Chapter VII

ADDITIONAL STUDIES

(SAFETY, RISK, DISASTER MANAGEMENT& PUBLIC HEARING)

7.1 SAFETY

Definition: Safety is the state of being "safe", the condition of being protected against physical, social, spiritual, financial, or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable.

The factory is proposing the following safety policy, which indicates the sincere commitment of the factory towards safety at work place.

- We have an idea that human life is precious
- We give priority to our production process as a safety, health and pollution free environment
- In our opinion, the accident is an avoidable event
- We are always careful to avoid accidents
- We are committed to covering the safety in the factory carefully
- We have made adequate organization to carry out all the above responsibilities

7.1.1 Goals/Targets of Safety

- Accident prevention
- Accident control
- Protection of human health/life
- Protection of material and property
- Protection of environment
- All workmen as well as staff of the factory are committed to safe work environment and hence they follow the basic principle of 'safety first'.

The safety department of the factory is responsible for creating safe environment at workplace. They are also responsible for creating and maintaining awareness on safety aspects at factory premises. This is achieved by regular training programmes, display of posters and notices at strategic locations, arranging documentary film shows related to safety, on job training, daily safety round, recommendation for corrective action, etc. The Department has formulated safety procedures and rules, depending upon the nature of work carried out at respective location.

These procedures allow the safety personnel to periodically inspect equipments such as safety guards, cranes, lifting tackles, etc. He also inspects the certificates of fitness of the equipment. In addition to this, each year employees has been rewarded for best safety suggestion.

As a result of excellent housekeeping and safety practices, the factory could able to achieve, zero fetal as well as near miss accidents for last five years and has not lost a single hour due to accidents. However, the factory has well laid procedure for accidents, which is as follows.

7.1.2 Procedures in case of accident

- According to the procedures, when an accident occurs at any place of the factory, respective shift in-charge immediately fills the accident report form. In the next step, this form is sent to respective Head of the Department who signs the form and submits it to Managing Director (MD), who communicate it to the Government Authority/ies. MD also initiates the process of investigation under the supervision of safety officer. Root cause of accident is determined and suitable preventive/corrective action is drawn. MD approves the findings of the investigations and corrective/preventive action plan is submitted to respective Head for implementation.

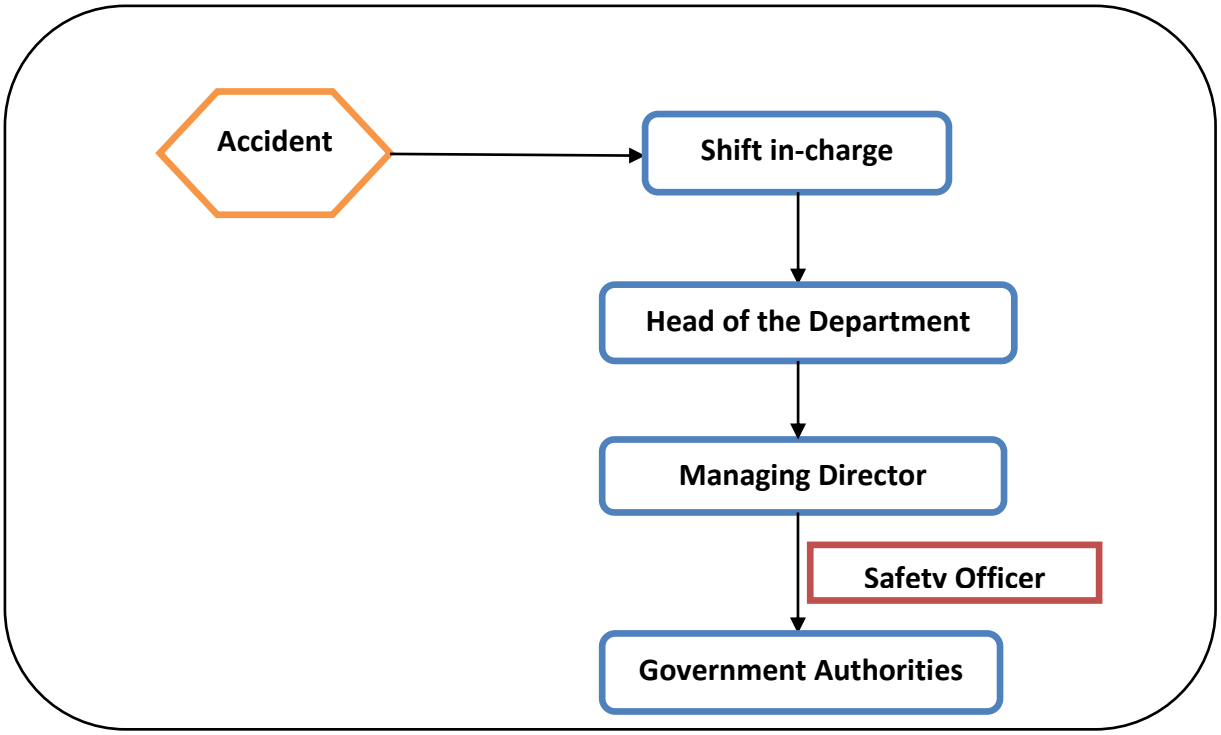


Figure 7.1: Schematic of procedure in case of accident

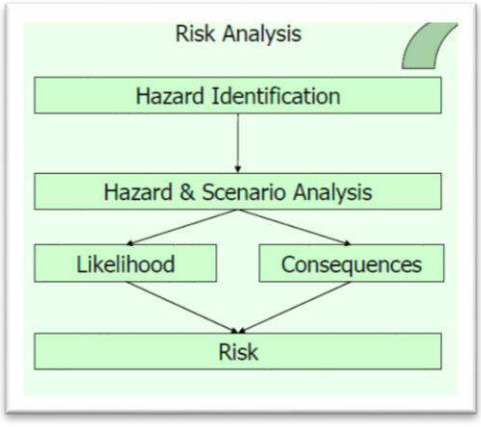
7.2 RISK ASSESSMENT AND RISK MANAGEMENT

Generally, risk associated with industrial processes can be defined as a measure of probability of harmful event such as death, injury, loss, etc. arising from exposure to chemical or physical agent may occur under the specific conditions of manufacture, use or disposal. Risk is a mathematical product of hazard and exposure. This relationship can, be expressed in the following simple formula.

Risk = Hazard x Exposure x Vulnerability

Multiplying any number by zero results in a product of zero, which means that an extremely hazardous substance can be present with little risk of adverse effect, if handled safely under proper conditions then the 'exposure' component of the risk equation is driven towards zero. Similarly, the hazard component can be reduced to zero even if there is a high probability of exposure, by changing the process design, substituting less hazardous commodity, using a lesser amount of a chemical, etc. and the recognition of vulnerability as a key element in the risk equation has also been accompanied by a growing interest in linking the positive capacities of people to cope, withstand and recover from the impact of hazards. It conveys a sense of the potential for managerial and operational capabilities to reduce the extent of hazards and the degree of vulnerability, which derives the total equation of risk towards zero.

