RISK ASSESSMENT

Risk is a potential that a chosen action or activity will lead to a loss of human or property.

Risk assessment is a step for Risk management. Risk assessment is determination of qualitative and quantitative value of risk related a situation or hazard.

Hazard is a situation that poses a level of threat to life, health or environment.

Disaster is a natural or man-made hazard resulting in an event of substantial extent causing significant physical damage or distraction loss of life or drastic change in environment.

Risk associated with the use of hazardous chemicals can be assessed and managed in terms of their effect on human health, environmental health, and business operations. When discussing a particular chemical, each of these categories should be examined to ensure a comprehensive understanding of the total risk and to provide the basis for an acceptable risk management programme.

Presence of a chemical commodity in the work place or the environment in general, generates some level of risk. Assessing the nature or severity of this risk is dependent upon a number of factors, all of which focus on one common element: exposure. However, an exposure to chemical doesn't always mean that the results will be detrimental. In other words, the specific hazardous nature of an exposure that present risk to a person and/ or the environment must be examined. It becomes clear that the risk assessor or risk manager must understand the principals of hazard, exposure, and risk.

Risk assessment involves the following:

- Hazard Identification
- Vulnerability Analysis
- Risk Analysis
- Emergency Plan

The Risk Equation

Risk is the probability that the hazard will occur (i.e. that an adverse effect or/event will result from a given set of exposure condition). Since the risk is typically expressed as a mathematical probability, the range of risk can be stated as zero (having no possibility of adverse effect or event). One (having a certainty that an adverse effect or event will result) having established this, it is important to note that risk is the mathematical product of hazard and exposure. This relationship can, be expressed in the following simple formula.

Risk = Hazard x Exposure/ Probability of occurrence of the event

Eliminating hazards or controlling risks is the best way to reduce workplace injury and illness

Simple Mathematics tells us that, multiplying any number by zero forces a product of zero. Therefore, the above equation means that an extremely hazardous substance can be present with little risk of adverse effect if it is handled with safe and proper conditions (i.e. when the exposure component of the risk equation is driven towards zero). Similarly, risk can be reduced towards zero by driving the hazard component of the equation towards zero (e.g. changing the process design, substituting less hazardous commodity, using a lesser amount of a chemical, etc.), even if there is still a high probability of exposure. Of course, the ultimate risk management solution would be driving both the exposure and the hazard components of the equation to as low probability as possible. Such measures would virtually guarantee a low or no risk scenario; however, in the real world, it is not always practical, feasible, or possible to reduce the elements of risk to zero level or probability. For this reason, risk assessment and risk management have become extremely vital element to successful business operations in recent years. More importantly, the proper assessment and management of risks, which may be posed by the use, transport, storage, or disposal of hazardous chemical can be laterally save lives, prevent illness and injury and preserve the precious environmental resources.

7.4.1 Hazard Identification

For the proposed distillery unit four categories of hazards are identified and listed below.

Natural Hazard

1. Earthquake
2. Flooding

Man Made Hazard

1. Fire & explosion
    - Explosive material
    - Chemicals
    - Short circuiting
    - Boiler
    - Diesel storage area
    - Process Area, Reactors
2. Electrical
    - Electrical room
    - Non insulated wires

3. Mechanical/ Accident
    - Raw material Handling
    - Equipment's area
    - Noise
    - Transportation
4. Thermal
    - Boiler
5. Chemical
    - Chemical storage area
    - Oil storage
    - Leakage from process
    - Reactors

Alcohol storage and handling area firefighting facility

- Fire Hydrant network will be provided for fire fighting in the entire project area.
- Provision of foam system for fire fighting to control fire from the alcohol storage tanks.
- Dry chemical powder (DCP) type extinguisher and sand buckets.
- Providing flame arrestors on the top of all the storage tanks.
- Flame proof fitting to all the systems which handles the alcohol.
- Transfer of alcohol is by pipes only.

Risk Analysis Methodologies

Risk assessment often requires the synthesis of risk profiles, which represent the probability distribution of total annual loss due to a certain set of events or activities. These assessments usually involve estimation of losses for several sub-classifications of the overall process and synthesis of the results into an aggregate risk profile. Main risk assessment technologies are:

- Hazard and operability study (HAZOP)
- Fault Tree Analysis (FTA)

Hazard Identification and Risk Assessment (HIRA)

There are three steps used to manage health and safety at work:

1. Spot the Hazard (Hazard Identification)
2. Assess the Risk (Risk Assessment)

3. Make the Changes (Risk Control)

Spot the Hazard (Hazard Identification)

A hazard is anything that could hurt you or someone else.

1. Fire & explosion
    - Explosive material
    - Chemicals
    - Short circuiting
    - Boiler
    - Diesel storage area
    - Process Area, Reactors
2. Electrical
    - Electrical room
    - Non insulated wires
3. Mechanical/ Accident
    - Raw material Handling
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Assess the Risk (Risk Assessment)

Assessing the risk means working out how likely it is that a hazard will harm someone and how serious the harm could be.

