Risk Assessment and Disaster management Plan

1 Introduction

Risk involves the occurrence or potential occurrence of some accident consisting of an event or sequence of events.

MCA stands for Maximum Credible Accident or in other words, an accident with maximum damage distance, which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. In practice the selection of accident scenarios for MCA analysis is carried out on the basis of engineering judgement and expertise in the field of risk analysis especially in accident analysis.

Detailed study helps in plotting the damage contours on the detailed plot plan in order to assess the magnitude of a particular event. A disastrous situation is the outcome of fire, explosion or toxic hazards in addition to other natural causes that eventually lead to loss of life, property and ecological imbalances.

MCA analysis encompasses defined techniques to identify the hazards and compute the consequent effects in terms of damage distances due to heat radiation, toxic releases, vapour cloud explosion etc. A list 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.

2. Risk Assessment

Disaster is synonymous with 'emergency' as defined by the Ministry of Environment and Forests & Climate Change (MoEF & CC). An emergency occurring in the proposed project is one that may affect several sections within it and/ or may cause serious injuries, loss of lives, extensive damage to environment or property or serious disruption outside the plant. It will require the best use of internal resources and the use of outside resources to handle it effectively. It may happen usually as the result of a malfunction of the normal operating procedures. It may also be precipitated by the intervention of an outside force such as a cyclone, flood, earthquake or deliberate acts of arson or sabotage.

A properly designed and operated plant will have a very low probability (to a level of acceptable risk) of accident occurrence. Subsequently, a properly designed and executed management plan can further reduce the probability of any accident turning into an on-site emergency and/or an off-site emergency.

The three main goals of risk assessment are

- Identify risks,
- Quantify the impact of the potential threats and
- Provide an economic balance between the impact of risk and the cost of the Safeguard

2.1 Salient Feature of Risk Mitigation

(i) Design, manufacture and construction of buildings, plant and machineries will be as per National and International Codes as applicable in specific cases and laid down by statutory authorities

(ii) Provision of adequate access ways for movement of equipment and personnel will be made.

(iii) Minimum of two numbers of gates for escape during disaster will be provided In the vicinity of main plant entrance, there will be an emergency assembly point where plant personnel will assemble in the event of any disaster.

(iv) Adequate numbers of Fire Fighting equipments & Fire extinguishers will be installed in the work places for emergency purpose and the Supervisors / Workers will be trained to use the equipment.

(v) A qualified Doctor and a compounder will be employed for attending to any emergency.

2.2 Identification of Risks

For identification of risk due to proposed project, it requires in depth study of

- Raw material
- Process Risk
- Storages
- Operations
- Maintenance
- Safety
- Fire protection
- Effluent disposal

A)Raw material

The materials, which will be required to run the plant, are sugarcane, Bagasse, Steam apart from some chemicals (acids and caustic soda to produce DM water, chlorine as disinfectant in the cooling water system, hydrogen for cooling of turbo generators, Acids in Treatment Process etc.) which will be stored in isolation.

B) Process / Operation

Operational risks are categorized below
Process hazards: Loss of containment during handling of hazardous materials or processes resulting in fire, explosion, etc.

- Mechanical hazards: Mechanical operations such as welding, maintenance, falling objects etc. - basically those NOT connected to hazardous materials.
- Electrical hazards: Electrocution, high voltage levels, short circuit, etc.

C) Boiler, turbine, generator and associated areas

Particulars: Failure of safety devices, including pressure relief valves and interlocks:
The explosion is expected due to bursting of high pressure equipments like boiler, turbine and As, the water required for boiler is pumped through high-pressure pumps, the high-pressure steam generated in the boiler is sent to the turbine through the pipeline. Which have flanged joints, with sandwich gaskets in between for better sealing. At times, due to water hammering this gasket fails and leads to bursting of the flange joint.

Carrying out regular inspection and periodic safety certification of all safety devices compliance with required rules and regulations of safety systems is necessary. It must be always ensured that the pressure relief valves and interlocking arrangements as per standard design of equipment.