Risk assessment is concerned with determining those factors which are especially dangerous and determining the likelihood of unacceptable toxic exposure. Risk should be assessed against defined limits of exposure, established on the basis of tests under appropriate conditions. Risk Management – a decision - making process to select the optimal steps for reducing a risk to an acceptable level. In the industrial context, it consists of 3 steps: risk assessment (evaluation), emission and exposure control, and risk monitoring.



7.2.1 Hazard Identification

7.2.1.1 Broad Categories of Hazard

To help with the process of identifying hazards it is useful to categorize hazards in different ways like by topic, for example:

a. Mechanical
b. Electrical
c. Thermal
d. Noise and vibration
e. Material/Substances
f. Fire and explosion

a. Mechanical Hazard

It mainly involves properties of machine parts or work pieces, such as:

a. Faulty design (Shape): It may cause injury to workman
b. Relative location: Confined location during repairs & maintenance
c. Mass and stability: May cause physical injury
d. Inadequacy of mechanical strength
e. Accumulation of energy inside the equipment: steam/ air /water pressure cause injury to workman
f. During commissioning, operation and maintenance following hazards are anticipated. Crushing hazard, shearing hazard, cutting or severing hazard, entangling hazard, friction or abrasion hazard and high pressure fluid injection or ejection hazard.

b. Electrical Hazard

Probable incidences for electrical hazards, could be

a. Contact of persons with live parts (direct contact),
b. Contact of persons with parts which have become live under faulty conditions (indirect contact)
c. Approach to live parts under high voltage
d. Electrostatic phenomena
e. Thermal radiation or other phenomena such as the projection of molten particles and chemical
f. Effect of short circuits, overloads, etc identified during construction, production and maintenance.

c. Thermal Hazard

Probable causes of thermal hazards are -

a. Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extremely high or low temperature, by flames or explosions and also by radiation of heat sources
b. Damage to health by hot or cold working environment
c. Thermodynamic hazard such as overpressure, under pressure, over-temperature, under-temperature need to be avoided by providing system management

d. Hazard generated by noise & vibration

In the proposed project, probable source of noise are – boilers, steam turbine generators and transportation of bagasse on conveyer belts, motors, loading of bagasse, etc. Usually prolong exposure to high noise level, results into

1. hearing loss (deafness), other physiological disorder (e.g., loss of balance, loss of awareness)
2. Interference with speech communication, acoustic signals, etc.

In the proposed project the hazard due to vibrations could be due to -

1. Use of hand-held machines resulting in a variety of neurological and vascular disorders
2. Whole body vibration, particularly when combined with poor postures

e. Hazards generated by materials/substances

1. Hazards from contact with or inhalation of harmful fluids such as: anti rusting chemicals, cleaning agents/acids/organic solvents gases, superheated steam through leaks and bagasse dusts
2. Fire or explosion hazard—dry bagasse
3. Biological or microbiological (viral or bacterial) hazards: -Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis.

During work activities following hazards could occur -

i. Slips/falls on the floor level
ii. Fall of persons from height
iii. Fall of tools, materials, etc. from height
iv. Inadequate headroom
v. Hazards associated with manual lifting/handling of tools, material, etc
vi. Hazards from plant and machinery associated with assembly, commissioning, operation, maintenance, modification, repair and dismantling
vii. Vehicle hazards, covering both on-site transport and off-site travel by road
viii. Fire and explosion
ix. Violence to staff

x. Substances that may be inhaled
xi. Substances or agents that may damage the eye
xii. Substances that may cause harm by coming into contact with, or being absorbed through the skin
xiii. Substances that may cause harm by being ingested (Entering the body via mouth)
xiv. Harmful energies (for example, electricity, radiation, noise, vibration, etc.)
xv. Non-compliance of regulation
xvi. Inadequate thermal environment (for example too hot temperature)
xvii. Lighting levels
xviii. Inadequate guard rails or hand rails on stairs
xix. Subcontractors' Activities

7.3 Probable Risk Factors (Associate with the Industry)

Following scenarios fall under maximum credible accident scenario

- Fire in fuel storage yard (bagasse yard)
- Fire and explosion at storage yard (molasses and alcohol storage tanks)
- Fire due to short circuits
- Injury to body and body parts (mechanical)

7.3.1 Fire in fuel storage yard

This is the most common accident known to occur in any plant, while storing and handling fuel. Usually, such incident takes sufficient time to get widespread. Enough response time is available for plant personnel to get away to safer distance. An elaborate fire hydrant network and firefighting system comprising of trained crew and facilities will mitigate the risk of such incidents. In addition, as per requirement fire alarm system and smoke detectors have been installed (in the existing unit).

The storage area is most vulnerable for fire and includes storage tanks of alcohol and molasses. This is the most common accident known to occur in any plant, while storing and handling fuel. Since such incident takes sufficient time to spread, enough response time is available for plant personnel to get away to safer distance. An elaborate fire hydrant network and firefighting system including trained crew and facilities will be provided to mitigate the risk of such incidents. In addition, as per requirement fire alarm system and smoke detectors will be installed.

Table 7.1NFPA (NATIONAL FIRE PROTECTION ASSOCIATION) Rating

Chemical	NFPA Ratings		
	Health Hazard	Fire	Reactivity
Ethanol	2	3	0

(Least-0, Slight-1, Moderate-2, High-3, Extreme-4)

Gas holder

- Pressure in gas holder should be always more than 100 mm.wg. If pressure falls below the biogas blower should be switched off and isolating valve in flare line should be closed.
- Moisture eliminator is provided at inlet & outlet of gas holder. These should be drained at least once in a day to drain the water.Drain valve should be operated such that it is closed tightly before gas can escape.
- In case of maintenance of gas holder, on roof top should be opened and gas holder should be properly purged before starting maintenance. Gas mask should be used for entering the gas holder.
- Continuous water supply to gas holder should be maintain for providing water seal.

Gas Handling System

- Gas Blower is provided with flame proof motor, cable connection should be maintained accordingly
- Safety valve on blower discharge side should be properly adjusted to provide desired gas
- Moisture is likely to collect in the gas pipe line to Boiler. Drain points should be provided at interval and drained at least once in a day. Precaution should be taken while operating drain valve so that gas does not escape while draining water
- Flame arresters provided in the gas line should be cleaned periodically so that gas pressure at boiler end is maintained
- At the time of lighting the burner, if burner does not light up within 15 to 20 sec. close the shut off valve in gas line, and purge the furnace before trying to light up burner again
- Do not light up burner from hot brick work.

7.3.2 Mechanical injury to body parts

In a plant, there are several places where workers are likely to be involved with accidents resulting in injury to body parts. The places are workshop, during mechanical repair work in different units, during construction work, road accidents due to vehicular movement, etc.

- Workers exposed to mechanical accident-prone areas are using personal protective equipment. The non-respiratory PPE includes tight rubber goggles, safety helmets, welders hand shields and welding helmets, plastic face shields, ear plugs, ear muffs, rubber aprons, rubber gloves, shoes with non-skid soles, gum boots, safety shoe with toe protection. All safety and health codes prescribed by the BIS will be implemented.

Table 7.2: Hazardous areas in a molasses based distillery attached to sugar mill.