- ☐ Supervisor should instruct and train employee/ worker before using equipment;
- ☐ Moving or lifting heavy objects should be done under supervision;
- ☐ Identify areas of hazard and should keep safety measures while assessing those areas.

Make the Changes (Risk Control)

The best way to fix a hazard is to get rid of it altogether. These are not always possible, but try to make the hazards less dangerous by looking at the following options (in order

from most effective to least effective):

Elimination - Sometimes hazards - equipment, substances or work practices - can be avoided entirely.

Substitution - Sometimes a less hazardous thing, substance or work practice can be used.

Isolation - Separate the hazard from people, by marking the hazardous area, fitting screens or putting up safety barriers.

Safeguards - Safeguards can be added by modifying tools or equipment, or fitting guards to machinery. These must never be removed or disabled by workers using the equipment.

Instruct workers in the safest way to do something - This means developing and enforcing safe work procedures.

Using personal protective equipment and clothing (PPE) - If risks remain after the options have been tried, it may be necessary to use equipment such as safety glasses, gloves, helmets and ear muffs. PPE can protect you from hazards associated with jobs such as handling chemicals or working in a noisy environment.

Sometimes, it will require more than one of the risk control measures above to effectively reduce exposure to hazards.

Review of HIRA Study

- At least once in a year;
- Amendments/ addition in legal requirements;
- Change in process or products handled;
- Internal and external audit results, including Specialized/ Third Party Audits;
- Occurrence of accident, emergency;
- While initiating any corrective and preventive action;
- While purchasing and erecting any new equipment/ machinery/ building.

Risk Matrix

Risk Rating	Remedy	Practically Impossible	Not likely to occur	Could Occur	Know to Occur	Occurs Frequently
Slight effect	First aid injury	1	2	3	4	5
Minor effect	Medical treatment injury	2	4	6	8	10
Localized effect	Lost time injury (Short term)	3	6	9	12	
Major effect	Lost time injury (Long duration)	4	8	12		
Massive effect	Fatality	5	10			

Risk Level Assessment

Types	Risk level	Category	Acceptability on necessary action and timescale
Low Risk	1 – 3	Low	No additional controls are required unless they can be implemented at very low cost (in terms of time, money and efforts), actions to further reduce these risks are assigned low priority. Arrangements should be made to ensure that the controls are maintained.
Medium Risk	4 – 8	Medium	Consideration should be given as to whether the risks can be lowered, but the costs of additional risk reduction measures should be taken into account. The risk reduction measures should be implemented within a defined time period. Arrangement should be made to ensure that the controls are maintained, particularly if the risk levels are associated with extremely harmful consequences and very harmful consequences.
High Risk	09 – 14	High	Substantial efforts should be made to reduce the risk. Risk reduction measures should be implemented urgently within a defined time period and it might be necessary to consider suspending or restricting the activity, or to apply interim risk controls are maintained. Arrangements should be made to ensure that the controls are maintained, particularly if the risk levels are associated with extremely harmful consequences and very harmful consequences.
Extreme Risk	15 – 25	Very high	These risks are unacceptable. Substantial improvements in risk controls are necessary, so that the risk is reduced to an acceptable level. The work activity should be halted until risk controls are implemented that reduce the risk so that it is no longer very high. If it is not possible to reduce risk the work should remain prohibited.

Mitigation of fire hazards due to Alcohol storage

3. Alcohol will be stored in leak-proof MS tanks, gauges of MOC will be strictly as per IS or relevant standards;
4. Storage area will be well ventilated with adequate spacing between units
5. Provision of alcohol vapor condensation system
6. Storage area will be strictly declared as 'No Smoking Zone' and prohibiting use of any ignitable material (e.g. even cell phones, etc.)
7. Electrical fittings of good quality and complying with national or international standards will be used
8. It will be mandatory for transport vehicle to use flame proof silencer
9. Lightening arresting system

Fire Protection Systems Proposed

- 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.
- Portable extinguisher such as pressurized water type, Dry Chemical Powder (DCP) type extinguisher, sand buckets and foam type will be located at strategic locations throughout the plant.
- Modular type carbon dioxide panel injection fire extinguishing system will be provided in control equipment room, cable space below control room and at other unmanned electrical and electronic equipment room.
- Automatic Medium Velocity water Sprinkler system for cable galleries/ vaults/ spreader room, coal conveyors, crusher house, transfer points.
- burners, boiler feed pump, lube oil systems, diesel engine driven fire pump, etc.
- Fire water reservoir will be part of the water storage tank.
- Electric audible fire siren will be provided to the farthest distance in the installation and also in the surrounding area up to 1 km from the periphery of the installation which will be of different sound with respect to shift alarm with continuous power supply
- Emergency exits shall be provided at specific locations and shall be marked on the

layout at specific locations

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

Mitigation measures for gases released

During the fermentation process, different gases may cause toxic and explosive risks. Therefore, adequate ventilation and strict maintenance are essential. Particularly significant are the risks of asphyxiation from the vapours of alcohol and carbon dioxide released by the fermentation process, especially when the liquids are transported and decanted into reservoirs, and in confined spaces where ventilation is inadequate.