D) Potential exposure to electricity

Particular: Entire power plant, specifically the generator area, distribution panel, and control rooms. Follow up of standard operating procedures and regular training on electrical safety. Ensure suitability and adaptability of electrical equipment with respect to classified hazardous areas and protection against lightening protection and static charges. Adopting preventive maintenance practices as per testing and inspection schedules. Ensure all maintenance and repair jobs with prior work permit system. Use of personal protective equipment and ensuring compliance of the Indian Electricity Rules, 2003.
Ensure all electrical circuits designed for automatic, remote shut down.

E) Fire incident

Particular: Bagasse Storage yard, entire power plant, specifically the Storage area, electrical wearing and fuel handling area. Follow up of standard operating procedures and regular training on fire fighting, Mock drills of fire fighting. Installation of fire alarm & proper fire extinguisher. Ensure suitability and adaptability of electrical equipment with respect to classified hazardous areas and protection against lightening protection and static charges. Adopting preventive maintenance practices as per testing and inspection.

F) Solid/ Liquid waste disposal

Particular: Ash generated from cogeneration plant, solid waste and effluent generated from sugar unit Standard operating procedures for disposal of ash need to be followed like isolated disposal of hot ash inside the silo, use ash will sold, brick & cement manufacturing industries. Effluent will be treated as per regulatory norms and treated water will be reused. Solid organic waste generated from sugar unit will be used as manure. Regular monitoring will be carried out as per schedule to avoid any kind of pollution

G) Health Risk

Particular: Exposure to toxic and corrosive chemicals Provision of secondary containment system for all liquid corrosive chemicals fuel and lubricating oil storages. Constructing storage tanks and pipes for toxic chemicals and fuel oil as per the applicable standards. Inspection and radiography will be followed to minimize risk of tank or pipeline failure. Provision of protective equipment's such as protective clothing, goggles, safety shoes and breathing masks for workers working in chemical storage. Provision of emergency eyewash and showers in the working area.

H) Safety risk

Particular: Ensure Workers Safety. Periodical SHE training of staff and contractor. Ensuring special training to develop competent persons to manage specific issues such as safety from the system, risk assessment, scaffolding, and fire protection, Training will include the proper use of all equipment operated, safe lifting practices, the location and handling of fire extinguishers, and the use of personal protective equipment. Ensure good housekeeping practices (e.g., keeping all walkways clear of debris, cleaning up oil spots and excess water as soon as they are noticed, and regular inspection and maintenance of all machinery). Daily collection and separate storage of hazardous and non-hazardous waste.

I) Force Majeure and Insurance coverage to the Project

Particular: Natural calamities like flood, earthquake, fire, and other act of God and Act of Man etc. Mitigation: Complete plant need to be insured and also care has been considered while designing and construction of the plant to minimize the impact. Third party Liability,

Workers compensation, Employers Liability, Legal and contractual liabilities, Loss of profit due to interruption due to fire machine, break down, and related perils, Loss of profit due to loss of generation are some of the other risk against which the mitigation measures have been considered in the project by the way of insurance.

3. Fire and Explosion Index

Fire, Explosion and Toxicity Indexing (FETI) is a rapid ranking method for identifying the degree of hazard. In preliminary hazard analysis, chemical storages are considered to have Toxic and Fire hazards. The application of FETI would help to make a quick assessment of the nature and quantification of the hazards in these areas. However, this does not provide precise information.

- Respective Material Factor (MF),
- General Hazard Factors (GHF)
- Special Process Hazard Factors (SPH)
  They are computed using standard procedure of awarding penalties based on storage handling and reaction parameters.