#	**Hazardous Area**	**Likely Accident**
1	Boiler	Explosion
2	Turbine room	Explosion
3	Electrical room	Fire and electrocution
4	Bagasse yard	Fire
5	Alcohol storage tank	Fire
6	Biogas holding tank	Fire

Figure 7.2: Bagasse yard with fire extinguishing system

7.3.3 Mitigation Measures for Fire Hazards

A. Storage

- Alcohol (RS, ENA or AA) and molasses will be stored in leak-proof MS tanks, gauges of MOC will be strictly as per IS or relevant standards
- Storage area will be well ventilated with adequate spacing between units
- Lightening arresting system
- Provision of alcohol vapor condensation system

- Strictly declared 'No Smoking Zone' and prohibition of use of any ignitable material (e.g. even cell phones, etc.)
- Electrical fittings of good quality that comply national or international standards

B. Firefighting system

The mill management is vigilant on the issues of safety of workers and plant. It has planned following firefighting system for the proposed distillery unit

a. Guidelines ofOISD-STD-117 will be implemented

b. Lightening arresting system for the plant as well as storage

c. Alcohol vapors condensing system for storage tanks

d. The fixed water spray system will be provided on all tanks; fire water flow rate will be calculated at a rate of 25 lpm/m^2 as per OISD-STD-117

e. Fire water system will be designed for a minimum residual pressure of 7 kg/cm^2(g) at hydraulically remotest point in the installation considering single largest risk scenario

f. Water for the firefighting will be stored in easily accessible surface or underground tanks of RCC/steel with minimum four hours aggregate rated capacity of pumps.There will be one or two standby diesel engine driven pumps of the same type, capacity & head as the main pumps will be provided; Jockey pump (one in number -AC motor driven) for maintaining pressure

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

h. High velocity water spray system near storage tanks

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

j. The diesel engines will be quick starting type with the help of push buttons located on or near the pumps or located at a remote location.

k. Portable foam and/or water-cum-foam monitors will be provided for suppression of pool fire in tank farm area.

l. Fire water pumps & storage will be located at 30 m (minimum) away from equipment or where hydrocarbons are handled or stored.

m. Fire water pumps will be exclusively used for firefighting purpose only

n. Fire water mains, hydrant & monitor stand posts, risers of water spray system will be painted with "Fire Red" paint as per IS: 5.

o. Hose boxes, water monitors and hydrant outlets will be painted with "Luminous Yellow" paint as per IS: 5

p. Electric audible fire siren will be to the farthest distance in the installation and also in the surrounding area up to 1 km from the periphery of the installation that will sound differently with respect to shift alarm with continuous power supply

q. Communication system like Telephone, Public Address System, etc. to be provided in non-hazardous areas of the installation

r. Concerned officer/employees will be trained to handle the firefighting system

7.3.4 Boiler Operations

1. Provision of adequate sets of Personnel protective equipment's
2. Pilot lights will be provided on electrical panel boards
3. Provision of hand operable firefighting cylinders at strategic locations

7.4 QUALITATIVE RISK ASSESSMENT

Table 7.3 Probability of occurrence of hazard

Probability Number	Causes/ Incident
1	Very unlikely (e.g. once in 10 yrs)
2	Remote (e.g. once in 5 years)
3	Occasional (e.g. once in a year)
4	Probable (e.g. once in a month)
5	Frequent or more often

Table 7.4: Severity - Impact Intensity

1	Minor	Failure results in minor system damage but does not cause injury to personnel, allow any kind of exposure to operational or service personnel or allow any release of chemicals into the environment
2	Major	Failure results in a low level of exposure to personnel, or activates facility alarm system
3	Critical	Failure results in minor injury to personnel exposure to harmful chemicals or radiation, or fire or a release of chemical to the environment
4	Catastrophic	Failure results in major injury or death of personnel

Frequency/ consequence	1 Very unlikely	2 Remote	3 Occasional	4 Probable	5 Frequent
Catastrophic					
Critical					
Major					
Minor					

Acceptable - only ALARP actions considered

Acceptable - use ALARP principle and consider further investigations

Not acceptable - risk reducing measures required

Calculation of Risk assessment and mitigation measures

Risk = Probability x severity

If, there is a probability number of any particular cause/incident is 1 and its severity is minor then,

Risk involved in the hazard is 1x1 = 1

Whereas,

If, there is a probability number of any particular cause/incident is 5 and its severity is catastrophic then, Risk involved in the hazard is 5x4 = 20

Thus, the Risk of those hazards scoring 20 are defined and considered as 'Non-acceptable Risk'.

Mitigation measures or operational control procedures required for such hazards identified is given below in **Table 7.5**.

Table 7.5: Mitigation measures for identified hazards

#	Hazard	Probability	Severity	Mitigation Measure
	Mechanical Hazard			
1.	Physical injury to hand/legs, body parts during process	Frequent Once per month or more often	Minor	Use PPE/PPA
2.	Burst of molasses tank	Remote	Catastrophic	Layers of Protection area (LOPA)
3.	Boiler Explosion	Remote	Catastrophic	Layers of Protection

#	Hazard	Probability	Severity	Mitigation Measure
				area (LOPA)
4.	Fingers nipping in between moving part. Eg. Belt	Probable Once per year	Major	Fixed /Movable Guards at probable sites
5.	Steam pipe leakages	Frequent Once per month or more often	Major	Proactive Maintenance/PPE
6.	Working on height Impact /falling down	Probable Once per year	Critical	Work permit system Life belts/Helmet
7.	Water feeder pump failure	Occasional Once per 10 years	Critical	Alarming/communication arrangements
	Electrical Hazard			
8.	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Occasional Once per 10 years	Major	PPE/PPA/Permits
9.	Approach to live parts under high voltage	Occasional Once per 10 years	Catastrophic	Guards/ authorization Enter Restriction
10.	Electrostatic phenomena	Remote	Major	Earthling, avoid Dust Explosion
11.	Thermal radiation or other Short circuits, overloads, etc.	Probable Once per year	Major	PPE/Checking /Inspection
	Thermal Hazard			
12.	Burns, scalds and other injuries by steam	Occasional Once per 10 years	Major	Safe working distance/PPA/protective dress code
12.	Damage to health by hot working environment	Frequent Once per month or more often	Critical	Minimum exposure Ventilation/Humidity control
	Hazard generated by Noise			
13.	Belt movement, Pump/Motor, Turbo generator	Frequent	Critical	Confinement of source, Use Ear Muff/Plugs
	Hazard generated by Vibration			

#	Hazard	Probability	Severity	Mitigation Measure
14.	Whole body vibration, during working on feeder platform	Remote	Major	Engineering solutions

Number of Accidents *Reportable* under the Factories Act, 1948(Including accidents to workers employed by Contractors, Vendors, Transporters and Visitors)		Assessment Period		
		2016	2015	2014
1	Fatal000	Nil	Nil	Nil
2	Total Permanent Disability 000	Nil	Nil	Nil
3	Non-Fatal (Excluding item #5.2) 000	Nil	Nil	Nil
4	Weighted Accident Frequency Rate (WAFR) $= \frac{[\{10(\text{Item \#5.1 + 5.2)+ Item \#5.3}\}] \times 10^8}{\text{Number of Total man-hours worked (as in item \#3.2C)000}}$	Nil	Nil	Nil

