

RISK ASSESSMENT

1.0 General Assessment

Risk assessment is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat. The common terms used in risk assessment are elaborated below:

Risk: Risk is defined as the combination of Chance or Frequency or Probability of Occurrence of an Accident and its damage consequences to life and property. So Risk has two parameters:

- i. Frequency of Occurrence of an accident,
- ii. Damage Consequences to life and Property.

Risk Analysis: A systematic approach for describing and/or calculating risk. Consequence Analysis determines the damage consequences to life and property from an accident. And QRA determines the following: Frequency of occurrence, Risk of Fatality to employees, Individual Risk-Risk of Fatality to neighboring population, Acceptability of Risk through ALARP at Least as Low as Reasonable Practical.

Risk analysis follows an extensive hazard analysis. This requires a thorough knowledge of probability of failure, credible accident scenario, vulnerability of population to exposure etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies. It provides basis for preparation of site and off-site emergency plan and also to incorporate safety measures.

The toxicity of ethyl alcohol is much lower in comparison to methanol or propanol. Ethyl alcohol is primarily toxic to humans by ingestion. While inhalation of its vapors can produce some toxic effects, its ability to enhance the effects of other chemicals poses a greater health risk for inhalation. Skin contact can cause topical damage and absorption is, therefore, not likely. It should be noted that most manufacturers of ethyl alcohol for use in industrial applications would normally mix it with a denaturant (substance added to make it undesirable to drink). These include gasoline, acetone,

formaldehyde, or methyl alcohol. Therefore, industrial exposures resulting from ingestion are very unlikely. Inhalation can cause irritation of the eyes, nose, throat, upper respiratory tract, and associated mucosa. There may be headache, nervousness, tremors, dizziness, tearing, fatigue, nausea, somnolence, and narcosis with stupor and loss of consciousness. There are no reports of cirrhosis occurring as a result of inhalation exposures. However, chronic exposure to ethyl alcohol vapors caused brain damage in mice. Vapor exposure can also increase the toxic effects of other chemicals being inhaled. Also, the toxicity of ethyl alcohol is enhanced with the presence of compounds such as barbiturates, carbon monoxide, and methyl mercury. Liquid contact with the eyes causes immediate burning and stinging with lachrymator and reflex closure of the lids. There may be injury to the corn epithelium and possible hyperemia (excessive blood) the conjunctiva. Skin contact results in drying cracking, which can lead to secondary infections dermatitis. Ingestion of ethyl alcohol is not likely to occur in the industrial environment.

However, if it does, symptoms can include sleep disorders, hallucinations, distorted perceptions, ataxia, motor function changes, convulsions and tremors, coma, headaches, pulmonary changes, alteration of gastric secretions, menstrual cycle changes, glandular changes, nausea or vomiting, and decrease in body temperature.

Acute Health Effects

The following acute (short-term) health effects occur immediately or shortly after exposure to alcohol.

Skin: Causes dryness and cracking leading to dermatitis and possible infection.

Eye: Severe irritation with burning a possible damage to the cornea and conjunctiva.

Lung: Irritation of the eyes, nose, throat, and respiratory tract.

CNS: High concentrations can cause depression the CNS with symptoms of sleepiness and I of concentration.

Chronic Health Effects

The following chronic (long-term) health effects occur at some time after exposure to ethyl alcohol can last for months or even years:

A) Cancer Hazards

Ethyl alcohol is known to cause liver cancer in humans, primarily due to ingestion. Industrial exposures through ingestion are not likely but are certainly possible.

Reproduction: According to the references, ethyl alcohol can affect human reproduction by ingestion. It causes changes in the female fertility index. Effects on newborns include changes in the Apgar score, neonatal measures or effects, and drug dependence.

Other Chronic Effects: Very high or prolonged exposure may result in mucous membrane irritation, headache, and depression of the CNS with symptoms of somnolence and lack of concentration. Prolonged skin contact can cause dermatitis.

B) Recommended Risk-Reduction Measures

Even though ethyl alcohol is a known carcinogen, this effect is primarily the result of ingesting large amounts of alcoholic beverages. Industrial exposures by this route are not likely to occur. The best risk reduction measure is to use a less toxic chemical as a substitute for an ethyl alcohol. However, based upon the fact that ethyl alcohol is one of the most widely used industrial solvents, substitution is usually not an alternative.

Therefore, engineering controls are the most effective methods of reducing exposures. The best protection is to enclose operations' and/or provide local exhaust ventilation at the site of chemical release. While not always operationally feasible, isolating operations can also reduce exposure risk. Using respiratory protection is less effective than the controls mentioned above, but is still advisable whenever working with or around ethyl alcohol. For concentrations over the PEL (1000 ppm), an air purifying respirator with an organic vapor cartridge will suffice. For higher exposures, a supplied-air respirator with full face piece operated in positive pressure mode or a self-contained breathing apparatus (SCBA) with full face piece and operated in pressure demand mode are the recommended respiratory protection methods of choice. If a full face piece is not available, then chemical goggles should be worn to protect the eyes. Whenever a chemical splash hazard exists, a face shield and a protective apron should be worn. To prevent hand and skin exposures, impervious gloves should be used.

C) Administrative controls should also be in place to minimize the potential for human exposures. These may include written procedures or policies, which specify the methods and techniques that will be practiced whenever personnel are to work with ethyl alcohol. All personnel should receive training on the use, hazards, protective measures, emergency actions, and other precautions per 29 CFR 1910.1200 (Hazard Communication), prior to the first assignment in an area where ethyl alcohol

is used or stored. If symptoms develop or overexposure is suspected, the following medical tests are recommended:

1. Liver function tests;
2. Skin testing with dilutes ethyl alcohol to help diagnose allergy (performed by a qualified allergist). Any medical evaluation should include a careful history of past and present symptoms with an examination. Medical tests that look for existing damage are not a substitute for controlling exposures. Also, since consuming large quantities of alcoholic beverages can lead to liver dysfunction and even cancer, persons with alcohol addiction who are exposed to ethyl alcohol on the job may develop symptoms much quicker and with greater intensity than those who do not drink under identical exposure conditions. Prudent risk management requires careful consideration of all possible factors which may be causing the appearance of exposure symptoms.