It can be used to classify separate elements of plant within an industrial complex. Before indexing is done, the plant is divided into plant elements. Depending upon the material in use, material factor, number of parameters such as exothermic reactions, handling hazards, pressure of system, flash point, operating temperature, inventory of flammable material, corrosive property, leakage points and toxicity are taken into consideration in determining a plant/ equipment /operation hazard. A standard method of awarding penalties and comparing the indices is used. However, this method does not give absolute status of the equipment or section. Dow's Fire and Explosion Index (F and E) is a product of Material Factor (MF) and hazard factor (F3) while MF represents the flammability and reactivity of the substances, the hazard factor (F3), is itself a product of General Process Hazards (GPH) and special process hazards (SPH). An accurate plot plan of the plant, a process flow sheet and Fire and Explosion Index and Hazard Classification Guide published by Dow Chemical Company are required to estimate the FE & TI of any process plant or a storage unit

3.1 Computations and Evaluation of Fire and Explosion Index

The degree of hazard potential is identified based on the numerical value of F&EI as per the criteria given Table 7.1

Degree of Hazard	F & EI Range
Light	0-60
Moderate	61-96
Intermediate	97-127
Heavy	128-158
Severe	159-up

Table No. 7.1 Fire & Explosion Index

Risk Index (RI)

The risk categories can be expressed in terms of the Risk Index as given below.

Category	Risk index
Acceptable region	<0

Low Risk	0
Moderate risk	0.67
Significant Risk	1.33
High Risk	2
Unacceptable region	>2

Table No. 7.2: Risk Index

Threshold Dose (Kj/m^2)	Effect
375	3rd degree burn
250	2nd degree burn
125	1st degree burn
65	Threshold of pain, no reddening or blistering of skin caused

Table No. 7.3: The Physiological Effects of Threshold Thermal Doses

Note:
1st degree burn- Involves only epidermis. Example sunburn. Blisters may occur.
2nd degree burn- Involves whole of epidermis over the area of burn plus some portion of dermis area.
3rd degree burn- Involves whole of epidermis and dermis. Sub cutaneous tissues may also be affected.

Incident Radiation Intensity (KW/m2)	Type of Damage
37.5	Minimum energy required igniting wood at infinite long exposure (non piloted).
32.0	Maximum flux level for thermally protected tanks
12.5	Minimum energy required for piloted ignition of wood, melting plastic tubing etc.
8.0	Maximum heat flux for un-insulated tanks.
4.5	Sufficient to cause pain to personnel if unable to reach cover within 20 seconds. However blistering of skin (1st degree burns) is likely.
1.6	Will cause no discomfort to long exposure.
0.7	Equivalent to solar radiation.

Table No. 7.4: Damage due to Incident Radiation Intensity

4. Consequence Analysis

Hazardous substance on release can cause damage on a large scale in the environment. The extent of the damage is dependent upon the nature of the release and the physical state of

the material. It is necessary to visualize the consequences and the damages caused by such releases.
The quantification of the physical effects can be done by means of various models, which can then be translated in terms of injuries and damage to exposed population and buildings.

Hazardous substances may be released as a result of a catastrophe causing possible damage to the surrounding areas. The extent of damage depends upon the nature of the release. The release of flammable materials and subsequent ignition results in heat radiation, pressure wave or vapour cloud depending upon the flammability. It is important to visualise the consequences of the release of such substances and the damage caused to the surrounding areas. An insight into physical effects resulting from the release of hazardous substances can be had by means of various models. Vulnerability models are used to translate the physical effects occurring in terms of injuries and damage to exposed population and buildings

5. Risk Mitigation Measures

The materials handled at the proposed installation are inflammable and reactive substances and based on the consequence analysis; the following measures are suggested as risk mitigation measures. It should be ensured that combustible materials such as oiled rags, wooden supports, oil buckets etc. are not kept in the storage and process areas as well as road tankers loading/unloading sites where there is maximum possibility of presence of flammable
hydrocarbons in large quantities, to reduce the probability of secondary fires.