Hazard Warning Information for Ethyl Alcohol

SECTION I	
Product Name	Ethyl Alcohol
Synonyms	Anhydrous Ethyl Alcohol, Dehydrated Alcohol
Chemical Family	Alcohol
Molecular Weight	46.07
Formula	C_2H_5OH

Health	Fire	Reactive	Other	Degree of Hazard	Colour Coding	Other Codes
0	3	0	-	0 = Minimum 1 = Slight 2 = Moderate 3 = Serious 4 = severe	Health = Blue Fire = Red Reactivity = Yellow Other = White	Ox = Oxidizer Acid = Acid Alk = Alkaline COR = Corrosive W = No use water

SECTION II – INGREDIENTS				
Composition	**Cas Rn.**	**Nominal Wt/Wt%**	**PEL/TLV**	**Hazard**
Ethyl Alcohol	64-17-5	100.0	**1000 ppm**	Flammable/Nervous System Depressant

PEL = Personal Exposure Limit

TLV = Threshold Limit Value

7.5 MITIGATION

7.5.1 Basic Design of The Sugar Unit

While designing the plant, ensure maximum plant load factors. The plant cycle should be optimized to give the best efficiency. The success of the sugar & cogeneration plant depends on this "basic design". Plant layout is a part of the basic design and is very important from the point of view of operability and maintainability of the plant.

The plant and equipment should be so laid out that there is optimum routing of piping, cables and conveyors. New boilers will be designed as per IS standard. Pilot lights will be provided on electrical panel boards. SMSKL will provide hand operable firefighting cylinder at strategic location viz. power house, control panel room, PRDS section etc.

7.5.2 Steam Generating System

Some fine tuning is required in the areas of excess air control and un-burnt carbon loss control. Feed water quality control is an area needing attention and this is separately dealt in the detailed project report (technical report).

7.5.3 Turbo Generator System

Problems in maintaining the steam purity in the boilers affect the turbine with deposits on the blades. The major contaminant is silica that gets carried over as vapor as the operating pressure of the boiler increases.

There could be some problems of vibration and failure of bearings. These could be due to-initial problems in the lube oil system, and these could be resolved by having proper pre-commissioning checks. Another problem observed usually in some industries is of exhaust hood spray falling on the blades and causing vibration. This is mainly due to a misdirected spray nozzle in the exhaust hood. Proper designing will resolve such problems.

7.5.4 Bagasse Handling

During the cane crushing season, the plant receives bagasse directly from the mill, and the surplus bagasse is taken to the yard. The bagasse thus saved will be used for the off-season operation of the cogeneration plant, or could be used to run the cogeneration plant on the

cleaning days or when the mill is not running due to some other reasons. Under such circumstances, back feeding of the bagasse from the yard to the boiler has been provided.

7.5.5 Milling Section

Milling section, where the juice is extracted from the cane, is the most important section of sugar mill. This is where the bagasse is prepared as a fuel, and the moisture in the bagasse controlled to a value of around 50%. If there are problems with this section, the moisture content in the bagasse could go high and the bagasse will not be prepared well for handling and combustion. Other points related to milling section are the use of optimum imbibition's and the use of electric or hydraulic drives for the mills.

7.5.6 Controls & Instrumentation

Being the most important subject from the point of view of operation and maintenance of the sugar &distillery plant, this subject deserves a lot of attention. Distributed Control System (DCS) is the order of the day.

7.6 RISK MITIGATION MEASURES: FIRE HAZARD

In view of vulnerability to fire, effective measures have been considered to minimize fire hazard. Fire protection is envisaged through hydrant and sprinkler system, designed as per the recommendation of Tariff Advisory Committee of Insurance Association of India / Loss Prevention Association of India. For detection and protection of the plant against fire hazard, any one or a combination of the following systems will protect susceptible areas:

a. Hydrant system
b. High velocity spray system
c. Portable fire extinguishers
d. Fire alarm system

The existing firefighting system is as per National Code/standards (for Factories), the details of which are as follows.

7.6.1 Fire Fighting System

While designing, the firefighting system, various vulnerable locations in the Unit, probable causes & chances of occurrence of fire, its class etc. has been considered in-depth.

The sugar factory has developed an excellent set up for firefighting. It is having a dedicated fire fighting vehicle and operating staff in all shifts.

7.6.1.1 Fire Extinguisher

7.6.1.2 Classification of Fire

Class (A): Fire involving combustible materials like wood, paper, cloth and bagasse etc.

Class (B): Fire due to liquid materials like oil, diesel, petroleum products and all inflammables.

Class (C): Fires involving domestic and industrial gases like butane and propane etc.

Class (D): Metal fires, etc.

Class (E): Electrical fires due to short circuiting, etc.

The factory has installed fire extinguishers, in the entire premises. Each extinguisher is properly numbered and placed at required location according to its type. These locations are painted with yellow and white bands, for an easier identification. These extinguishers are checked periodically and sent for refilling immediately after its expiry. In order to know which type of cylinder to be used in respective fire, boards have been displayed at several locations in the factory.

7.6.1.3 Use of Fire Fighting Equipment

Most of the workers have been trained with respect to nature and utility of firefighting equipment, its type and class of fire for which it is to be used. They also perform mock drills to handle disaster situation such as fire.

7.6.1.4 Fire Evacuation

The factory has provided multiple exits to main building for easy and fast evacuation in case of emergency. These exists are properly displayed using glow signs. Fire doors have been provided in the corridors of buildings. Contact numbers in case of emergency are displayed at various locations. In case of fire, a control room has been provided at ground floor at safe locations. Provision has been made for alternate power supply for pumps, lights and other emergency machineries. As described earlier, a dedicated tank has been provided which is available around the year. Fire alarm, fire extinguishers, hydrant and pumps are properly maintained. Pumps and extinguishers are checked for desired pressure.

The entire factory premises have been declared as 'No smoking zone' and this is strictly implemented. All lobbies, staircases and open spaces are kept free from scrapped material such as packaging boxes, used files, waste papers, and broken furniture such as chairs, tables and cupboards as well as similar fire catching material. Office buildings, work places, storage areas as well as parking places have been designed thoughtfully, so as to use natural light and ventilation to maximum extent. The factory follows best housekeeping practices to keep workplace neat and clean.

7.6.1.5 Procedure For In Case Of Fire

In case of fire, an alarm is pressed that gives signal to all staff as well as workers. It is advised, not to be panic in such situation and follow the procedure as laid down and for which they have been trained. In brief, the procedure is as follows -

All the machineries located near fire place are shut downed immediately including EOT cranes. The workers are suggested to vacate the area immediately. While vacating the area, it is advised to walk and not to run (specially using staircases) and not to push each other. Vacate the premises through safe exits which are away from fire and assemble at the place defined as 'assembly point'.