D) Other methods to reduce exposure include:

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respiratory protection should be mandatory.
- Always ensure that proper protective clothing is worn when using chemical substances.
- Wash thoroughly immediately after exposure to ethyl alcohol and at the end of the work shift or before eating, drinking, or smoking.
- Hazard warning information should be posted in the work area. In addition, as part of an on-going education and training program, all information on the health and safety hazards of ethyl alcohol should be communicated to all potentially exposed workers.

Risk involves occurrence or potential occurrence of some accidents due to an event or sequence of events. The risk assessment study covers the following: Identification of potential hazard areas;

- Identification of representative failure cases;
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion;
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios;
- Assess the overall suitability of the site from hazard minimization and disaster mitigation points of view;

- Furnish specific recommendations on the minimization of the worst accident possibilities;
- Preparation of On-site and Off-site Emergency Plan, which includes Occupational and Health Safety Plan.

There is always possibility of occurrence of incidents in an industry which requires proper risk assessment and proper safety preparedness. Activities requiring assessment of risk due to occurrence of most probable instances of hazard and accident are both onsite and off-site.

On-site

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

Off-site

Exposure to pollutants released from offsite/ 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.

2.0 Risk assessment: Environment

A) General Assessment

The environment is at risk of exposure during transportation, storage, disposal, or destruction of ethyl alcohol. In almost every scenario, the threat of environmental exposure is contingent upon the proper handling of the chemical substance. Accidental spills, large or small, can result in fire, explosion, and possible contamination of the surrounding environmental mediums (water, soil, and air). Ethyl alcohol is considered a class IB flammable liquid (according to OSHA 29 CFR 1910.106). Its low flash point and relatively low boiling point present a serious fire and explosion hazard concern. Also, because it is incompatible with a number of common materials, especially strong oxidizers and many metal nitrates, contact can result in violent and explosive reactions. It can form explosive mixtures in air and can ignite on contact with heat, fire, or sparks. It will react and then explode in contact with acetic anhydride + sodium hydrogen sulfate. It also reacts violently with acetyl bromide (evolves hydrogen bromide). These characteristics require special

consideration during any emergency situation involving a leak or spill of ethyl alcohol. Ethyl alcohol can enter the environment through unchecked industrial discharges into effluents and through spills.

B) Acute Ecological Effects

Acute (short-term) toxic effects may include the death of animals, birds, or fish, and death or low growth rate in plants. Acute effects are seen 2 to 4 days after animals or plants are exposed to ethyl alcohol. This chemical has moderate acute toxicity to aquatic life. Insufficient data are available to evaluate or predict the short-term effects of ethyl alcohol to plants, birds, or terrestrial animals.

C) Chronic Ecological Effects

Chronic toxic effects may include shortened life span, reproductive problems, lower fertility, and changes in appearance or behavior in exposed animals. These effects can be seen long after first exposure(s) to toxic chemicals. Ethyl alcohol has moderate chronic toxicity to aquatic life. Insufficient data are available to evaluate or predict the long-term effects of ethyl alcohol to plants, birds, or land animals.

C) Water Solubility

Ethyl alcohol is highly soluble in water. Concentrations of 1000 milligrams and more can be expected to mix with a liter of water.

E) Persistence in the Environment

Ethyl alcohol is slightly persistent in water, with a half-life of between 2 to 20 days. The half-life of a pollutant is the amount of time it takes for one-half of the chemical to be degraded. About 90% of ethyl alcohol will eventually end up in the air; the remainder will end up in water.

D) Bioaccumulation in Aquatic Organisms

Some substances increase in concentration, or bioaccumulate, in living organisms as they breathe contaminated air, drink contaminated water, or eat contaminated food. These chemicals can become concentrated in the tissues and internal organs of animals as well as humans. The concentration of ethyl alcohol found in fish tissues is

expected to be about the same as the average concentration of ethyl alcohol in water from which the fish was taken.

E) Recommended Risk-Reduction Measure

Proper training of all transporters will reduce the likelihood of a mishap or accident resulting in a leak or spill to the environment. The correct use of **DOT labeling (per the MSDS)** on all containers, trucks, and rail cars will enable emergency responders to react properly and quickly to any disaster thereby reducing the potential risk to the environment and to personnel. Storage of ethyl alcohol should be segregated from incompatible chemicals to minimize the risk of cross contamination or contact.

Buildings designated for storage should be equipped with appropriate fire protection systems (alarms, sprinklers, emergency lighting, portable extinguishers). Equipment should be designed to meet explosion-proof standards. If a spill or leak to the environment has occurred, fire department, emergency response, and/or hazardous materials spill personnel should be notified immediately. Cleanup should be attempted only by those trained in proper spill containment procedures.

Contaminated soils should be removed for incineration and replaced with clean soil. If ethyl alcohol should contact the water table, aquifer, or navigable waterway, time is of the essence. It is highly soluble in water and, therefore, total containment and remediation may not be entirely possible. When such spills occur, the local and/or state emergency response authorities must be notified. A comprehensive emergency response of disaster preparedness/recovery plan should be in place prior to any operations involving the use, transportation, storage, or disposal of ethyl alcohol. If ethyl alcohol is spilled or leaked, the following specific steps are recommended:

- Restrict persons not wearing protective clothing from area of spill or leak until cleanup is complete and area can be opened for normal work.
- Ventilate area and remove ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers. Use non-sparking tools.
- It may be necessary to dispose of ethyl alcohol as a hazardous waste. The responsible state agency or the regional office of the federal Environmental Protection Agency (EPA) should be contacted for specific recommendations.