- Smoke and fire detectors should be suitably located and linked to fire fighting system to reduce the response time and ensure safe dispersal of vapours before ignition can occur.
- Training in fire fighting, escape action, operation of emergency switches etc. is vital.
- Pump loading line failures also have possibility of causing major damage. Strict inspection, maintenance and well laid down operation procedures are essential for preventing escalation of such incidents.
- Emergency procedures should be well rehearsed to achieve state of readiness.

5.1 Possibilities, Nature and Effects of Emergency

Leaving aside earthquake, cyclone, flood, arson and sabotage, the possible emergencies that can arise in the power plant due to operations and storages and handling of the fuels and gases are:

- Explosion in boilers, turbo generators, transformers and hydrogen plant
- Subsequent fire in the fuel handling area
- Large fires involving the bagasse storage yard and bagasse handling areas
- Accidental release of ash slurry
- Accidental fire due to some other reasons such as electrical short circuit.

6. Methodology of Multi Criteria Decision Analysis (MCA)

The MCA analysis involves ordering and ranking of various sections in terms of potentialvulnerability. The data requirements for MCA analysis are:

- Flow diagram and P&I diagrams
- Detailed design parameters
- Physical & chemical properties of all the chemicals
- Detailed plant layout
- Detailed area layout
- Past accident data

The MCA analysis includes Identification of potential hazardous process units, storage sections and representative failure cases from the vessels and pipe lines

7. Factors Influencing the Use of Physical Effect Models

In order to calculate the physical effects of the accidental releases of hazardous substances the following steps must be carried out in succession:

- Determine the form in which the hazardous substances occur- gas, gas condensed to liquid or as a liquid in equilibrium with vapour
- Determine the way in which the release takes place, above or below the liquid level in a process unit or storage facility, instantaneous or continuous
- Determine the outflow volume (as a function of time) of the gas, vapour or liquid in the event of liquid outflow, possible two phase outflow,
- Determine the evaporation from the pool of liquid formed
- Dispersion of the released gas or vapour which has formed into the atmosphere

A distinction has to be made between toxic and flammable substances. In the event of the incidental release of toxic substances it is necessary to compute the concentrations of gas cloud (as a function of time and place) spreading in the surrounding areas. In the case of flammable substances, the heat radiation is computed for the following situations:

- Torch, if vapours are ignited
- Pool fire, if pool of liquid is ignited
- Boiling Liquid Expanding Vapour Explosion (BLEVE) which is a physical explosion

In the event of an explosive gas cloud the peak overpressure resulting from the explosion is calculated and the damage contours are plotted. In the distribution model account is taken of the atmospheric stability, the so-called Pasquill classes (A to F) and a wind velocity. The model is based on a point source. In practice, however, a point source will never exist;

For example, a surface sources in the case of pools. To enable the source dimensions to be included in the calculation in the dispersion models in spite of this, an imaginary (virtual) point source is assumed, which is put back in such a way that the cloud area calculated according to the model has the source dimensions at the site of the actual source. In calculations based on a continuous source, the duration of the source is also included in the calculation. Some conditions for this calculation model are as follows:

There must be some wind at the site, The model applies only to open terrain; allowance is made, however, for the roughness of the terrain. The influence of trees, houses, etc. on the dispersion can be determined by means of the roughness length.

7.1 Models for the Calculation of Heat Load and Shock Waves

If a flammable gas or liquid is released, damage resulting from heat radiation or explosion may occur on ignition. Models for the effects in the event of immediate ignition (torch, pool fire and BLEVE) and the ignition of a gas cloud will be discussed in succession. These models calculate the heat radiation or peak overpressure as a function of the distance to the torch, BLEVE, the ignited pool or gas cloud.