Mitigation measures for chemicals spilled/ leakage

Materials such as caustics, acids and many other solvents and cleaners are used for different purposes. Employees must be trained to handle these products safely. Workers must be educated on the use of material data safety sheets (MSDSs), which are information sheets available from suppliers, giving information on the contents of the hazardous product and the related health hazards, emergency action, first aid and so on. It is imperative that every worker who is exposed or likely to be exposed to a hazardous material be trained of handling ofhazardous material. In addition to the training, first aid stations should be made available in the plant in order to control/minimize injuries to anyone who is accidentally exposed to a hazardous chemical.

Mitigation measures for injury due to machinery

Conveyors are used commonly for transport and loading/unloading of materials; traps in the gearing between belts and drums can be avoided by efficient machinery guarding. There should be an effective lockout/tagout programme for maintenance and repair. Where there are walkways across or above conveyors, frequent stop buttons should also be provided. In additionto this, adequate guards on the machinery and face guards, rubber gloves, rubberized aprons and non-slip boots for the workers can prevent injury.

Mitigation measures for injury due to electricity

Owing to the prevailing damp conditions, electrical installations and equipment need special protection, and this applies particularly to portable apparatus. Ground fault circuit interrupters should be installed where necessary. Wherever possible, low voltages should be used, especially for portable inspection lamps. Steam is used extensively, that may causes burns and scalds; lagging and protection of pipes should be provided, and safety locks on steam valves will prevent accidental release of scalding steam.

Mitigation measures for injury due to boiler operations

- Provision of adequate sets of personnel protective equipment
- Pilot lights will be provided on electrical panel boards
- Provision of hand operable firefighting cylinders at strategic locations

Fire Fighting Strategy

- In case of small fire, it can be extinguished with the help of DCP followed by water to prevent re-ignition.
- If it is a major fire, cordon the area and restrict entry of any unauthorized personnel
- Keep a safe distance if there is any possibility of explosion
- In the event of any threat to the neighboring residents, besides alerting those on the incident ensure that necessary precautions have been taken by them with the help of Civil Administration Authorities
- Mutual aid to be activated and district authorities shall be contacted for activating off site emergency preparedness
- Proper safety equipment should be used & back up of firefighting/rescuing team to be provided.
- Keep constant vigil on that particular spot and as well as on the neighboring area.
- Avoid directing heavy streams of water on the roof to avoid water stagnation.
- Follow the instruction of Man-In-Charge during the entire firefighting exercise.
- Cooling water streams should be applied to the top of tank (excluding floating roof tank) so that the run-off down the sides of the tank will reduce the heat input to the tank.
- Water must be applied on tank appurtenances, un-insulated supports and any porting of the tank shell above the liquid level where there is direct flame contact.
- If the flames from vents are discharging onto the top of the shell of the tank, water must be directed on that area to keep it cool.
- Cooling of tanks usually in needless unless there is direct flame contact or sufficient radiant heat to scorch the paint.
- As a rule, ground fires around the tanks must be controlled or extinguished before attempting to extinguish the fire in the tank.

Disaster Management Plan

A major emergency in an activity/project is one which has the potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the activity/project. It would normally require the assistance of emergency services to handle it effectively.

The overall objectives of the emergency plan will be:

- To localize the emergency and eliminate it
- To minimize the effects of the accident on people and property.

Elimination will require prompt action by operations and works emergency staff using, for example, fire–fighting equipment, water sprays etc.

Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

Disaster Management Plan for an industrial unit is necessarily a combination of various actions which are to be taken in a very short time but in a present sequence to deal effectively and efficiently with any disaster, emergency or major accident with an aim to keep the loss of men, material, plant/machinery etc. to the minimum. The main functions of the Disaster Management Cell are to prepare a detailed Disaster Management Plan, which includes:

- Identification of various types of expected disaster depending upon the type of the industrial unit.
- Identification of various groups, agencies, departments etc. necessary for dealing with a specific disaster effectively.
- Preparation – by intensive training of relevant teams/ groups within the organization to deal with a specific disaster and keep them in readiness.
- Establishment of an early detection system for the disaster.
- Development of a reliable instant information/ communication system.
- Organization and mobilization of all the concerned departments/ organizations / groups and agencies instantly when needed.
- A major disaster that can be expected due to fire in this proposed distillery.

On-Site Emergency Plan

The views of the possible hazards that can arise out of the daily operations in the distillery plant, various measures are adopted to prevent the occurrence of a major accident. This comprises of:

- Built in safety measures, alarms, trips and interlocks etc.
- Standard safe operating and maintenance procedures permit system etc.

- Training of all the involved staff in normal and emergency operating procedures.
- Training of all employees in safety, firefighting and first aid.

However, in spite of these precautions, it is required to foresee situation of major accident and plan for taking timely action to minimize the effects of such incident on the safety and health of persons working in the plant as well as those living around the premises.