

1. RISK ASSESSMENT

1.1. HAZARD IDENTIFICATION

In practical terms, hazard identification is a thorough look at the workplace and processes to identify those things, situations, processes that may cause harm, particularly to the working force and nearby population. After identification of the potential hazards, one has to evaluate its potential to cause harm and then decide what type of control measures shall be taken to control it from the happening. Hazard identification is a very important tool as it is an integral part of a good occupational health and safety management plan. The aim of the hazard identification process is to reduce the level of risk by taking precautions or initiating control during project execution.

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

1.2. Hazard Identification & Risk Assessment (HIRA)

The purpose of a Hazard Identification and Risk Assessment (HIRA) is to understand what risks or threats to public safety, property or the environment exist.



Figure 1 Hazard Identification & Risk Assessment (HIRA) process

- Hazard Identification and Risk Assessment (HIRA) Process,
- Identification of hazards
- Analyze or evaluate the risk associated with the hazards
- Determine appropriate ways to eliminate or control the hazards
- Evaluate the likelihood of an injury or illness occurring, and its severity
- Review of all available health and safety information about the hazard including MSDS, manufacturer's literature, information from organizations and results of testing
- Identify actions necessary to eliminate or control the risk
- Monitoring to confirm the risk is controlled
- Keep any documentation or records that may be necessary. Documentation may include detailing the process used to assess the risk, outlining any evaluations, or detailing how conclusions were made.

1.3. Identification Hazard

Details of the major anticipated risks from the Hazards is given in below

Table 1 Hazards of the proposed plant

| Sr. No. | Name | Description | Severity | Hazard |
|---------|---|---|----------|-----------------------|
| 1 | Transportation of raw material | Molasses | Major | Exposure |
| | | Coal | Major | -- |
| | | Yeast, urea | Minor | Exposure & inhalation |
| | | Sulphuric acid, Di-ammonium Phosphate, Antifoam reagent, Caustic soda | Major | Exposure & inhalation |
| 2 | Storage of Molasses Products and byproducts | Molasses, RS/ ENA/ Technical Alcohol, fusel oil | Major | Explosive, Fire |
| 3 | Manufacturing process | Fermentation | Major | Fire |
| | | Distillation Unit | Major | Heat & Fire |
| | | Power Plant | Major | Heat fire & |
| 4 | Utilities | D.G set, Boiler, Turbine | Major | electrocution |
| 5 | Other accidents | Leakages from the vessels, Catastrophic rupture of pressure vessels and Storage Tanks | Major | Exposure & Fire |

1.4. RISK ASSESSMENT

Risk analysis deals with the identification and quantification of risks, the plant equivalent and personnel are exposed to, due to accidents resulting from the hazards present in the factory. Risk classification is given in following **Table 2**

Table 2 Risk classification and score table

| Impact | Likelihood | | | | |
|--------|----------------------|-----------------|-----------------|---------------|-----------------------|
| | Rare (1) | Unlikely (2) | Possible (3) | Likely (4) | Almost Certain (5) |
| | Catastrophic (5) | Moderate Risk | Moderate Risk | High Risk | Critical Risk |
| | Major (4) | Low Risk | Moderate Risk | High Risk | Critical Risk |
| | Moderate (3) | Low Risk | Moderate Risk | High Risk | High Risk |
| | Minor (2) | Low Risk | Low Risk | Moderate Risk | Moderate Risk |
| | Insignificant (1) | Low Risk | Low Risk | Low Risk | Moderate Risk |

| Risk Score | Risk Level Category | Description |
|------------|---------------------|--|
| 1 to 4 | Low Risk | Manage by routine procedures and operations; should not require much attention but should be reviewed at least every 18 months. |
| 5 to 10 | Moderate Risk | Manage by specific monitoring or response procedures; should be monitored and reviewed every 12 months. |
| 11 to 18 | High Risk | Requires escalation to VP; should be constantly monitored and reviewed every 3 months. |
| 19 to 25 | Critical Risk | Requires escalation to Board Committee responsible for risk management oversight; should be constantly monitored and reviewed monthly. |