7.2 Model for a BLEVE

BLEVE stands for Boiling Liquid Expanding Vapour Explosion. BLEVE is a follow-up effect that occurs if the vapour side of a tank is heated by a torch or a pool fire. Due to the heating, the vapour pressure will rise and the material of the tank wall will weaken. At a given moment the weakened tank wall will no longer be able to withstand the increased vapour pressure and it will burst open. As a result of the expansion and flash-off a pressure wave occurs. In the case of flammable gases a fireball will form. The effects of a BLEVE for a tank with a flammable liquid are:

- A fireball: model gives the radius of the fire ball and the thermal load
- Pressure wave effects resulting from the expansion of the vapour and the flash-off. This is however, not predominating in this case
- Rupture of the tank, resulting in the formation of numerous fragments of the tank. These fragments can be hurled over at fairly great distances by the energy released.

7.3 Ignition of a Gas Cloud

If a flammable gas is not ignited directly, this cloud will spread in the surrounding area. The drifting gas cloud will mix with air. As long as the gas concentration is between the lower and upper explosion limit, the gas cloud may explode or give flash fire on availability of an ignition source. The flammable content of a gas cloud is calculated by a three-dimensional integration of the concentration profiles, which fall within the explosion limits. If the gas cloud ignites, two situations can occur, namely non-explosive combustion (flash fire) and explosive combustion (flash fire + explosion). The heat radiation from a flash fire is not calculated since the burning time is very short. Models exist for the calculation of the peak overpressure in explosive combustion as a function of the distance from the center of the gas cloud.

7.4 Burning Torch

The out flowing gas on immediate ignition gives a burning torch. In this model, an ellipse is assumed for the shape of a torch. The volume of the torch (flare) in this model is proportional to the outflow. In order to calculate the thermal load the centre of the flare is regarded as a point source.

7.5 Injuries resulting from Flammable Liquids and Gases

In the case of flammable liquids and gases on immediate ignition, a pool fire or BLEVE or a flare will occur. The injuries in this case are mainly caused by heat radiation. It is only in the case of a BLEVE that injury may occur as a result of flying fragments also. Serious injuries as the result of the shock wave generally do not occur outside the fire ball zone. Fragmentation of the storage system can cause damage up to distances of over 1 km. If the gas is not ignited immediately, it will disperse into the atmosphere. If the gas cloud ignites, it is assumed that everyone present within the gas cloud will die as a result of burns or asphyxiation. The duration of the thermal load will be too brief in case of explosion to cause any injuries. In the event of very rapid combustion of the gas cloud the shock wave may cause damage outside the limits of the cloud. Explosive combustion will only occur if the cloud is enclosed to some extent between buildings and structures.

7.6 Damage Models for Heat Radiation

It is assumed that everyone inside the area covered by the fire ball, a BLEVE, a torch, a burning pool or gas cloud will be burnt to death or will asphyxiate. The following probit functions are examples of methods which can be used to calculate the percentage of lethality and first degree burns that will accurate a particular thermal load and period of exposure of an unprotected body.

Lethality

Pr = 36.38 + 2.56 ln (t.q4/3)

First degree burn symptoms

Pr = 39.83 + 3.0186 ln (t.q4/3)

Where, t= Exposure time in seconds,
q= Thermal load in W/m2,
Pr= Probit value, which relates to the percentage of affected people
For the exposure time, two values are chosen:

- 10 seconds: In a residential area, it is reasonable to assume that affected people can find protection from the thermal load within 10 seconds.
- 30 seconds: This pessimistic assumption applies if people cannot directly flee or no protection is provided to them.

7.8 Safety Equipment

Particulars	Nos
DCP Type 5 Kg Fire Extinguisher	3
DCP Type 10 Kg Fire Extinguisher	2
CO_2,Water type ,Capacity 9 lit	5
Mechanical Foam Type, Capacity 9 lit	2
Carbon Di Oxide,(CO_2) Capacity 4.5 Kg	3

Table No. 7.5 : Fire & safety facilities with SMSKL.