7.6.1.6 Ventilation

Proper ventilation must be provided both in sugar and distillery unit. Since, adequate natural ventilation is available at site, the mechanical ventilation is presumed to be minor or less significant. However, if mechanical exhaust ventilation needs to be provided, it should be to the order of 1 cfm/sq.ft. or floor area (0.3 $m^3/min.m^2$) by fans of adequate capacity having their suction intake located near floor level to ensure a sweep of air across the entire area.

7.6.1.7 First Aid

A first aid center with adequate facilities should be provided at the site. It should be maintained round the clock by trained personnel.

Important standards to be followed are -

1. **Fire Protection**
   - IS 2189: Standard for automatic fire detection and alarm system
   - IS 2190: Code of practice for selection and maintenance of first aid fire extinguishers
   - IS 3844: Code of practice for installation and maintenance of internal fire hydrants and hose reels
   - IS 6382: Carbon dioxide fire extinguishing system – fixed, design and installation
2. **Occupational Health And Safety**
   - IS 4489: Code of practice for occupational safety and health audit
3. **Electrical Risk**
   - Hazardous area classification based on IS 5572
   - Selection of electrical equipment for hazardous area based on IS 5571
   - Lightning protection system based on IS 2309
   - NFPA 70 B Recommended practice for electrical equipment maintenance
   - NFPA 70 E Standard for electrical safety in employee work places
4. **Process Safety Management**
   - Hazard and Operability studies (HAZOP)
   - Failure Tree Analysis (FTA)

- Event Tree Analysis (ETA)
- Primary Hazard Analysis (PHA)
- Risk Assessment with risk ranking technique

5. Electrical Risk Assessment

- Review of Hazardous area classification
- Lightning protection risk assessment
- Identification and control of electro-static hazards
- Review of electrical preventive maintenance system
- Electrical risk assessment (Fire, shock, explosion) using semi-quantitative risk ranking (SQRR) technique

6. Fire Risk Assessment

- Identification and assessment of fire risks at receiving station/s, storage, transfer and handling of materials such as raw material, fuel, finished products
- Identification and control of ignition sources in areas where flammable materials are stored/handled/transferred
- Review of fire detection measures adopted in the plant and to suggest suitable improvement measures
- Review of various active (fire hydrant, sprinkler, portable fire extinguishers) and passive fire protection requirements for all work places and suggest improvements as necessary
- Review of contractor safety awareness (firefighting, emergency communication, knowledge of plant hazards and safety regulations) and to recommend suitable improvement measures to enhance safety
- Review of safety awareness and safety training requirements (training identification and efficacy) of employees with respect to hazards

The consequences, likelihood and exposure of each hazard are arrived using a systematic approach and will help to determine the relative importance of hazard and focus on significant risks.

7.7 Other Measures

Other mitigation measures include:

- Emergency shutdown system
- Pumps of reliable quality will be installed
- Lightening protecting system as per Indian Electricity Rules

- Power cables, control cables, instrumentation cable, thermocouple extension wire will be complying IEEE fire tests as defined in IEEE 422
- Keeping safe distance between fuel storage area and main unit
- Corrosion protection methods for pipelines
- All locations where the above pipelines are close to traffic movement, protection like crash guards should be provided

7.8 SAFETY ORGANIZATION

The organizational set-up to carry out the declared policy for Health, Safety & Environment matters and in particular, the arrangements which have been made to implement the policy will be as follows: -

- The overall responsibility for Health, Safety & Environment will be that of a "Occupier"
- The Works Manager will have the overall responsibility for the operations in the factory.
- All the Department Heads will be responsible for implementation of this policy in their respective areas of the operations. They will be accountable for the safety performance in their area and due weightage will be given to this performance in their career planning appraisal.
- Safety Department will plan and administer the Safety Programme and Activities and assist and advice on implementation of the Programme. The implementation will be through Line Management.
- Maintenance Department will be responsible for maintenance of machines and equipment, inspection and testing of various equipment, guards, operation and Maintenance of Effluent Treatment Plant and Pollution Control Equipment as prescribed. Proper record of these activities will be maintained. Proper intenance schedule will be drawn and strictly followed.
- All employees have the responsibility and obligation to co-operate with Supervisors and Managers to achieve the Safe and Healthy Working Environment, and to follow all Safety Rules, Procedures, Systems and Practices including use of Safety Equipment and to take reasonable care for the Safety and Health of themselves and their colleagues. These have been enumerated in the Safety Manual of the Company.
- In order to ensure that all Safety Rules, Procedures, Systems and Practicesincluding use of Safety Equipment are followed. Regular Safety Audits either internally or through external experts will be carried out.

- Communication between Management and Employees will be provided throughSafety Committees which will assist in propagating Safety and motivatingEmployees to achieve the objectives set-out in the Safety Policy.
- Chief Security Officer/Fire Officer will be responsible for Inspection, Testing andMaintenance of all Fire Extinguishing Appliances and Fire Hydrant installationincluding record of such maintenance and for dealing with any fire emergencies.He will also be responsible for organizing Fire Drills and Emergency" Drillsparticularly for Security Personnel and selected persons from MaintenanceDepartment.
- The Doctor will be responsible forOccupational Health & Medical Checksof Employees and remedial measures, as required statutorily and maintain up-to-date health record of such employees.
- The Purchase Department will consider the safety aspect while purchasing plantmachine, equipment, material, etc. They will obtain and provide to the user plant,Material Safety Data Sheets while purchasing any chemicals. While procuringmaterial handling equipment, the Purchase Department will ensure that the necessary certificates regarding safe working load, etc, are made available.
- The Contractors will be responsible for all safety measures related to their work.Contracting Departments will ensure compliance and supervision. It will beobligatory on all Contractors and Visitors to follow the existing Plant Safety Rules,Procedures, Systemsand Practices. They must start their work only afterreceiving proper instructions and permission.

7.9 ON - SITE EMERGENCY PLAN

7.9.1 Introduction

A major emergency in a work place is one, which has the potential to cause serious injury and or loss of life. In addition it may cause extensive damage to property and environment. The rapid growth in the use of hazardous chemicals in industry and trade has brought about a very significant increase in the number of people, both workers and members of general public, whose life could be endangered at any one time by an accident involving these chemicals. In addition, it causes serious disruption of activities both inside and outside the works. It would normally require the assistance of outside emergency services to handle it effectively. Although emergency may be caused by a number of different factors like, earthquake, vehicles crash, sabotage, it will normally be manifested itself in two basic forms, fire and explosions

Scope

Prevention of accidents is possible to a large extent through good design, correct operation, periodic maintenance and routine inspection. Achieving all these will reduce the risk of an accident, but it will not eliminate it altogether absolute safety is not achievable, and an essential part of major hazard control, is concerned with mitigating the effects of a major accident. An important element of mitigation is emergency planning, i.e. recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on- site and off-site, that would need to be implemented in the event of an emergency.

7.9.2 Objectives

The overall objectives of an emergency plan are to
(1) Locate the emergency, if possible and eliminate it.
(2) Minimize the effects of the accident on the people and property.

Elimination: It requires prompt action by operators / works, emergency staff, e.g. firefighting equipment, emergency shut off valves, water sprays. Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people being nearby.