1.4.1. Potential risk and mitigation measures for during construction phase

Existing factory has maintained the risk associated with the operational component. Following are the general risk assessment and mitigation measures associated with proposed project operation. Risk impact and mitigation measures during the construction phase are shown in **Table 3**

Table 3 Risk Impact and rating matrix during the construction phase

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|-----------------------------------|---|--|-------------|--|
| 1 | Site Leveling | Vehicular movement, Insect/snake bite | Physical injury, and organ damage | M | <ul style="list-style-type: none"> • Providing PPEs to workers • Appointing the qualified persons for the particular job. • Speed limit control • Providing Training |
| 2 | Loading and Unloading of material | Accidents | Physical Injury | M | <ul style="list-style-type: none"> • Providing PPEs to workers • Training to workers |
| 3 | Excavation | <ul style="list-style-type: none"> • Falling objects or objects near an excavation. • Slips, trips, and falls | Property Loss Physical injury | M | <ul style="list-style-type: none"> • Work Permit System will be followed. • Excavated material will be stacked safely. • Area will be barricaded • Training to workers • PPEs will be provided |
| 4 | Construction | <ul style="list-style-type: none"> • Structure may fall down • Workers may fall down from the height. | Physical Injury Physically handicapped Property Loss | H | <ul style="list-style-type: none"> • Work Permit System will be followed. • Height work permit will be issued to the person. • Safety belt will be provided to workers Training to workers |
| 5 | Cutting and Welding | Fire or explosion Electric shock from electrical welding | Physical Injury Burn Injury Property loss | H | <ul style="list-style-type: none"> • Standards Work Procedure • Training will be provided • Proper PPE will be provided. • Regular monitoring of electrical equipment's to avoid loose connection • Area will be barricaded |
| 6 | Installation of Machinery. | Structure may collapse | Property loss Physical Injury | M | <ul style="list-style-type: none"> • Only authorized personnel will operate the machine • The appropriate platform will be designed as per the load bearing calculation. |

1.4.2. Potential risk and mitigation measures during the operation phase

1.4.2.1. Boiler Operation

The potential risk and its mitigation measures for Boiler operation is given in **Table.4**

Table 4 Risk Impact and rating matrix for Boiler operation

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|-----------------------------|------------------------------------|--|-------------|---|
| 1 | Working near Boiler | High noise | Noise-induced hearing loss | M | <ul style="list-style-type: none">Required PPE need to be used |
| 2 | Boiler maintenance | Mechanical hazard | Physically injury | M | <ul style="list-style-type: none">PPEsRegular monitoring for checking leakagesIndividual vigilance and proper training to the workers for proper handlingProvision of First aid box |
| 3 | High Pressure Steam | Explosive | Risk of severe injury, damage to equipment | H | <ul style="list-style-type: none">Required PPEsGood housekeepingRegular monitoring of the storage facilityFlammable chemicals stored away from the source of ignitionFirefighting facility Provision of First aid Box |
| 4 | Incomplete Combustion | Asphyxiati on from carbon monoxide | Possible fatality | H | <ul style="list-style-type: none">Online CO monitors Regular checking of Workplace Individual alertness and precaution |
| 5 | Maintenance work | Slips, Trips and Falls | Physical injury | M | <ul style="list-style-type: none">PPEsIndividual alertness and precaution |
| 6 | Electrical maintenance work | Electricity | Electric shock, Possible burns | H | <ul style="list-style-type: none">PPEsRegular checking and maintenance of electrical unitsProvision of first aid box |
| 7 | Maintenance of burner | Burn injury | Severe physical injury or burn | M | <ul style="list-style-type: none">PPEs will be providedWork will be carried out under proper supervision.Individual alertness and precaution is importantFollow of SOPsProvision of first aid box |

1.4.2.2. Risk during Electrical Transformer

Table 5 Risk during Electrical Transformer

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|---|--------------------|---------------------------------------|-------------|--|
| 1 | Electrical Transformer- Electrical shock and fire | Fire, shock, burn | Severe Physical injury or burn, Death | H | Cut off the power supply Treat the injured for electrical shock If the fire is caused, immediately fight fire with available resources, summoning outside help if necessary |

