENT OF PLAN

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 Disaster Management Plan, it will be widely circulated and personnel training through rehearsals.

The Disaster Management Plan would reflect the probable consequential severity of undesired event due to deteriorating conditions or through knock on effects. Further the management should be able to demonstrate that their assessment of the consequences uses good supporting evidence and 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 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.

- Minimise damage to property and the environment.
- Effect the rescue and medical treatment of causalities.
- Provide for the needs of relatives.
- Provide authoritative information to news media.
- Secure the safe rehabilitation of affected areas.
- Safeguard other people.

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

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

7.13.3 EMERGENCIES

7.13.3.1 GENERAL, INDUSTRIAL, EMERGENCIES

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

- Pool fire scenario due to storage of R.S / ENA / Ethanol.
- Contamination of food / water.
- Sabotage / social disorder.
- Structural failures.
- Slow isolated fires
- Earthquakes.

7.13.3.2. SPECIFIC EMERGENCIES ANTICIPATED

Fire consequences can be disastrous as they involve in huge quantities of fuel. During the study of risk assessment, the probabilities of occurrence of hazards are worked out along with the nature of damage. This is the reason why one should study risk assessment in conjunction with DMP.

7.13.3.3 EMERGENCY ORGANISATIONS

It is recommended to setup an Emergency Organisation. A senior executive who has control over the affairs of the plant would be heading the Emergency Organisation. He would be designated as Site Controller. In case of stores, utilities, open areas which are the not under the control of production heads, executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controller would be reporting to the site controller. Each Incident Controller, for himself, organises a team responsible for controlling the incidence with the personnel under his control. Shift Incharge would be the reporting Officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller.

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

In each shift, electrical supervisor, electrical filters, pump house Incharge and other maintenance staff would be drafted for emergency operations. In the event of power communication system failure, some of staff members in the office/ plant offices would be drafted and their services would be utilised as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

7.13.3.4 EMERGENCY COMMUNICATION

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

7.13.3.5. EMERGENCY RESPONSIBILITIES

The responsibilities of the key personnel are appended below:

7.13.3.5.1 SITE CONTROLLER

On receiving information about emergency he would rush to Emergency Control Centre and take charge of ECC and the situation and assesses the magnitude of the situation on the advice of incident controller and decides.

- Whether affected area needs to be evacuated.
- Whether personnel who are at assembly points need to be evacuated.
- Declares Emergency and orders for operation of emergency siren.
- Organises announcement by public address system about location of emergency.
- Assesses which areas are likely to be affected, or need to be evacuated or are to be altered.
- Maintains a continuous review of possible development and assesses the situation in consultation with Incident Controller and other key personnel whether shutting down the plant or any section of the plant required and if evacuation of persons is required.
- Directs personnel of rescue, rehabilitation, transport, fire brigade, medical and other designated mutual support systems locally available, for meeting emergencies.
- Controls evacuation of affected areas, if the situation is likely to go out of control or effects are likely to go beyond the premises of the factory, informs to District Emergency Authority, Police, Hospital and seeks their intervention and help.
- Informs Inspector of factories, Deputy Chief Inspector of factories, KSPCB and other statutory authorities.
- Gives public statement if necessary.
- Keeps record of chronological events and prepares an investigation report and preserves evidence.

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

7 .13.3.5.2 INCIDENT CONTROLLER

- Assembles the incident control team.
- Directs operations within the affected areas with the priorities for safety to personnel minimise damage to the plant, property and environment and minimise the loss of materials.
- Directs the shutting down and evacuation of plant and areas likely to be adversely affected by the emergency.
- Ensures that all-key personnel help is sought.
- Provides advice and information to the Fire and Security officer and the local Fire Services as and when they arrive.
- Ensures that all non-essential workers / staff of the effected areas evacuated to the appropriate assembly points and the areas are searched for causalities.
- Has regard to the need for preservation of evidence so as to facilitate any enquiry into the cause and circumstances, which caused or escalated the emergency.
- Coordination on with emergency services at the site.
- Provides tools and safety equipments to the team members.
- Keeps in touch with the team and advice them regarding the method of control to be used.
- Keep the site Controller of Emergency informed of the progress being made.