7.9.3 Identification And Assessment Of Hazards

- Fire & Explosion possibilities in Storage and Handling of fuel, Sugar Godown, Molasses Tank, Bagasse yard and Sulphur Godown, and alcohol storage area

Statutory Requirement: Section 41-B (4) of the Factories Act 1948 stipulates that the occupier of the Factory engaged in a hazardous process shall draw up an on—site emergency plan and detailed disaster control measures for the factory and more known to the workers and the general public in the vicinity. This includes the safe measures required to be taken in the event of a major emergency taking place. Further an occupier of hazardous chemicals storage plant is to prepare an emergency plan as per Rule 13 of the Manufacture, Storage and Import of Hazardous Chemical Rules 1989. This plan shall incorporate the guidelines given by office of the Chief Inspector of Factories, and to be revised every 6 months to keep it in the latest form.

7.9.4 Emergency Control Centre

Security Main Gate Office is chosen as the “EMERGENCY CONTROL CENTRE”. The emergency control center is the place from where the operations related to emergency are coordinated. The Emergency control center is suitably equipped to receive and transmit information and

directions from the incident site and furnish useful data to other affected areas inside & outside works. The center shall contain the following information and facilities.

1) An updated copy of the ON—SITE EMERGENCY PLAN which gives the following information.

- Master plan of the works showing different locations, where hazardous materials are stored/ processed.
- Sources of Personal Protection Equipment, portable fire extinguishers, and other safety material.
- Fire fighting system and sources of water. Mutual Aid system with other industries.
- Plan of the works with safe distance areas, escape routes, assembly points.
- Vicinity Plan of the area in which the industry is located.
- List of key personnel and their telephone numbers.
- List of Government officials, other areas of help — their telephone numbers

2) Updated Nominal roll of the employees and other visitors

3) Communication facilities like phones, mobile phones, walkie-talkie sets etc.

4) Standby power arrangements like— Generator –sets

7.9.5 Responsibilities of Works Manager

1. Prepare on—site emergency plan and revise it from time to time (once in 6 months)
2. Conduct regular mock drills
3. Educate / train all the employees regarding on-site emergency plan
4. Submit copy of "on—site emergency plan" and mock drill to Chairman / District Disaster Plan, Deputy Chief Inspector of factories Office.
5. Stock necessary PPE for firefighting.
6. Device data collection forms for collecting data during emergency.

7.9.6 Emergency Siren

An emergency siren of minimum 500 Meter Capacity is installed for the purpose of alarming employees on emergency. It is located near the Security Main Gate or Emergency Control Room. The "CHIEF INCIDENT CONTROLLER" **will decide** the operating controls at appropriate time.

The following information is given for the identification of various signals of the siren to the employees.

Sr. No.	Type of Siren	Duration
1	Factory shift siren	continuous for 30 seconds
2	In case of fire	Special Hooter Siren
3	Emergency Siren for other Emergency	Special Hooter Siren repeating TWICE
4	All Clear siren	Continuous Siren for three minutes

7.9.7 Wind Direction:

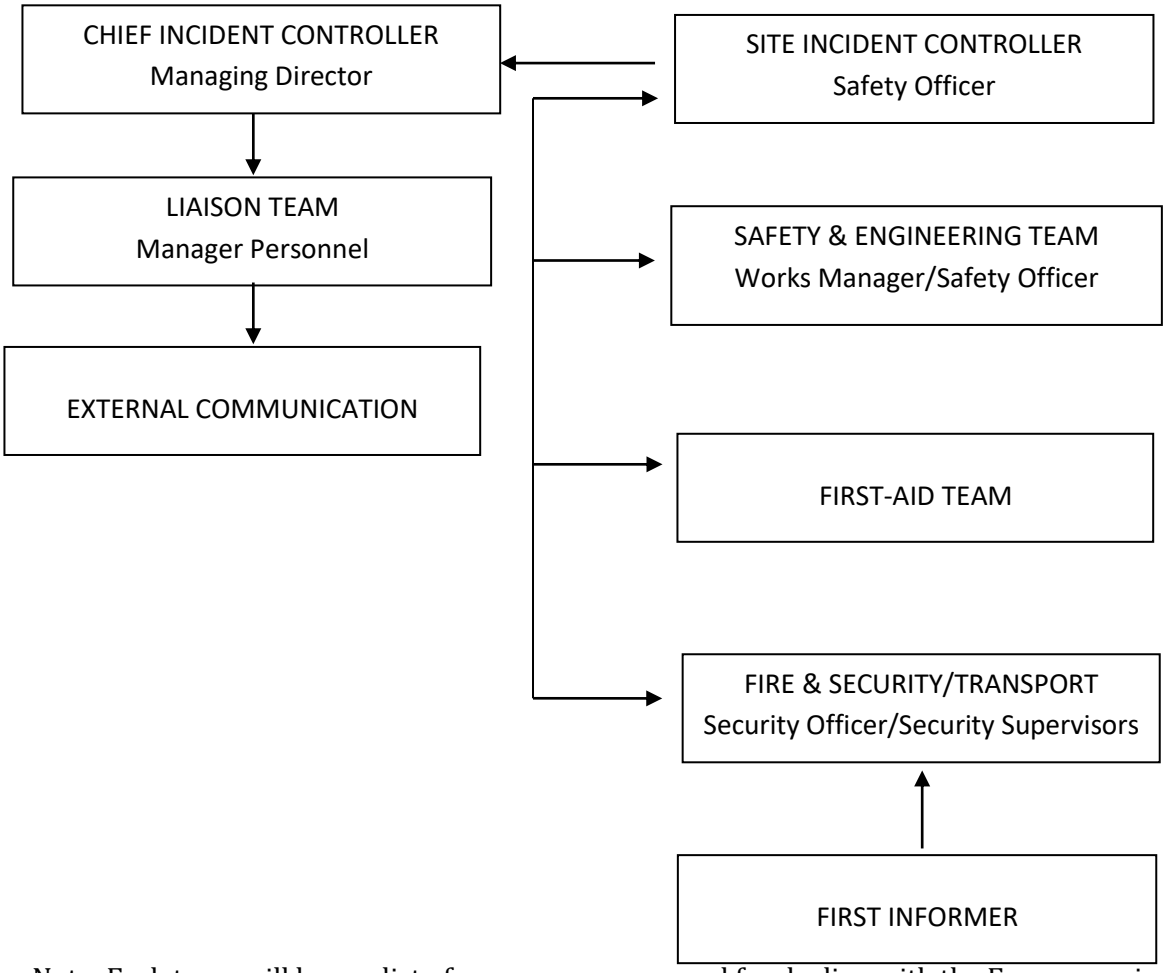
For the purpose of identifying the wind direction WINDSOCKS are installed at company. The windsock is located on the roof of workshop. The WINDSOCKS bore distinct white & red stripes to attract immediate attention.

All the employees and visitors are requested to note the wind direction at the time of major incidents.

- **Recommended Practice During Emergencies**

There is an **Assembly point** located at Security Main gate for the purpose of assembly of the Non-Emergency employees and visitors in case of emergency. However, the KEY Emergency personnel will give appropriate guidance as and when situation warrants.