1.4.2.3. Risk during D.G. set operation

Table 6 Risk Impact and rating matrix for D.G. set operation

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|--------------------|--------------------|---|-------------|--|
| 1 | Working near DG | High noise | Noise-induced hearing loss | M | <ul style="list-style-type: none">• Use of PPE• Acoustic enclosure |
| 2 | Maintenance | Fire | Burns, Serious injury | H | <ul style="list-style-type: none">• Use of PPE• Restricted entry• Use of flameproof fittings |
| 3 | HSD storage | Leakage/Fire | Risk of severe physical injury and burn | H | <ul style="list-style-type: none">• PPEs will be provided• First aid box• Regular monitoring to check the leakage and spillage• storage facility• Storage will be away from the ignition source• Firefighting facility will be provided |
| 4 | DG set maintenance | Mechanical Hazard | Physical injury | M | <ul style="list-style-type: none">• PPEs• First aid box at the approachable place• Leakage and heat in the joint will be checked before maintenance |

1.4.2.4. Hazard & associated Risk of storage and handling of raw material

Impact matrix for risk associated with storage and handling of the material is given in **Table 7**. Various material and its storage/capacity details are given **Table 9**.

Table 7 Impact matrix of Storage and handling of raw material

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|--|------------------------------------|---|-------------|--|
| 1 | Storage, handling, loading & Unloading of material | Exposure, leakage, Fire, Explosion | Physical Injury, burn, Eye irritation and respiratory problem | H | <ul style="list-style-type: none"> • Provision of Eyewash • Inspection and regular monitoring of storage area • Training to Workers for proper handling • PPEs will be provided as Nose mask, Hand gloves. • A proper system for loading operation to prevents spillage • Provision of level indicators for Storage Tanks • Spill kit for Acid and other chemicals • Proper ventilation • First Aid boxes |
| 2 | Transportation | Fire, Accident, leakage | Burns, Serious injury | H | <ul style="list-style-type: none"> • Firefighting facility • Training to Driver • MSDS • TREM Card • First Aid Box |

1.4.2.5. Hazard & associated Risk of Molasses storage tank

Molasses can ferment if excessive moisture contamination is allowed. Fermentation can yield carbon dioxide with possible traces of ethanol or volatile fatty acids (e.g. acetic, propionic, lactic, or butyric) and if exposed to a spark or flame may result in an explosion. Fermentation may also occur in dilute surface layers formed by condensation from the headspace above the liquid.

Table 8 Impact matrix of storage of molasses

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|----------------------|--------------------|---|-------------|---|
| 1 | Storage and Handling | Explosion | <ul style="list-style-type: none"> • May cause slight irritation • May cause irritation | H | <ul style="list-style-type: none"> • Proper ventilation shall be provided • Inspection and regular monitoring of storage area • Training to Workers for proper handling • PPEs will be provided as Nose mask, Hand gloves. • Provision of level indicators |

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|----------|--------------------|---------------|-------------|--|
| | | | | | for Storage Tanks <ul style="list-style-type: none"> If causes eye irritation wash area with soap, flood eye with water and water |

Table 9 Storage Tanks/Area/Capacity details

| Sr. No. | Material | Storage capacity |
|---------|----------------------------|---|
| 1 | Water | 32110 CMD |
| 2 | Molasses | Storage tanks 5 Each of capacity 6000 MT |
| 3 | Bagasse | 20000 m2 Bagasse yard area & Capacity 114800 MT |
| 4 | Pressmud | Press mud yard 500 m2 & capacity 10000 MT |
| 5 | Coal | Coal shed existing Nil & For proposed Area 1000 m2, Capacity 8400 MT |
| 6 | Ash | 500 m2, Capacity 200 MT |
| 7 | Spentwash storage | Spentwash generated from 45 KLPD Stored in lagoon having 30 days spentwash storage capacity (8100 m3 spentwash per month). Composting principle treatment for spentwash generated from 45 KLPD distillery. Spentwash generated from 100 KLPD Stored in proposed lagoon having 7 days spentwash storage capacity (1400 m3 spentwash per 7 days). Concentration and incineration treatment for spentwash generated from 100 KLPD distillery. |
| 8 | Alcohol | Existing 1350000 Liter & Total storage after proposed expansion would be around 4350000 Liter |
| 9 | Other raw material storage | 500 m2 area with 10 MT capacity |