7.9 Risk Reduction Measures

The following opportunities will be considered as a potential means of reducing identified risks during the detailed design phase:

- Buildings and plant structures designed for cyclone and seismic events (where appropriate), to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods;
- Provision for adequate water capacity to supply fire protection systems and critical process water;
- Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations;
- Installation of fit-for-purpose access ways and fall protection systems to facilitate safe access to fixed and mobile plant;
- Provision and integrity of process tanks, waste holding tanks and bunded areas as per relevant standards;
- Containment of hazardous materials;
- Security of facility to prevent unauthorized access to plant, introduction of prohibited items, and control of onsite traffic; and

- Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).
- Surrounding population (includes all strata of society) should be made aware of the safety precautions to be taken in the event of any mishap within the plant. This can effectively be done by conducting the training programs.
- Critical switches and alarm should be always kept in line
- Fire extinguishers should be tested periodically and should be always kept in operational mode
- A wind direction pointer should also be installed at storage site so that in an emergency the wind direction can be directly seen and downwind population caution.
- Shut off and isolation valves should be easily approachable in emergencies A detailed HAZOP and Fault Tree Analysis should be carried out before commissioning of any new installation.

7.10 Disaster Management and Emergency Plan

SMSKL will be a new growth oriented centre in the Patethan area district Pine. Such unit can pose threat of danger / hazard due to storage of hazardous materials. Distillery plant also poses electrocution, fire, and explosion hazards. When the full fledge activity of Ethanol Plant will gear up it will have to follow Factories Act 1948 & Maharashtra Factories Rules 1963 with all amendments till today and any directives from Director Safety, Health & Environment [SHE] will automatically be binding on SMSKL. In such condition to appoint a qualified Safety Officer is a must & will be an adequate, wise step in such direction. On site and off site disaster control plans and their perfect implementation will be part and parcel of the management & such safety officer. To lessen the probability of hazard to occur & avoid the consequent damage, a disaster management and control plan has to be worked out for whole complex in anticipation to the threat.

7.11 Type of Disaster at SMSKL complex

Disaster can occur as on site or off site variety i.e. disaster on campus or disaster in nearby area causing indirect damage to site area & the complex. Disaster may occur due to two categories, natural and manmade calamities. Natural calamities cover Flood, Storm / typhoon, Earthquake, Tsunami, Heavy mist, fog, hail storm, Land slide.
Manmade calamities involve Fire & Explosion, All types of leakages & spillage, Electrocution, excavation, construction, erection, Sabotage, rail & road accidents, Mass agitation, Looting, Morcha, war.
The identified hazardous areas in the complex are
1. Boiler area - Explosion
2. Oil tanks - Fire and spillage
3. Turbine section - Explosion
4. Electrical rooms - Fire and electrocution
5. Transformer area - Fire and electrocution
6. Cable - Fire and electrocution
7. Storage facilities – Fire / spillage for fuel and alcohol

Considering various probabilities the management & safety department has to create safety awareness & preparedness in all employees and people in vicinity area in case of any sort of emergency to occur & a chalked out attempt to surely overcome the disaster in time. This includes preparation of on site and off site disaster control plans, their mock drills at least 2 times in a calendar year, reports for the same to DISH & due amendments for the perfect implementation.

7.12 Level of accident

If there is any disaster in any part of plant/work place due to any reason the level of accidents from damage point of view may vary. Accordingly accident prevention program will have to be initiated by safety department simultaneously.

7.13 Critical Targets during Emergency

Level - I Accidents

Under this level disaster may happen due to electrocution, fire explosion, oil spillage and spontaneous ignition of combustible material. This level has probability of occurrence affecting persons inside the plant. Various hazardous areas identified in section 6.3 are potential areas to be affected due to level – I accidents.

Level - II Accidents

Disaster of this level can occur in case of sabotage and complete failure of all automatic control / warning systems, and also if the fuel oil stored in tank and covered by tank bunds leaks out. However, probability of occurrence of this is very low due to the proposed adequate security training, and education level of plant personnel for the captive power plant.

7.14 Site Emergency Control Room (SECR) & Site main controller

In each segment of work from domestic level to war fighting team level approach always helps.
If concerned man is aware of his duty at his place & need of the time he can complement to huge task of lessening the damage of the disaster. To overcome the emergency in its occurrence it is the strategy to get prepared in advance, plan for the team effort, educate others and reduce all effects of disaster.