3.0 Risk assessment: Business

A) General Assessment

Accidents or mishaps involving ethyl alcohol can present a moderate threat to business operations. The loss or damage of equipment or facilities can significantly affect fiscal viability. Lawsuits that may result from personnel injury/death, public exposures, and/or environmental contamination will also require a serious expenditure of resources. Media attention surrounding an injury, death, or environmental damage can also result in a loss of profits and loss of current as well as future business.

B) Recommended Risk-Reduction Measures

Company attorneys, safety and health professionals, and environmental specialists should be involved in the development of any procedures or policies intended to manage the use of chemicals in the workplace. A company official should be predesignated as a public relations officer with specific training in dealing with the press. Corporate plans and policies should be developed, approved, and implemented long before any need for such arises.

Area in the factory where potential and major fire hazard can take place as follows.

- i. Storage of molasses.
- ii. Boiler operation.
- iii. Storage of Rectified Spirit
- iv. Others.

I. Storage of Molasses: -

1. Molasses should be stored in good quality and leak proof steel tanks.
2. Continuous mixing of molasses should be done.
3. If there is increase in temperature beyond 30°C external cooling of tanks should be provided. A temperature recorder should be provided to the tanks.
4. If there is leakage –
 - Leakage should be washed out and diluted. Following work permit system should do b. Replacing of leaky gaskets, joints, strictly.
 - Leakage of pipelines, welding repairs should be attached out side the plant.

- Leakage through gland should be regularly attached. It should be perfectly stopped by adopting improved techniques such as mechanical seals.
- To attend all major leakage in tanks the following procedure should be followed -
 - Transfer the material to other tank.
 - Prepare the tank for welding repairs and skilled workers should do this.

II. Boiler operations: -

1. Personnel protective equipment's should be given to workers.
- 2 Pilot lights should be provided on electrical panel boards.
3. Hand operable fire fighting cylinders should be provided.

III. Storage of Ethanol : -

1. Electrical wiring should be flameproof.
2. Ventilation should be provided
3. Warehouse should be kept in good conditions
4. Adequate fire fighting equipment should be kept.
5. If there is leakage
 - Leakage should be washed out and diluted.
 - Following work permit system should do by Replacing of leaky gaskets, joints, strictly.
 - Leakage of pipelines, welding repairs should be attached out side the plant.
 - Leakage through gland should be regularly attached. It should be perfectly stopped by adopting improved techniques such as mechanical seals.
 - To attend all major leakage in tanks the following procedure should be followed - Transfer the material to other tank.
 - Prepare the tank for welding repairs and skilled workers should do this.

IV. Others: -

- Frequent checking of pipelines and storage units should be done.
- Welding should not be done near combustible material storage.
- Ash generated from fire should always be placed in metal receptacles and removed as soon as possible.

- Fuel pipes provided should be as short as possible and should be separated from any unprotected combustible material by a distance of 3 times the diameter of fuel pipe.

4.0 Disaster Management Plan & Social Impact Assessment and Action Plans

4.1 Disaster

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

Disaster can be divided into two main groups. In the first are disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, landslides and forest fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are war, industrial accidents, factory fires, radiation accidents, explosions and release of toxic gases or chemicals, river pollution, mining or other structural collapses etc.

There can be no set criteria for assessing the gravity of a disaster since this depends to a large extent on the physical, economic and social environment where it occurs.

Objective of Disaster Management Plan

The disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and the salvage operation in the same order of priorities. For effective implementation of Disaster Management Plan, it should be widely circulated and personnel training through rehearsals/ drills. To tackle the consequences of major emergencies inside the factory or immediate vicinity of the factory, a Disaster Management Plan has to be formulated and the planned emergency document is called "**Disaster Management Plan**".

The objective of the Industrial Disaster Management Plan is to make use of the combined resources of the plant and the outside services to achieve the following:

- Effect the rescue and medical treatment of the casualties;
- Safeguard other people;
- Treatment of injured.
- Minimize damage to property & environment;
- Initially contain and ultimately bring the incident under control;
- Identify any deceased;
- Provide for the needs of relatives;
- Provide authoritative information to the news media;
- Secure the safe rehabilitation of affected area;
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.
- Resorting normalcy.

The pre-requisites for a good disaster management plan have been given below:

- Management's commitment to safety.
- Emergency organization.
- Written guidelines for the duty team members.
- List of key personnel, experts, doctors, village leaders, authorities with their locations and telephone numbers (both office and residence).
- Clear-cut definition of role of individuals.
- Adequate means of communication with good back-up facility for telephone system. Also, alternative methods of communication like wireless, messengers etc. should be available
- Training, Regular rehearsals including alarms at least once / quarter.
- Fire and safety manuals (Both common and plant wise).
- Operating and Maintenance Manuals.
- Strong conviction that "the prevention is better than cure". Therefore, more emphasis should be made to prevent disasters.
- Warehouse safety manual.
- Chemical Information Sheets (CIS) or Material Safety Data Sheets (MSDS) or
- Work Practice Data Sheet (WPDS) for all the hazardous substances handled.

- Transport emergency cards (Tremcards) for the products transported by road.
- Disaster Management Plan (both On-site and Off-site)
- Rehearsal of the disaster management plan and modifying/ updating it.
- Division of each large factory into 'Safety Districts' for better safety
- Rehearsals of the disaster management plan (disaster control plan) and modifying / updating the same, if necessary. The timing of events, communication failures etc. should be noted and analyzed for improvement. The plan may therefore, have to be regularly discussed and updated.
- Availability of emergency 'Install light' (emergency light) to take care of power failures.
- Mutual aid scheme, if feasible
- Provision of antidotes, emergency medicines and beds in nearby hospitals
- Liaison with outside agencies and civic and government authorities for mitigation of the effects of a disaster. Round- the- clock availability of trained first-aid personnel.
- Standby communication system in case the telephone system is affected. e.g. Walkie-talkie, radio telephone, mobile phone etc.