7.9.8 Organization Chart for Dealing Emergencies



Note: Each team will have a list of emergency personnel for dealing with the Emergency in their respective specialization

7.9.9 First Information

Any person, who notices an abnormality like fuming, fire in shall phone to the security / inform the security guard. He shall give his identity in case he contacts the security Main gate directly.

7.9.10 Brief Responsibilities

7.9.10.1 Chief Incident Controller

- Declares emergency
- Rushes to emergency control centre
- Controls emergency by coordinating with site-incident controller
- Communicates to external agencies through liaison team
- Declares lifting of emergency

7.9.10.2 Site Incident Controller

- Receives a call from security supervisor
- After a brief visit to incident site, decides and advises chief incident controller to declare emergency.
- Controls the emergency by coordinating various activities through his teams '
- Advises to chief incident controller lifting of emergency
- Reviews and prepares a detailed report on the incident and submits to “Chief Incident Controller”

7.9.10.3 Safety And Engineering Team

- Device methods to isolate emergency and movement of people.
- Provide necessary safety data to site controller
- Provide required PPE.
- Provide time to time information to site incident controller

7.9.10.4 First-Aid Team

- Provide First-and /medical care to persons injured inside factory
- Keep a lust of people sent for outside treatment and other welfare measures undertaken
- Maintain the list of people inside premises and sent out including visitors
- Provide time to time information to site incident controller

7.9.10.5 Fire Team, Security Team

- Control the emergency by firefighting.Give a call tomutual aid if required.
- Move people to safe areas specified by safety andengineering teams
- Control the movement o‘ traffic at Gate
- Provide time to tame information to siteincident controller

7.9.10.6 Liaison Team

- Provide important information to external agencies

(Government Officials Press and Public) Take necessary guidelines from Chief Incident Controller

7.10 RESPONSIBILITY IN DETAILS

7.10.1 Chief Incident Controller

- He will decide and declare emergency on the advice of 'Site Incident Controller'.
- He will advise to raise the emergency Siren to draw the attention of employees and contract workmen to follow emergency regulations
- He will rush to emergency control center. (SECURITY MAINGATE)
- He will decide calling off emergency on the advice of 'siteincident controller'.
- He will instruct to raise all clear siren to mark calling offemergency.
- He will give guidelines to liaison team on sharing information togovernment officials**, press and general public.
- He will have Time to Time interaction with site incident controller on dealing of emergency.
- He will call a meeting of the Site incident controller andemergency teams to discuss and decide steps to restore normal working in the area of incident. He will also discuss on theincident report and decide remedies to be implemented to avoid its recurrence.
- Instructions given by Site incident controller and respective teams.
- **District collector, deputy. Directors of factories, Municipal commissioner, Police commissioner, chief Officer Fire brigade.

7.10.2 Site Incident Controller

- On receipt of information from security office, he will rush to the site of incident / accident.
- After assessing the situation, he will advice 'Chief Incident Controller' to declare emergency.
- Coordinate the activities of various teams.
- Give time to time feedback to 'Chief Incident Controller'.
- Formulate systems to collect data during emergency.
- Isolate and take non-emergency employees to assembly point (safe location) through security team.
- Cordon off the area through security team.
- Regulate the traffic in main gate through security team.

- Keep the escape routes clear through security team.
- Fight and control the emergency through fire team.
- Discuss and decide measures to control / isolate appliances and power through safety and engineering teams.
- Review at regular intervals on the availability of required PPE, Medicine and water for firefighting.
- Record the directions given in specified formats.
- Collect filled in formats from respective teams, prepare a detailed 'incident report' and submit the report to Chief incident controller.
- To draw plans and assist Chief incident controller to restore normal working conditions.

7.10.3 Safety Team & Engineering Team

- Act as per the directive of 'site controller'.
- Check direction of wind and decide assembly points for non-emergency employees.
- Check availability of water, fire extinguishers and make arrangements for replenishing theme.
- Discuss and execute isolation of equipment for localizing emergency i.e. combustibles storage locations.
- Shift/cordon off flammable materials from the danger zone.
- Put off power supply wherever not required.
- Provide necessary personal Protective equipment like firefighting suits, gas masks, hand gloves, helmets, etc.
- Keep a list of essential staff needed during emergency.
- Record the activities in a specified format

7.10.4 Fire Team & Security Team

- Inform site incident controller the incident and call him to site ofIncident
- Act as per the directive of Site incident controller.
- Rush fire—fighting team to site of incident and start fire-fightingoperation.
- Rush security team to cordon off the incident site.
- Move nonessential employees to assembly point.
- Regulate the traffic at gates.
- Keep the escape routes and roads free from obstruction.
- Make transport facilities for transporting nonessential employees.
- Keep list of essential staff needed during emergency

7.10.5 First-Aid Team

- Keep a detailed list of employees and contract workmen present in the premises for the day. Make arrangements for head count.
- Offer first aid facilities to the injured and send to assembly point.
- Recommend hospital treatment to the injured and inform the hospital authorities in advance.
- Keep enough stock of medical equipment, drugs, and antidotes.
- Give information to the families of the injured.
- Make ambulance facilities for the injured persons and transport facilities to non—emergency persons.
- Inform government authorities and fulfill statutory regulations.
- Record the activities in a specified format.
- Act as per the instructions of site incident controller.
- Keep a list of essential staff required to assist during emergency.

7.10.6 Responsibility Of Non-Emergency Employees And Visitors

- On hearing the emergency siren stop the work, put off the equipment wait for the instruction of shop in charge / supervisor
- Leave calmly to the specified assembly point.
- Don't block the emergency escape routes.
- Don't spread rumors/ unnecessary information to public.