1.4.2.6. Risk associated with alcohol storage and its mitigation measures

Impact matrix of risk associated with storage and transportation of alcohol along with control and mitigation measures are given in **Table 10**

Table 10 Impact matrix of risk associated Alcohol storage

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|--------------------|--|--|-------------|--|
| 1 | Storage of Alcohol | Exposure, inhalation, ingestion & Fire | <ul style="list-style-type: none"> Exposure to over 1000 ppm may cause a headache, drowsiness and lassitude, loss of appetite, and inability to concentrate. Throat Irritation | H | Storage <ul style="list-style-type: none"> Storage will be away from process area with good ventilation. Avoid all possible sources of ignition like spark or flame. Use spark/flame proof hand tools Electrical wiring will be flameproof type |

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|----------|--------------------|---|-------------|---|
| | | | <ul style="list-style-type: none"> Ingestion causes depression of the central nervous system, nausea, vomiting, and diarrhea Liquid or vapor may cause eye and skin irritation Burn injury | | <ul style="list-style-type: none"> Based on the leakage quantity, wiped out with or dilute by spraying the water to suppress the vapors Control measures in case of overexposure If the victim is conscious and able to swallow, then give water or milk to drink to dilute the contents in the stomach Look out for medical help Skin or Eye exposure immediately flush affected area with plenty of water. Eyes should be flushed for at least 15 minutes with water PPEs will be provided to avoid exposure |

1.4.2.7. Risk associated with the work area of distillation

Table 11 Impact matrix of risk associated distillation area

| Sr. No. | Activity | Associated Hazards | Health impact | Risk rating | Proposed mitigation & control measures |
|---------|----------------------------------|--------------------|---------------------------|-------------|--|
| 1 | Working near Distillation column | Heat & Fire | Physical injury & burning | H | <ul style="list-style-type: none"> PPEs Firefighting facility First aid box Periodic checking of all parts |

Table 12 Alcohol Warning Information for Ethyl

| Alcohol | Section |
|------------------|---|
| Product Name | Ethyl Alcohol, |
| Synonyms | Anhydrous Ethyl Alcohol, Dehydrated Alcohol |
| Chemical Family | Alcohol |
| Molecular Weight | 46.07 |
| Formula | CH ₃ CH ₂ OH |

| Health | Fire | Reactive | Other | Degree of Hazard | Colour Coding | Other Codes |
|--------|------|----------|-------|------------------|---------------|---------------|
| 0 | 3 | 0 | - | 0 = Minimum | Health = Blue | Ox = Oxidiser |
| | | | | 1 = Slight | Fire = Red | Acid = Acid |

| Health | Fire | Reactive | Other | Degree of Hazard | Colour Coding | Other Codes |
|--------|------|----------|-------|-----------------------------|------------------------|-----------------------------------|
| | | | | 2 = Moderate 3 = Serious | Reactivity = Yellow | Alk = Alkaline COR = Corrosive |
| | | | | 4 = severe | Other = White | 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