4.2 Elements and Essentials of Disaster Management Plan

- Vulnerable areas of the plant where disasters are likely to originate should be identified and planned measures to deal with the same should be decided.
- Organization, i.e. appointment of key personnel with their duties and responsibilities should be done. This should cover personnel by their designation and it should not only consider the normal working but shifts and holiday work.
- Communication mechanism for raising the alarm as well as that for the interaction within and outside works should be provided.
- Roles and responsibilities of other individuals, as mentioned below, need to be defined clearly.

- FIRE FIGHTING?

- MEDICAL?
 - RESCUE?
 - ENGINEERING SUPPORT?
- All others not taking part in emergency handling operations.
 - Location of emergency control center and assembly points should be precise and carefully planned.
 - Check -list for sequence of operations to be followed should be prepared.

4.3 Identification / Assessment of Situation

It is essential that the situation is identified at the earliest possible time and judged correctly and if necessary, the emergency is to be declared. The Shift In-charge, who is at all times in the fermentation & distillation house, shall identify situation of the hazard or calamity and report immediately the same to Distillery Manager and shall also sound the alarm bell provided in each of the sections. Under this plan, the Managing Director takes charge of the situation. No sooner, he gets the information from Shift In-charge, he shall move to the place of hazard / calamity. He shall assess the situation and decide to declare emergency either in that particular section or the entire plant and sound alarm bells accordingly. If the emergency is to be declared only in one plant, the other plants will work. Normally, he shall take immediate steps to control the situation.

4.4 Action Plan

He shall initiate all such actions that are essential at the distillation house / fermentation house / shop floor etc. which would include- Evacuation of all the personnel on the shop floor who are not required for controlling the situation or hazard. Immediate grasping of gravity of the problem / hazard and issue or giving of instructions to the concerned teams as laid down to act in a manner required to control the situation.

In case of fire, the help of fire force should be immediately sought and put into action. Simultaneously, the workman trained in the fire fighting procedures shall be called to extinguish the fire.

Only hazardous that is expected in the Distillery is fire. The following steps may be followed

▲ **Put off the main supply**

▲ **Distillation Section**

Shut down the boiler section and control the steam supply/movements.

▲ **Control Room**

The security office shall function as a control room as the same is ideally situated nearer to the main gate and away from the plant. Thus, there shall be no risk as regard to the vapour of any toxic substances affecting the security office. However, if there should be a situation where / when the entire premises has to be declared as emergency, the control room shall operate from the premises which is out side the main gate. Since the entire plant is provided with good quality electrical fittings, there should be no anxiety as regard to switching on or off the motors and no sparks will occur. However, the declarer / controller of emergency shall decide, depending on the situation, whether to use generator power or the electricity Power. In case the entire lighting has to be switched off to meet such an eventuality, the stand by generators, provided near the office, shall be started and the floodlights shall be used to tackle the situation during the nighttime.

5.0 **Emergencies**

General & Industrial Emergencies

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

- Slow isolated fires;
- Fast spreading fires;
- Structural failures;
- Natural Calamities;
- Contamination of food/ water; and
- Sabotage/ social disorder.

5.1 Specific Emergencies Anticipated in Distillery Plant

Chemical spills

Chemicals are stored in bunded areas and any spills will be contained in a controlled area. Safety gear and training is provided to all staff who handles chemicals or dangerous goods and the likelihood of injury to person is very low due to training and procedures. The chemicals and dangerous goods are kept away from moving machinery to reduce the risk of fire. The mill has a first aid officer on every shift.

Injury to person:

Safety gear and training will be provided to all employees. Affected employees will be trained in safe handling of chemicals, dangerous goods, machinery (fixed and moving), their surrounding and their work environment. Safety guards, light curtains and other safety measures will be implemented and the likelihood of injury to person is very low due to training and procedures.

Damage to machinery and property

Whilst the likelihood is very low, there is always a small risk of fire. Our site is fitted with fire sprinklers, has several fire extinguishers fire hoses and emergency fire warnings. Our fire system is linked to the fire brigade and all employees will be trained to follow emergency procedures.

Fire & Explosion

Fire consequences can be disastrous, since they involve huge quantities of fuel either stored or in dynamic inventory in open yard. Preliminary Hazard Analysis has provided a basis for consequence estimation. During the study of risk assessment, the natures of damages are worked out and probability of occurrence of such hazards is also drawn up. Therefore the risk assessment report is to be essentially studied in conjunction with the Disaster Management Plan.

Emergency Organization

An Emergency Organization is working in the plant. The Vice President of the factory is heading this organization. He is also designated as site controller. The person not below the designation of General Manager and who are working as

department heads are designated as Incident Controllers. Each Incident Controllers are reporting to the Site Controller. Each Incident Controller, for himself, organized a team responsible for controlling the incidence with the personnel under his control. Shift In charge in each department is the Reporting Officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller. Emergency coordinators are appointed who would take the responsibilities like fire fighting, rescue and rehabilitation, transport and provide essential & support services. All these personnel are designated as Key Personnel. In case of power or communication failure during any incident, some of the staff members in the office or plant offices and their services would be utilized as messengers for quick passing of the communications. All these personnel would be declared as essential personnel. A flow diagram of Emergency Organization is shown in Figure 7.1.

Emergency Communication

Whoever notices an emergency situation such as fire, growth of fire, leakage of chemicals etc. would inform his immediate superiors and emergency control centre. 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 In charge and takes a decision about an impending On-Site Emergency. This would be communicated to all the Incident Controllers and Emergency Coordinators. Simultaneously, the emergency warning system would be activated on the instruction of the Site Controller.