7.13.3.5.3 EMERGENCY COORDINATOR - RESCUE, FIRE FIGHTING

- On knowing about emergency, rushes to Emergency Control Centre.
- Helps the incident controller in containment of the emergency.
- Ensure fire pumps in operating conditions and instructions pump house operator to be ready for any emergency, which stand arrangement.
- Guides the fire fighting crew i.e. Firemen trained plant personnel and security staff.
- Organises shifting the fire fighting facilities to the emergency site, if required.
- Takes guidance of the Incident Controller for fire fighting as well as assesses the requirements of outside help.
- Arranges to control the traffic at the gate and the incident area / Directs the security staff to the incident site to take part in the emergency operations under his guidance and supervision.
- Evacuates the people in the plant or in the near by areas as advised by site controller
- Searches for casualties and arranges proper aid for them.
- Assembles search and evacuation team.
- Arranges for safety equipments for the members of this team.
- Decides which paths the evacuated workers should follow.

- Maintains law and order in the area, and if necessary seeks the help of police.

7.13.3.5.4 EMERGENCY COORDINATOR - MEDICAL, MUTUAL AID, REHABILITATION, TRANSPORT AND COMMUNICATION.

- In the event of failure of electric supply and there by internal telephone, sets up communication point and establishes contact with the Emergency Control Center (ECC).
- Organises medical treatment to the injured and if necessary will shift the injured to near by hospitals.
- Mobilises extra medical help from outside, if necessary
- Keeps a list of qualified persons first aiding workers of the factory and seek their assistance.
- Maintains first aid and medical emergency requirements.
- Makes sure that all safety equipment are made available to the emergency team.
- Assists Site Controller with necessary data and to coordinate the emergency activities.
- Assists Site Controller in updating emergency plan.
- Maintains liaison with Civil Administration.
- Ensure availability of canteen facilities and maintenance of rehabilitation centre.
- He will be in liaison with Site Controller / Incident Controller.
- Ensures availability of necessary cash for rescue / rehabilitation and emergency expenditure.
- Controls rehabilitation of affected areas on discontinuation of emergency.
- Makes available diesel, petrol for transport vehicles engaged in emergency operation.

7 .13.3.5.5 EMERGENCY COORDINATOR – ESSENTIAL SERVICES

He would assist Site Controller and Incident Controller

- Maintains essential services like Diesel Generator, Water, Firewater, Compressed Air / Instrument Air, Power Supply for lighting.
- He would plan alternate facilities in the event of power failure, to maintain essential services such as lighting, etc.
- He would organize separate electrical connections for all utilities and during emergency or fires, essential services and utilities are not affected.
- Gives necessary instructions regarding emergency electrical supply, isolation of certain sections etc. to shift Incharge and electricians.
- Ensure availability of adequate quantities of protective equipment and other emergency materials, spares etc.

7.13.3.5.6 GENERAL RESPONSIBILITIES OF EMPLOYEES DURING AN EMERGENCY

During an emergency, it becomes more enhanced and pronounced when an emergency warning is raised, the workers if they are incharge of process equipment should adopt safe and emergency shut down and attend any prescribed duty as essential employee. If no such responsibility is assigned, he should adopt a safe course to assembly point and await instructions. He should not resort to spread panic. On the other hand, he must assist emergency personnel towards objectives of DMP.

7.13. 3.6 EMERGENCY FACILITIES

7.13.3.6.1 EMERGENCY CONTROL CENTRE

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

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

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

7.13.3.6.2 EMERGENCY POWER SUPPLY

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

7.13.3.6.3 FIRE FIGHTING FACILITIES

First Aid Fire fighting equipment suitable for emergency should be maintained as per stationary requirements as well as per TAC Regulations. Fire hydrant line converting major areas would be laid. It would be maintained as 6 kg / sq. cm. Pressure.