SECTION III-HEALTH

INFORMATION

| | |
|--|--|
| INHALATION | Exposure to over 1000 ppm may cause headache, drowsiness and lassitude, loss of appetite, and inability to concentrate. Irritation of the throat. |
| INGESTION | Can cause depression of central nervous system, nausea, vomiting, and diarrhea. |
| EYE CONTACT | Liquid or vapor may cause irritation. |
| SKIN CONTACT | May cause irritation and defatting of skin on prolonged contact. |
| SECTION IV – OCCUPATIONAL EXPOSURE LIMITS | |
| PEL (OSHA Permissible Exposure Limit): Mixture | See Section II |
| TLV (ACGIH Threshold Limit Value): Mixture | See Section II |
| SECTION V – EMERGENCY FIRST AID PROCEDURE | |
| FOR OVEREXPOSURE BY SWALLOWING | If victim is conscious and able to swallow, have victim drink water or milk to dilute. Never give anything by mouth if victim is unconscious or having convulsions. CALL A PHYSICIAN OR CHEM-TREC (POISON CONTROL) IMMEDIATELY. Induce vomiting only if advised by physician (Poison Control) |
| INHALATION | Immediately remove victim to fresh air. If victim has stopped breathing, give artificial respiration, preferably mouth-to-mouth. GET MEDICAL ATTENTION IMMEDIATELY |
| CONTACT WITH EYES OR SKIN | Immediately flush affected area with plenty of cool water. Eyes should be flushed for at least 15 minutes. Remove and wash contaminated clothing before reuse. GET MEDICAL ATTENTION IMMEDIATELY |
| SECTION VI – PHYSICAL DATA | |
| BOILING POINT | 173° F (78 °C) |
| MELTING POINT | -173° F (-114 °C) |
| VAPOR PRESSURE | 44.6 mm Hg @ 68° F (20 °C) |
| SPECIFIC GRAVITY | 0.7940 @ 60°/60° F |
| VAPOR DENSITY (AIR = 1) | 1.59 |
| SOLUBILITY IN WATER | Complete in water, chloroform, acetone, ether, benzene and methanol |
| APPEARANCE AND COLOR | Clear and colorless, volatile liquid with a weak, vinous, alcohol odour and bitter taste. Odour threshold = 84 ppm |
| SECTION VII – FIRE AND EXPLOSIVE HAZARDS | |
| FLASH POINT | 56° F ASTM D-56 (Tag Closed Cup) |
| AUTO-IGNITION TEMPERATURE | 685° F |
| FLAMMABLE LIMITS IN AIR, % BY VOLUME | LOWER: 3.3 UPPER: 19 |
| NFPA (National Fire Protection) | HEALTH (0) FIRE (3) REACTIVITY (0) |

| | |
|--------------------------------------|---|
| Association) RATING | |
| FIRE FIGHTING PROCEDURES | (Note: Individuals should perform only those fire-fighting procedures for which they have been trained.) Use dry chemical, “alcohol” foam, or carbon dioxide; water may be ineffective, but water should be used to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect men attempting to stop a leak. Water spray may be used to flush spills away from exposures and to dilute spills to nonflammable mixtures. |
| | Firefighters should wear self-contained breathing apparatuses in the positive pressure mode with a full-face piece when there is a possibility of exposure to smoke, fumes, or hazardous decomposition products. |
| SECTION VIII – REACTIVITY | |
| STABILITY | Generally stable. |
| HAZARDOUS POLYMERIZATION | Not likely. |
| CONDITIONS & MATERIALS TO AVOID | Contact with acetyl chloride and a wide range of oxidizing agents may react violently. |
| SECTION IX – EMPLOYEE PROTECTION | |
| CONTROL MEASURES | Handle in the presence of adequate ventilation. |
| RESPIRATORY PROTECTION | Where exposure is likely to exceed acceptable criteria, use NIOSH/MSHA approved respiratory protection equipment. Respirators should be selected based on the form and concentration of contaminant in air and in accordance with OSHA (29 CFR 1910.134). |
| PROTECTIVE CLOTHING | Wear gloves and protective clothing, which are impervious to the product for the duration of the anticipated exposure if there is potential for prolonged or repeated skin contact. |
| EYE PROTECTION | Wear safety glasses meeting the specifications of ANSI Standard Z87.1 where no contact with the eye is anticipated. Chemical safety goggles meeting the specifications of ANSI Standard Z87.1 should be worn whenever there is the possibility of splashing or other contact with the eyes. |
| SECTION X – ENVIRONMENTAL PROTECTION | |
| ENVIRONMENTAL PRECAUTIONS | Avoid uncontrolled releases of this material. Where spills are possible, a comprehensive spill response plan should be developed and implemented. |
| SPILL OR LEAK PROCEDURES | Wear appropriate respiratory protection and protective clothing as described in Section IX. Contain spilled material. Transfer to secure containers. Where necessary, collect using absorbent media. In the event of an uncontrolled release of this material, the user should determine if the release is reportable under applicable laws and regulations. |
| WASTE DISPOSAL | All recovered material should be packaged, labeled, transported, and disposed off, or reclaimed in conformance with applicable laws and regulations and in conformance with good engineering practices. |

SECTION XI HANDLING AND STORAGE

Precautions

Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, alkalis, and moisture.