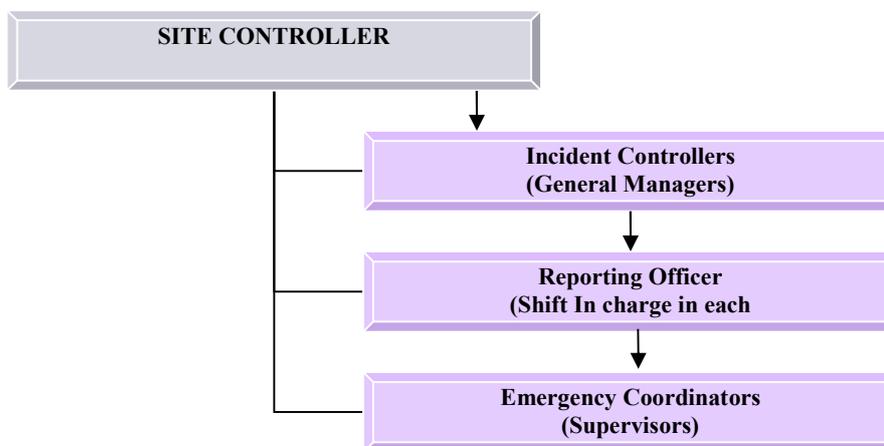


Figure 7.1: Emergency Organization Chart

6.0 Emergency Responsibilities

Site Controller

- On receiving information about emergency, he would rush to the emergency control centre and take charge of ECC and the situation and;
- Assesses the magnitude of the situation on the advice of the Incident Controller and decides;
- Whether the affected area needs to be evacuated;
- Whether personnel who are at assembly points need to be evacuated;
- Declares emergency and order for operation of emergency siren;
- Organizes announcement by public address system about location of emergency;
- Assesses which area are likely to be affected, or need to be evacuated or are to be alerted;
- Maintains a continuous review of possible development and assesses the situation in consultation with incident controller and other key personnel as to whether shutting down the plant or any section of the plant required and if evacuation of persons is required;
- Direct personnel for rescue, rehabilitation, transport, fire brigade, medical and other designated mutual support system locally available for meeting emergencies;
- Control evacuation of affected areas, if the situation is likely to go out of control or affects are likely to go beyond the premises of the factory, inform to district emergency authority, police, hospital and seeks their intervention and help;
- Informs inspector of factories, deputy chief inspector of factories, PCB and other statutory authorities;
- Gives a public statement, if necessary;
- Keeps record of chronological events and prepares an investigation report and preserve evidence;
- On completion of On-Site Emergency and restoration of normalcy, declares all clear and order for all clear warning.

Incident Controller

- Assembles the incident control team;

- Directs operation within the affected areas with the priorities for safety to personnel minimize the damage to the plant, property and environment and minimize the loss of materials;
- Directs the shutting down and evacuation of the plant and areas likely to be adversely affected by the emergency;
- Ensures that all key personnel's help is sought;
- Provides advise and information to the fire and security officer and the local fire services as and when they arrive;
- Ensure that all non-essential workers/ staff of the affected areas are evacuated to the appropriate assembly points and the areas are searched for casualties;
- Has regard to the need for preservation of evidence so as to facilitate any inquiry into the causes and the circumstances which caused or escalated the emergency;
- Co-ordinates with emergency services at the site;
- Provides tools and safety equipments to the team members;
- Keeps in touch with the team and advices them regarding the method of control to be used;
- Keeps the site controller of emergency informed of the progress being made.

Emergency Co-ordinators – Rescue, Fire Fighting

- On knowing about emergency, rushes to ECC;
- Help the incident controller in containment of the emergency;
- Ensure fire pumps in operating conditions and instruct pump house operator to be ready for any emergency with stand-by arrangement;
- Guides the fire fighting crew i.e. firemen, trained plant personnel and security staff;
- Organizes shifting the fire fighting facilities to the emergency site, if required;
- Takes guidance of the incident Controller for firefighting as well as assesses the requirements of outside help;
- Arrange 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 nearby areas as advised by Site Controller;

- Searches for casualties and arrange proper aid for them;
- Assembles search and evacuation team;
- Arrange for safety equipments for the members of his team;
- Decides which paths the evacuated workers should follow;
- Maintains law and order in the area, and if necessary, seeks the help of police.

Emergency Co-ordinator – Medical, Mutual Aid, Rehabilitation, transport and Communication

In the event of failure of electric supply and thereby internal telephones, sets up communication points and establishes contact with the Emergency Control Centre (ECC).

Organizes medical treatment to the injured and if necessary, will shift the injured to nearby hospitals;

- Mobilizes extra medical help from outside, if necessary;
- Keeps a list of qualified first aiders of the factory and seeks their assistance;
- Maintains first aid and medical emergency requirements;
- Makes sure that all safety equipments are made available to the emergency team;
- Assist Site Controller with necessary data and in coordinating the emergency activities;
- Assist site controller in updating the emergency plan, organizing mock drills,
- verification of inventory of emergency facilities and furnishing report to Site Controller;
- 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 transportation facilities;
- Ensure availability of necessary cash for rescue/ rehabilitation and emergency expenditures;
- Controls rehabilitation of affected areas on discontinuation of emergency.

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 in charge of process equipment,

should adopt safe and emergency shut down and attend to any prescribed duty as an essential employee. If no such responsibility is assign, he should adopt a safe course to assembly point and await instructions. He should not resort to spreading panic. On the other hand, he must assist emergency personnel towards objective of DMP.