7.13.3.6.4 LOCATION OF WINDSOCK

On the top of each main block and on the top of administrative block wind sock would be installed to indicate direction of wind during emergency period.

7.13.3.6.5 EMERGENCY MEDICAL FACILITIES

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

Apart from plant first aid facilities, external facilities would be augmented. Names of Medical Personnel, Medical facilities in Almatti town would be prepared and updated. Necessary specific medicines for emergency treatment of Burns patients, and for those affected by toxicity would be maintained.

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

7.13.3.7 EMERGENCY ACTIONS

7.13.3.7.1 EMERGENCY WARNING

Communication of emergency would be made familiar to the personnel inside the plant and people outside. An emergency warning system would be established.

7.13.3.7.2 EMERGENCY SHUTDOWN

There are number of facilities which can be provided to the help deal with hazard conditions. The suggested arrangements are

Stop feed
Deluge contents
Remove heat
Transfer contents

7.13.3.7.3 EVACUATION OF PERSONNEL

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

7.13.3.7.4 ALL CLEAR SIGNAL

At the end of emergency, after discussing with Incident Controllers and Emergency Coordinators, the site controller orders an all clear signal.

7.14 OCCUPATIONAL HEALTH

In large scale industries where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs. Along with the booms, the industrialization generally brings several problems like occupational health and safety. Occupational health needs attention both during construction and operation phases. However the problem varies both in magnitude and variety in the above phases.

7.14.1 CONSTRUCTION & ERECTION

The occupational health problems envisaged at this stage can be mainly due to constructional accident and noise.

To overcome these hazards, in addition to arrangements to reduce it within TLV'S, personnel protective equipments should also be supplied to workers.

7.14.2 OPERATION & MAINTENANCE

The working personnel should be given the following appropriate personnel protective equipments.

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

7.14.3 OCCUPATIONAL HEALTH SURVEILLANCE (Std. TOR # 8 - i)

In this Integrated Sugar Plant, there will be utilization of chemicals like Sulphur, DAP, Lime, Alum and polymers. The usage of this above chemicals will be in low quantities and exposure of these chemicals to the employees will be also very low. However all the precautionary measures are being taken while handling these chemicals.

The following are the details of the Occupational Health Surveillance

- Occupational Health Surveillance (OHS) is being under taken as regular exercise for all the employees specifically for those engaged in handling hazardous substances.
- All the first aid facilities are provided in the Occupational Health Centre.
- The medical records of each employee are being maintained separately.
- Occupational health center for medical examination of employees with all the basic facilities have been established with in the plant.
- The noise levels in critical area are being monitored regularly and the workers at high noise level generating areas will undergo audiometric tests once in six months.
- Liver function test is also being planned for the workers as a part of surveillance.

Anticipated Occupational & Safety Hazards

- Heat Stress & Stroke
  - ✓ Physical activity
  - ✓ Extremes of age, poor physical condition, fatigue
  - ✓ Excessive clothing
  - ✓ Dehydration
  - ✓ Cardiovascular disease
  - ✓ Skin disorders
- Noise
- Dust Exposure
- Illumination
- Burns and shocks due electricity

EMP for the Occupational Safety & Health hazards

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

- Proper Designing of building, Work area.
- Relaxation facilities to workers with good ventilation & air circulation. This will help in relieving of thermal stress.
- Good Housekeeping practices.
- Well engineered ventilation & exhaust system.
- Enclosure.

- Isolation of specific areas
- Enforcement of usage of Personal Protective Devices.
- Regular Work Environment Monitoring
- Statistical Monitoring
- Working hours
- Rotation of employees in specific areas to avoid continuous exposure
- Frequency Of Periodical Examination:
    a. For employees <30 Years once in five years
    b. Between 31-50 Years once in four years
    c. Between 41-50 Years once in two years
    d. Above >50 years once a year

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

- Plan of evaluation of health of workers
- Chest x rays
- Audiometry
- Spirometry
- Vision testing (Far & Near vision, color vision and any other ocular defect)
- ECG
- Haemogram (examination of the blood)
- Urine (Routine and Microscopic)
- Complete physical examination
    - Musculo-skeletal disorders (MSD)
    - Backache
    - Pain in minor and major joints
    - Fatigue, etc.
- Medical records of each employee will be maintained separately and will be updated as per finding during monitoring.
- Medical records of the employee at the end of his / her term will be updated.