In case of any disaster main responsibility lies with the Chairman and Board of Directors, where they can nominate one fellow to be responsible person who will be Chief incidence controller. In case of disaster key person like Chief engineer, Chief chemist, Distillery manager will be the site main incidence controller and will commence respective duties in that capacity to curtail the emergency & minimize the losses may be occurring.

People in all departments can assist to contact external persons, district, state & central authorities, hospital & ambulance contact, evacuation if needed for people in the vicinity with assistance of state transport buses. People from maintenance department can help to rectify the fault in system. Security persons assist in fire fighting & material movement operation to avoid losses. It is utmost necessary to plan the control plan & to involve all staff in factory to get any sort of external help / assistance in time to lessen all sorts of damage.

To assist the disaster control more effectively a site emergency control room (SECR) will be established at the plant site. The SECR may be provided with following sections:

- All site plant layout
- List of important telephone numbers of Chairman & Directors SMSKL, Chief Engineer,
  Chief Chemist, Distillery Manager, Administration Manager.

- Telephone numbers of Patethan Gram Panchayat, Daund Tehesil, Tahasildar of Daund,
  Pune District collector, Pune State transport depot office, Pune District & local fire brigade station, home guard, civil defence, N.C.C. unit, State crisis group, Mumbai, crisis group, CGO complex, MoEF, New Delhi
- All material handling & incoming vehicle traffic to be stopped temporarily.
- All out going lines to be used to contact above authorities.
- Captive power plant layout showed with inventories and locations of fuel
- Oil / furnace oil storage tanks, storage yard etc.
- Hazard identification chart, maximum number of people working at a time, assembly points etc
- List of village and their population in the vicinity of proposed Distillery plant
- Public address system like loud speaker, battery operated speaker, sirens,
- Whistles, batteries, signaling flags etc.
- Rechargeable and battery operated torch lights and invertors.
- Tie up with nearest hospital for medical assistance and facility for stretchers, chairs etc.
- List of registered medical practitioners in vicinity.
- Study map showing various villages and towns in the vicinity of distillery plant.
- Muster Roll of all present employees.
- Note pads and ball pens to record message received and instructions to be passed to concerned persons
- The blow up copy of Layout plan showing areas where accident could occur.
- Accident mock drill for at least 2 times in a calendar year is to be a part of routine exercise. The report bf such drill has to be submitted to DISH for his information & approval.

7.15 Disaster Preventive Measures

The proposed power plant will have following preventive measures to avoid occurrence of disasters:

(i) Specification & marking of safe area to gather in emergency.

(ii) Design, manufacture and construction of plant, machineries and buildings will be as per national and international codes as applicable in specific cases and laid down by statutory authorities.

(iii) Provision of adequate access ways for movement of equipment and personnel shall be kept.

(iv) Minimum two numbers of gates to escape during disaster shall be provided.

(v) Fuel oil storage shall be in protected and fenced. The tank will be housed in a dyke wall. As per regulations of CCOE its testing & certification will be performed each 5 years regularly.

(vi) Proper colour coding for all process water, air & steam lines will be done.

(vii) Proper insulation for all steam & condensate, hot water lines will be done.

(viii) Provision of circuit brakers, isolation switches, signals will be provided as per electricity act & rules.

(ix) Proper & rigid bonding and earthing to all equipment will be arranged.

(x) Meager value of earthing connections will be checked each 6 months and the same record will be available.

(xi) System of fire hydrants comprising, of electrical motor driven fire pumps is planned. The fire hydrant system will have electrical motor and a generator driven jockey pump to keep the fire hydrant system properly pressurized.

(xii) Automatic water sprinkling system is planned for all transformers.