7.0 Emergency Facilities

Emergency Control Centre

An office at the administrative block on main gate is working as Emergency Control Centre. The internal and external telephone facilities, fax etc. will be provided in the block. During an incident, Site Controller and all the Incident Controllers are to be assembled here. The materials available in the ECC are:

- Internal & External telephone facility;
- Hand tools;
- Telephone directories;
- Factory layout and site plan;
- Emergency lamp/ torch light/ batteries;
- Plan indicating locations of hazard inventories, plant control room, sources of safety equipments, work road plan, assembly points, rescue location vulnerable zones, escape routes;
- Hazard chart;
- Emergency shut-down procedures;
- Nominal role of employees;
- List of key personnel, list of essential employees, list of emergency co-ordinators;
- Duties of key personnel;
- Address with telephone numbers and key personnel, emergency co-ordinators,
- essential employees;
- Important address and telephone numbers including government agencies,
- neighboring industries and sources of help, outside experts, chemical fact sheets, population details around the factory.

Assembly Point

Numbers of assembly points depending upon the plant location are to be identified wherein employees who are not directly connected with the disaster management would be assembled for safety and rescue. Emergency breathing apparatus minimize facilities like water etc. are provided.

In view of the size of plant, different locations are ear marked as assembly points. Depending upon the location of the hazards the assembly points are to be used.

Emergency Power Supply

Water pumps, plants lighting and emergency control centre, administrative building and other auxiliary services will be connected to emergency power supply. Also, in case of turbine failure, DG sets will be carried or available to illuminate the area. There is plan to procure the flame proof emergency lighting system for each of the sections.

Fire Fighting Facilities

First Aid fire fighting equipment suitable for emergencies will be maintained in each section in the plant. This would be as per statutory requirements.

Emergency Medical Facilities

First aid facilities are provided at Emergency Control Centre and at main gate of the mill to deal with chemical burns and fire burns etc. Private and government medical hospital's help would be sought in case of emergency. Apart from first aid facilities, external facilities would be augmented. Names of the medical personnel and details like phone number etc. will be displayed at main gate of the mill and the details of facilities will be maintained and updated at main gate of the mill.

8.0 **Emergency Actions**

Emergency Warning

Communication of emergency is familiar to the personnel inside the plant and people outside. An emergency warning system will be provided at the main gate.

Emergency Shutdown

Whenever a given method is appropriate depends on that particular case, cessation of the process is the best action in some instances but not in all. Emergency shutdown switches are to be provided to all those machinery that pose hazard in any condition.

Evacuation of Personnel

There could be more number of persons in the storage area and other areas in the vicinity. The area would have adequate number of exits, stair cases. In the event of an emergency, unconnected personnel have to escape to assembly point. Operators, if needed, have to take emergency shutdown procedure and escape. Based on these requirements, evacuation of the personnel through emergency exits are provided in the plant. Time office maintains a copy of deployment of employees in each shift. If necessary, persons can be evacuated by rescue teams.

Accounting of Personnel

It shall be the responsibility of the Team to immediately take stock of the personnel on duty and cross-check the personnel who have come out of the plant or have got stuck up. This team shall co-ordinate with Team to ensure that all the personnel are accounted for. It is also essential for Team to counter check the security if any visitor or transport workers have entered the plant and if so they should also be accounted.

All Clear Signal

Also, at the end of an emergency, after discussing with Incident Controllers and Emergency Co-ordinators, the Site Controller orders an all clear signal. When it becomes essential, the Site Controller communicates to the District Emergency Authority, Police and Fire Service personnel regarding help required or development of the situation into an Off-Site Emergency.

Controlling the Disaster

The declarer / controller of Disaster shall take steps to train all the teams and shall draw up an "Action Plan" forthwith. The Distillery In-charge is earmarked as "INCIDENT CONTROLLER" and shall act as an in-charge at the site of the hazard to control entire operations.

Implements for Repairs and Safety Gears:

The declarer / controller of disaster along with the incident controller shall immediately prepare a list of safety gear, tools and other implements required to control the emergency situations in respect of-

1. Fire
2. Bursting of Boiler
3. Short Circuiting

This list shall be submitted to the Managing Director for approval and the material should be brought immediately. Also, It shall be the responsibility of "Incident Controller" to ensure that a separate set of implements, safety gear and tools are

9.0 General

Employees Information

During an emergency, employees would be warned by raising siren in specific pattern. Employees are given training on escape routes, taking shelter, protecting from toxic effects. Employees are provided with information related to fire hazards, and first aid measures. The key personnel and essential employees are to be given training in responding to emergency (emergency response).

Public Information and Warning

The industrial disaster effects related to this plant may mostly be confined to the plant area. The detailed risk analysis has indicated that the pool fire effects would not be felt outside. However, as an abundant precaution, the information related to chemicals in use would be furnished to District Emergency Authority for necessary dissemination to general public and for any use during an off-site emergency.

Mutual Aid

Mutual aid in the form of technical personnel, runners, helpers, special protective equipment, transport vehicles, communication facilities would be sought from neighboring industrial establishments.

Mock Drills

Emergency preparedness is an important task in planning of Industrial Disaster Management. Personnel in the mill are trained suitable and prepared mentally and physically in emergency response through carefully planned, simulated procedures. Similarly, the key personnel and essential employees are to be trained in the operations.

Important Information

Important information such as names and address of key personnel, essential employees, medical personnel outside the plant etc. are to be maintained in the mill.

An on-site emergency organization chart for various emergencies is shown in Figure below.

Large and medium 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 boons, the industrialization generally brings several problems like occupational health and safety.