Storage

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Do not store above 23⁰C (73.4⁰F)

1.5. SAFETY MEASURES RECOMMENDATION

1.5.1. Storage and material handling area

- Proper ventilation shall be provided
- Area will be marked as “No smoking Zone”
- Use of proper PPEs
- Pressure relief valves shall be provided
- Provision of Safety valves and rupture disk
- Provision of fire hydrant system along with other portable fire extinguishers
- Adequate distance between the storage Tanks
- Provision of dyke wall to the Tanks
- Proper earthing to the Tanks

1.5.2. Reactor Safety

- Provision will be made for temperature & pressure indicators
- Heating & cooling Jacket will be provided to maintain the temperature
- Pressure switch with hooter shall be provided
- Pressure safety valve will be provided
- Double earthing shall be provided

1.5.3. DG Sets

- Acoustic enclosures to be provided
- Entry near the unit shall be restricted
- Qualified and highly trained engineers shall be appointed

1.5.4. Boiler

- Work permit system will be evolved and will be followed during maintenance work
- Proper ventilation shall be maintained
- Entry shall be allowed only after proper checking of gases, if any
- Worker should be trained properly
- Working should be under supervision of qualified and trained personnel

1.5.5. Storage and Handling of Alcohol

- Keeping away from oxidizers, heat and flames.
- Avoidance of plastics, rubber and coatings in the storage area.
- Cool, dry, and ventilated storage and closed containers.
- Leakage should be washed out and diluted.
- Regular monitoring and maintenance to avoid leakages.
- If major leakage in tanks can be mitigated by transferring the material to other tank.
- Grounding of the container and transferring of equipment to eliminate static electric sparks. In case of any emergency following measures would be taken:
- First Aid Measures
- Use of extinguishing media surrounding the fire as water, dry chemicals (BC or ABC powder), sand, dolomite, etc.
- Foam system for fire fighting will be provided to control fire from the alcohol storage tank. The foam thus produced will suppress fire by separating the fuel from the air (oxygen), and hence avoiding the fire and explosion to occur in the tank. Foam would blanket the fuel surface smothering the fire. The fuel will also be cooled by the water content of the foam. The foam blanket suppresses the release of flammable vapors that mix with the air.
- Special Fire Fighting Procedures; Keeping the fire upwind. Shutting down of all possible sources of ignition, keeping of run-off water out of sewers and water sources. Avoidance of water in straight hose stream which will scatter and spread fire. Use of spray or fog nozzles will be promoted, cool containers will be exposed to flames with water from the side until well after the fire is out.

1.5.6. Molasses storage

- Store in good quality ventilated and leak-proof tanks (mild steel, stainless steel, polyethylene, PVC) at ambient temperatures, out of moisture.
- Continuous mixing of molasses should be done.
- 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.
- Avoid microbiological contamination or dilution with water.
- Regular monitoring and maintenance to avoid leakages.

1.5.7. Building & workspace

- Adequate space will be provided for equipment repair or removal
- Equipment maintenance shops will be set up with appropriate safety provisions for hazards associated with maintenance activities
- Lightning protection will be provided

1.5.8. Electric items

- Medium and high voltage cables will be completely enclosed
- Electrical equipment will be grounded adequately
- Wiring will be properly insulated, grounded, and non-exposed
- Emergency shutoff switch, clearly labelled, at all machinery units will be provided
- DG set will be provided as stand by source of power

- Maintenance tools with insulated handles will be provided

1.5.9. Fire

The fire protection system is to provide for early detection, alarm, containment and suppression of fires. The complete fire protection system will comprise of the following. Fire hydrant network will be provided for firefighting in the entire project area along with following firefighting equipment will be provided