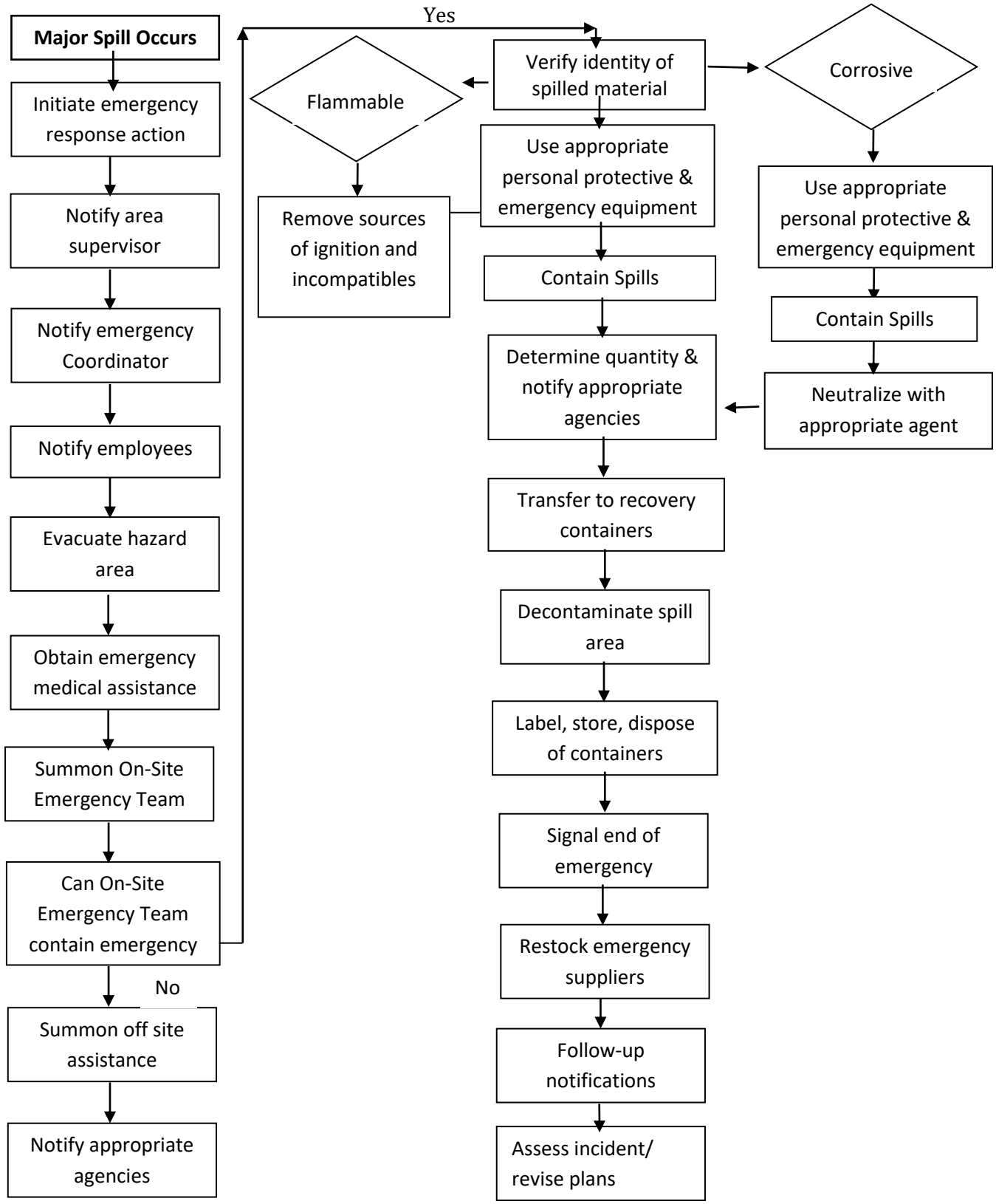
7.10.7 Key Emergency Personnel: Respective group leaders of the teams in the ON—SITE EMERGENCY organization chart.

7.11 OFF - SITE EMERGENCY PLAN

Since the only hazard that expected in the distillery is fire and normally contained within the premises. In rare case if the fire hazard spreads out-side the premises respective group leaders shall communicate to the District Magistrate, Commissioner of the Police, Control Room and inform the situation as Off- Site Emergency. It shall be the responsibility of the Police Personnel to look after the law and order, traffic control, evacuation of workers and other personnel. They should also advise, through public address system, the localities that are likely to get affected and the steps to be taken.

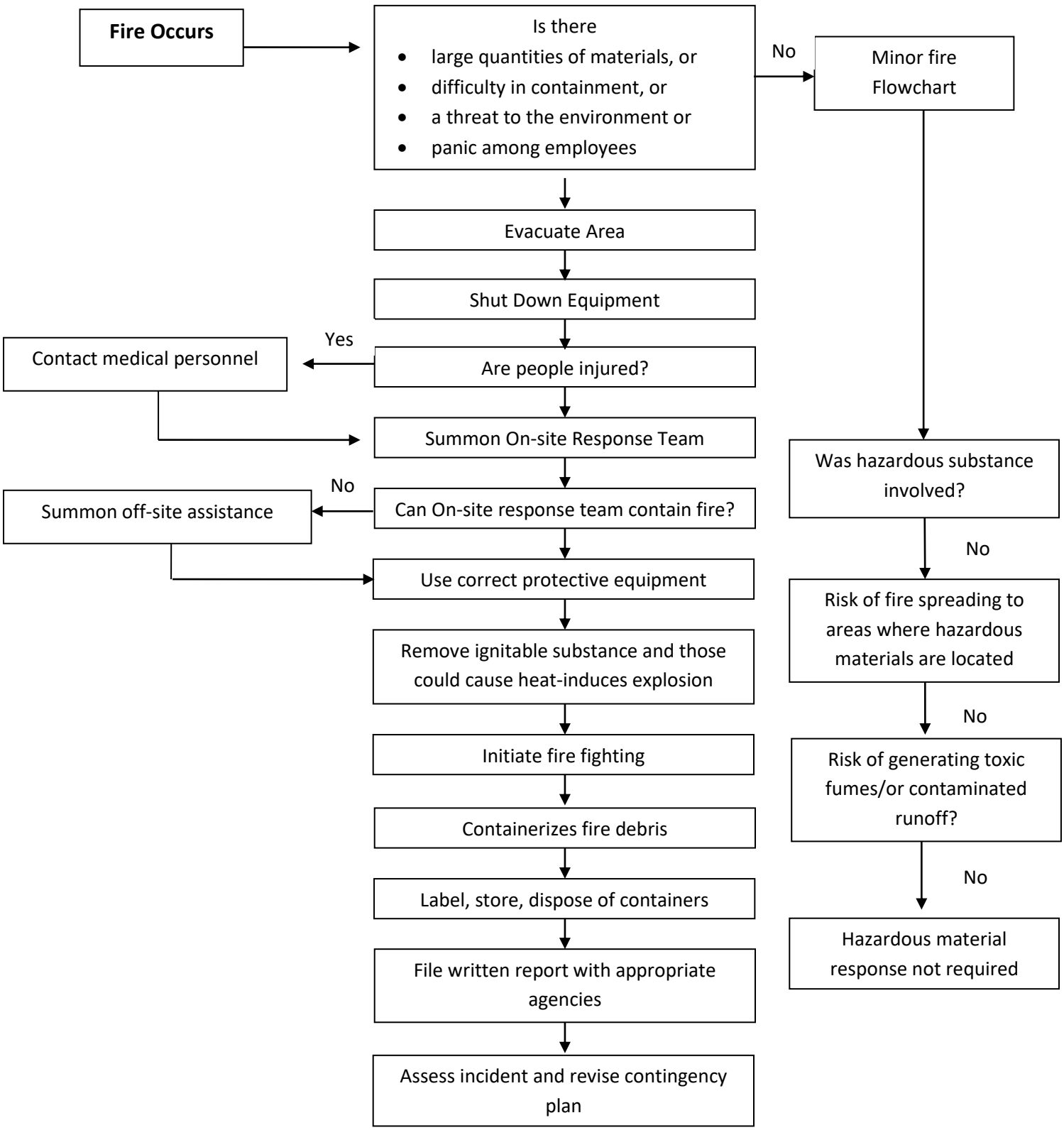
Emergency Response Flow Chart

Major Spills



Emergency Response Flow Chart

Major Fire



Emergency Guidelines for teams