The industrial planner, therefore, has to properly plan and take steps to minimize the impacts of industrialization and to ensure appropriate occupational health and safety including fire plans. All these activities again may be classified under construction & erection and operation & maintenance. **Harinagar Sugar Mills Ltd. (HSML)** has prepared its own safety plan which will be implied during construction & erection and operation & maintenance phases. The safety plan is as follows:

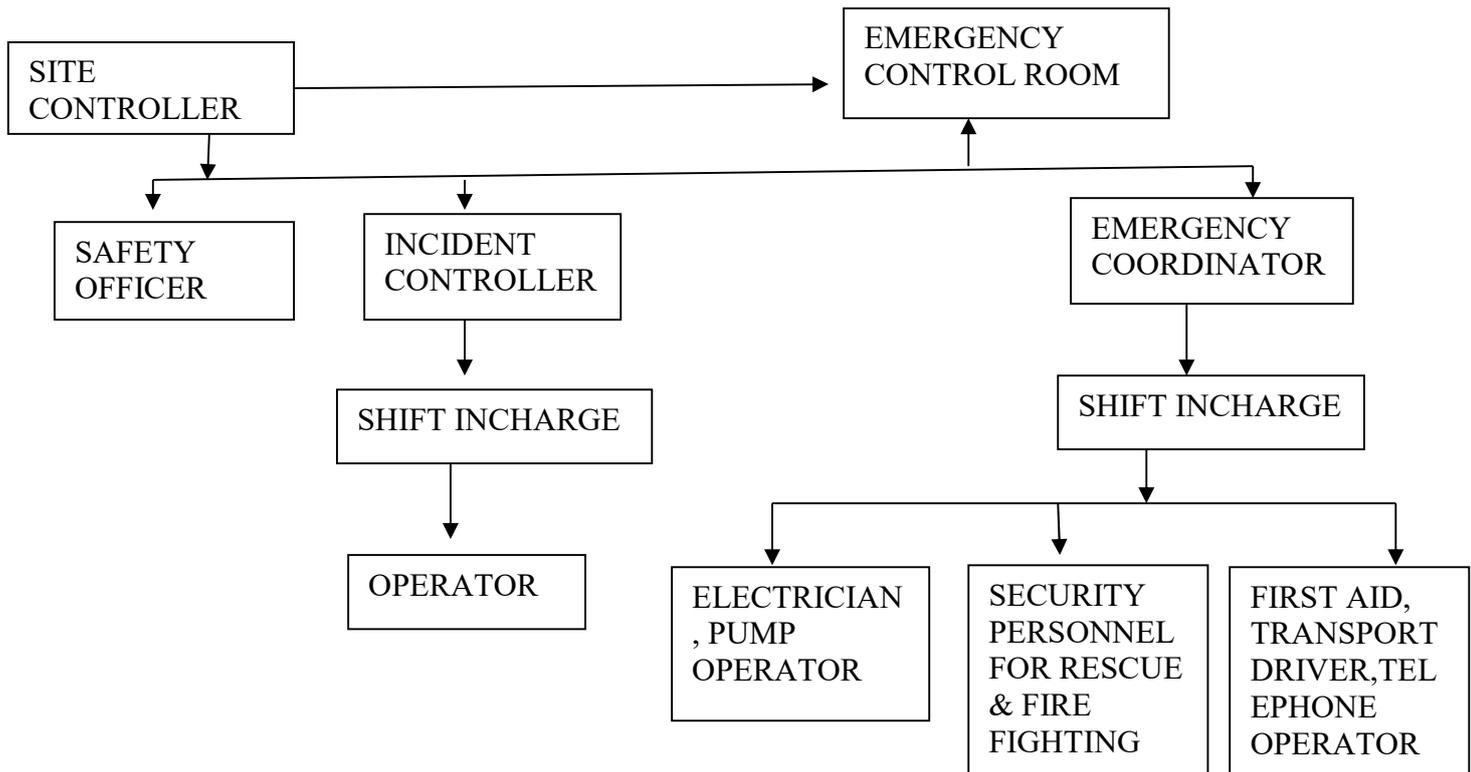


Figure 7.2: On Site Emergency Organization

On-site Emergency Plan:

Functions of Designated Persons

In addition to the specific responsibilities, assigned to various employees following are the general functions to be performed by the designated persons

- a. To communicate & report the clear position of a Disaster to Key Persons of the Distillery.
- b. To communicate & co-operate with other departments / aspects like security, safety of victims etc.
- c. To minimize the extent of Disaster by taking all possible measures which, are in control.
- d. To minimize the exposure of Disaster to human beings.
- e. To save property and valuable things as far as possible.

Special Handling Requirement

During handling of the above materials equipment such as- electrical motor pumps, mechanical mixers, automatic weighing arrangement, automatic dosing arrangement, pressure release and safety accessories on steam generating, handling as well as

conveyance systems, heat exchangers, condensers and cooling as well as chilling machinery, temperature and pressure gauges are used.

The concerned workers are provided with adequate operation and safety tools /equipment. Sufficiently trained and qualified workers are employed in all sections of the Distillery.

Notification Procedures & Communication Systems

Communication Equipment like Telephone, Wireless System and Personal messaging would be employed. The families of injured employees would be notified by Telephone, Personal messaging and through Verbal Communication.

Emergency Equipment and Facilities-

The following emergency equipment & facilities would be provided.

Emergency Cupboard:

An emergency cupboard will be available in all plant areas. This cupboard should contain certain number of various personal protective equipment (PPE) for use in case of disaster. These items kept in the cupboard should be used only during an emergency and not under normal working conditions. A printed or typed list of items available in the cupboard should be displayed on the cupboard.

The following items may be kept in the Emergency Cupboard .

1. Air line mask set
2. Self-containing breathing apparatus
3. Safety belt with life time
4. PVC gloves
5. Leather gloves
6. Flextra or asbestos gloves
7. PVC Suit
8. Electrical rubber gloves
9. Safety touch
10. Safety goggle
11. Face- shield
12. Ear-muff
13. Flextra or asbestos blanket
14. Manila Rope 100 meter long bundle
15. Resuscitator

16. Safety helmet

This item shall be examined once a week by the safety observer to ensure that all the items are available and that they are in good condition and defective must be replaced immediately.