7.15 SAFETY PLAN

Safety of both men and materials during construction and operation phases is of concern. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster in any plant is possible due to collapse of structures and fire / explosion etc .

Keeping in view the safety requirement during construction, operation and maintenance **E.I.D. Parry (India) Limited** has formulated safety policy with the following regulations.

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

7.15.1 SAFETY ORGANISATION

7.15.1.1 CONSTRUCTION AND ERECTION PHASE:

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

7.15.1.2 OPERATION & MAINTENANCE PHASE

When the construction is completed the posting of safety officers should be in accordance with the requirement of factories act and their duties and responsibilities should be as defined there off.

7.15.1.3 SAFETY CIRCLE

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

7.15.1.4 SAFETY TRAINING

Safety training will be provided by the safety officers to all the employees with the assistance of faculty members called from professional safety institutions and universities. In addition to regular employees, limited contractor labours are also provided with safety training.

To create safety awareness safety films will be shown to workers and leaflets etc. will be distributed.

- Compartmentalization of the cable galleries, use of proper sealing techniques of cable passages and crevices in all directions would help in localising and identifying the area of occurrence of fire as well as ensure effective automatic and manual fire fighting operations.
- Spread of fire in horizontal direction would be checked by providing fire stops for cable shafts.
- Reliable and dependable type of fire detection system with proper zoning and interlocks for alarms
- Housekeeping of high standard helps in eliminating the causes of fire and strengthens fire prevention and fire fighting.

7.15.1.5 HEALTH AND SAFETY MONITORING PLAN

The potential occupational hazardous work places will be monitored regularly. The health of employees working in these areas will be monitored once in a year.

7.16 SOCIAL IMPACT ASSESSMENT

The local areas will be benefited by way of generation of employment opportunities, increased demand for local products and services. There will be an overall improvement in the income level of the local people.

The project creates employment to about 500 persons once the plant is commissioned and for 500 persons during construction stage. Priority will be given to locals for Semi-Skilled and Unskilled workers. With the development of this Plant there will be lot of scope for more industrial investments which in turn will benefit the nation.

E.I.D. Parry (India) Limited, being a constituent of "The Murugappa Group" has upheld its ancient family tradition of earmarking and spending a portion of its income for social service in its business

enterprise as well. E.I.D Parry firmly believes that social responsibility is not just a ritual, but it is fulfilling one's dharma. Therefore, in all its philanthropic endeavors, the Murugappa Group reflects its spiritual conscience and not just corporate obligation.

EID PARRY believes not only in value-added business, but also in discharging its responsibilities to various sections of society and in providing opportunities to learn, contribute, advance, recognize and reward initiative, innovativeness and creativity. It believes in not only making customers delighted, but the community around also, by establishing service-oriented philanthropic institutions in the field of Education and Medicare.

EID PARRY , through Murugappa Group invests a portion of its wealth - one percent of profit after tax (PAT), for the welfare of society since it went into business. In addition to this, it also conducts a lot of welfare measures for the needy residing in and around its various units.

EID PARRY, Bagalkot has been involved with community and social services in factory related villages. SSL has commenced a series of social development programs in villages. We believe that a social interface with the community is a continuous process and is essential for a long term relationship where we contribute to each other's growth and well-being.
Similarly after proposed expansion, many developmental programmes will be taken up as per the need based and in consultation with village heads.

7.17 R & R ACTION PLAN

There is no habitation in the proposed expansion project site. The proposed expansion will be taken up in the existing plant premises only. Hence no Rehabilitation & Resettlement Action Plan has been envisaged in the proposed expansion project.