7.16 Fire Fighting Arrangements

In addition to the existing Fire Fighting System, separate Fire safety system is planned to be installed for 3 KLPD Demonstration Pilot Plant, which will cover its following sections :

1. Feed stock storage & Material Handling & Milling
2. Wet Washing & Pretreatment Section
3. Enzymatic Hydrolysis
4. Co- Fermentation
5. Distillation
6. Solid Liquid Separation
7. Effluent Treatment section
8. RS Storage Tank (In existing Alcohol storage section)
9. Fire Fighting System
10. Cooling Towers
11. Labs and Control room.
12. Office and Admin Buildings

Fire system will be designed primarily as per TAC guidelines. Fire safety system includes:

a) Hydrant System with water cum foam monitor for the Complete Plant

b) Wet Riser System for Milling, Pre-treatment, Solid Liquid Separation/Filter Press, Fermentation and Distillation

c) Suitable Fire Alarm & Detection system for the Complete Plant

The existing RS tank will be used to store RS produced from the 3 KLPD demonstration plant and will be equipped with necessary fire safety systems.

7.17 Location Type Of Fire Extinguishers

- Turbo-generator area: CO_2 Type, Foam Type Dry chemical powder
- Cable galleries: CO_2 Type, Foam Type Dry chemical powder
- High voltage panel: CO_2 Type, Foam Type Dry chemical powder
- Control rooms: CO_2 Type, Foam Type Dry chemical powder
- MCC rooms: CO_2 Type, Foam Type Dry chemical powder
- Pump houses: CO_2 Type, Foam type dry chemical powder
- Fuel tank Area: CO_2 type, Foam Type Dry chemical powder Sand Basket
- Offices & Godowns: Foam or Dry chemical powder Type

- Crushers house: CO_2 Type, Foam Type dry chemical powder

7.18 Recommendations

The fire tender, which will be part of project with following minimum fire fighting arrangements shall be procured:

- Water tank - 500 litres
- CO2 - 2700 litres
- Foam tank - 45 litres
- CO2 type fire extinguishers - 6 nos of 4.5 kg each

7.18 Alarm System to be followed during disaster

On receiving the message of 'Disaster from Site Main Controller, fire station control room attendant will sound Siren 'WAVING TYPE' for 5 minutes. Incident controller will arrange to broad cast disaster message through public address system. On receiving the message of "Emergency Over" from incident Controller the fire station control room attendant will give "All Clear Signal" by sounding alarm straight for two minutes. The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster. It is necessary to take one trial for perfect functioning of the siren at least once in one week with prior intimation to Pune District Collector.

No.	HOSPITALS	Location	Phone Number
1	Govt. Hospital	Daund	263765
2	Dr. Rajendra Mane	Daund	262020, 262433, 9850935620, 9226245257

FIRE BRIGADE	Location	Telephone / Mobile Number
Fire brigade	Daund	262339, 262324, 9890762184
POLICE STATION		
Police		100
Police Station	Daund	262333, 262444

Sonone Hospital	Daund	264433, 262624, 262021
Dr. Lonkar's Hospital	Daund	262451, 262425
Dr. Jaikar Hospital	Daund	263560
Dr. Bhattad Eye Hospital	Daund	262027, 263354, 9226761103
Dr. Sameer Kulkarni-Accident		262355, 265879, 9422312145
Blood Bank (Dr. C.T. Shah)	Daund	263938, 9226924750
Sasoon Hospital	Pune	020-26128000
KEM Hospital	Pune	020-25125600
Ruby Hall Clinic	Pune	020-26123391 / 8
Jehangir Hospital	Pune	020-26122551, 26050550
AMBULANCE		
Ambulance		101
Daund Nagarpalika	Daund	262444
Patit Pawan Sanghatana	Daund	262197, 262542
Dr. Divekar Hospital	Warvand	02119-283444
Sasoon Hospital	Pune	020-26128000
KEM Hospital	Pune	020-25125600
Jehangir Hospital	Pune	020-26122551
Ruby Hall Clinic	Pune	020-26123391