A) Requirement of Equipments and Other Materials-

1. Helmets for the Incident Controller and others.
2. Megaphone (workable hand-held PA system).
3. Walkie- Talkie/ mobile phones/ pagers.
4. Stock of fire fighting material.
5. Note books/pads and pens/ pencils.
6. Sign boards.
 - Assembly point
 - Emergency control center
 - Road closed

B) Fire hazard is possible in the following wings of Distillery Unit.

1. Fermentation Section
2. Distillation Section
3. Daily Receiving Room
4. Spirit Storage Tanks

Emergency Medical Supplies:

Sufficient number of First Aid Boxes would be located at appropriate and easily accessible locations. The First Aid Box would contain Bum Relief Sprays and Ointments, Bandages, Antiseptic as well as Pain Relief Medicine.

Training and Drills

Knowledge of Chemicals

Every worker, working in a particular section, would be given a thorough knowledge of all the chemicals involved/ handled in that section, their reactions as well as properties etc. Also they shall be instructed regarding the chemical spillage and its waste disposal practices.

Location of Fire Fighting Equipment

Every worker would be given clear-cut information regarding the 'location of Fire Extinguishers, Fire Buckets, and Water Points etc.

Use of Fire Fighting Equipment

Every worker would be trained with respect to nature and utility of Fire Fighting Equipment, its type and class of fire for which it is to be used.

Use of Personal Protective Equipment (PPE)

Every worker would be trained in using the PPE such as safety helmets, hand gloves, nose mask, goggles etc.

Off-site Emergency Plan

Since only hazard that is expected in the distillery industry is fire and is normally contained within the premises no OFF-SITE EMERGENCY PLAN is needed. However, in case the hazard spreads out-side the premises employees 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.

Information to Local Authorities.

It shall be the responsibility of declarer / controller of emergency to inform the Local Panchayat Official regarding the likely hazards from the industry and the steps to be taken when there is an Off-Site Emergency. It is preferable that the Local Panchayat Officials are also trained, on simple protective methods, through demonstrations.

10.0 Occupational Health

Occupational health needs attention both during construction & erection and operation & maintenance phases. However, the problem varies both in magnitude and variety in both the phases.

Construction and Erection

The occupational health problems envisaged at this stage mainly due to constructional accidents and noise.

To overcome these hazards, personal protective equipments (PPEs) are provided to all the employees. These includes helmets, gum boots, dust masks, ear plugs, safety goggles, rubber and asbestos gloves, safety belts etc. Depending upon the work an employee is doing and the location where he is working, necessary PPEs are provided to them.

Operation and Maintenance

The problem of occupational health, in the operations and maintenance phase, is due to many factors. It may be chemical or toxic gas leakages from any tank or vessel, heat, fire, noise etc. Following is a list of PPEs that are / will to be provided to the employees working in the factory premises:

- Industrial Safety Helmets
- Face Shields with Replaceable Acrylic Vision
- Punk Type Safety Goggles for Dust Protection
- Chemical Splash Proof Goggles
- Welder's Equipments for Eye and Face Protection
- Cylindrical Type Earplugs
- Ear Muffs
- Canister Gas Masks
- Self Contained Breathing Apparatus
- PVC Aprons
- Aluminized Fiber Glass Fix Proximity Suits with Hood, Gloves & Boots
- Boiler Suits
- Safety Belts
- Asbestos and Rubber Hand Gloves
- Acid/ Alkali Proof PVC Hand Gloves
- Electrically Tested Electrical Resistance Hand Glove
- Eye/ Face Shower
- Gum Boots

- Eye Wash Bottles

Full-fledged hospital facilities are available round the clock in Patna urban area/town, approx. 5k.m from the factory site to attend the emergency arising due to any kind of accidents, if any. One number of vehicles will be available for attending emergencies arise due to accidents round the clock in the factory.

11.0 Safety Plan

Safety of both men and materials during construction and operation phases is of concern. The preparedness of any industry for the occurrence of possible disasters is known as emergency plan. The disaster in **Harinagar Sugar Mills Ltd. (HSML)** is possible due to leakage of hazardous chemicals, collapse of structures and fire/explosion etc.

Keeping in view the safety requirement during construction, erection, operation and maintenance phases, **Harinagar Sugar Mills Ltd. (HSML)** has formulated a safety policy with the following regulations:

- To allocate sufficient resources to maintain safe and healthy conditions of work
- 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 ensure that adequate safety instructions are given to all employees
- To provide wherever necessary protective equipment, safety appliances and clothing, and to ensure their proper use
- To inform employees about materials, equipments or processes used in their work which are known to be potentially hazardous to health or safety
- To keep all operations and methods of work under regular review for making necessary changes from the point of view of 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 instruction, training, retraining and supervision to employees in health and safety and first aid
- To ensure proper implementation of fire prevention methods and an appropriate fire

- fighting service together with training facilities for personnel involved in this service
- To organize collection, analysis and presentation of data on accident, sickness and incident involving personal injury to health, with a view to take corrective, remedial and preventive action
- To promote through the established machinery, joint consultation in health and safety matters to ensure effective participation by all employees
- To publish/ notify regulations, instructions and notices in the common language of employees
- To prepare separate safety rules for each type of processes involved in a project
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipment, work places and operations.
- In operation, the safety guidelines are framed in consultation with department heads and are tested under their guidance.

12.0 Safety Circle

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circle is constituted in the mill. The circle consists of equal representation of workers & staff members of the mill and comprise of 14 members headed by GM (HR & Admin.).

13.0 Safety Training

A full-fledged training centre with proper sitting capacity, overhead projector etc. is constructed in the mill and the trainings are given by the GM (HR & Admin.) with the assistance of subject matter expert from different departments. In addition to regular employees, contract laborers are also to be provided with safety training. To create safety awareness among all members, competition among safety circles are organized, during the celebration of National Safety Day/Week.

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