- Different type of Fire Extinguishers, Detectors and fire Alarm shall be provided.
- Fire hydrant system
- Fire Tender with chemicals foam and required arrangement for firefighting to control the fire from the alcohol storage
- Foam system shall be contain aqueous film forming compound of 3 to 6% alcohol resistance foam concentrated with ISI mark 4889
- Water storage Tank exclusively for firefighting operation
- Rubber mat will be used near panel area
- Periodical training to the identified supervisors and Employees in the field of Firefighting and safety
- Emergency exits at specific locations and will be marked on the layout
- Cautionary note, safety posters, stickers will be displayed at appropriate locations
- First Aid boxes will be made available at appropriate locations
- Emergency Control Center Provision shall be made to establish an Emergency Control Centre (ECC) from which emergency operations are directed and coordinated. This center is activated as soon as on-site emergency is declared. ECC is equipped with adequate communication systems in the form of telephones (Emergency telephone numbers.) and other equipment's to allow unhampered organizations and other nearby facility personnel.

1.5.10. Occupational health hazard and safety measures

During operation handling of chemicals and other material used, a practice of preventive maintenance shall be adopted to take care of employee's health. The various safety equipment such as breathing apparatus, gum boots, goggles and helmets will be provided to the workers/operators. Besides, all the first aid, firefighting devices will also be inspected, tested and maintained periodically so that it is available in ready to use condition. Provision of pre- medical and periodical health check-up for all the employees shall be implemented and record maintained. If any abnormality is noticed due to occupational exposure, necessary Treatment will be assured from qualified physician. Following measures shall be implemented to avoid the occupational hazards to the employees:

- Regular housekeeping of the entire plant area
- Regular or preventive maintenance of floor, platforms, staircases and passages to avoid the slip incident
- Provision of obstruction free walkways and workplace
- Periodical training to the employees for the proper operation of the plant and various processes
- Restricted entry into the plant premises
- Checking and calibration of all Instruments and Fire Devices to keep them in proper operating conditions

- Installation of Electrical devices as per the prescribed standards
- Provision of D.G. Sets to avoid the complication during power failure
- Provision of required fire Extinguishers at different locations for easy access
- Provision of lighting Arrester
- Various types of PPEs like breathing apparatus, ear muffs, earplug, masks, leather hand gloves; asbestos hand gloves; acid/alkali proof rubber hand gloves; electrical resistance hand gloves and gum boots, goggles and helmets will be made available

Provision of First aid Boxes and periodical checking for required medicine and other material to take care of superficial bodily injuries during work



Figure 2 First Aid Box facility placed properly in the required location

1.6. DISASTER MANAGEMENT PLAN (DMP)

A disaster is an unforeseen combination of circumstances that cause serious body injuries, loss of life or extensive damage to the plant, Machinery or to the environment. Existing factory has prepared a details Disaster management plan, the following is the generalize disaster management plan recommended for the proposed project.

Following uncontrollable situation may lead to disaster or plant emergency

1.6.1. Manmade

- Plant failure
- Rupture or damage of the line, vessel or Tank
- Excessive leakage of flammable material

1.6.2. Natural

- Cyclone
- Earthquake
- Flood
- Fire
- Terrorist attack

A disaster management plan is a written document where all the details regarding the causes of the disaster are noted along with required control measures. It also gives details about the responsible personnel shall be available on site during an emergency and their role to control the disaster to a minimum level or from spreading the outside to protect the plant and machinery including employees and nearby areas. The DMP to tackle the emergency can be divided into the two parts for the ease of operation and to effectively control the emergencies within the shortest possible time.



Figure 3 Disaster management process

1.6.3. Onsite Emergency Plan

If an accident/incident takes place and its effects are confined only, then it is termed as an on-site emergency. It involves employees and other infrastructure within the organization. In this plan, the company officers and employees are given pre-decided responsibilities to handle the emergency. All other required resources to tackle this type of emergency are available. The individual employee or designated persons will be held responsible to take or initiate appropriate action when required. All the employees/responsible persons required to take or initiate the action at the time of emergency are trained appropriately so that they can perform their task without any difficulty. To make the handling of emergencies absolutely perfect, mock drills need to be conducted periodically for a particular scenario. During mock drills, a particular scenario is simulated to understand the gravity and requirements of action. During the mock drills, all the important points or happenings are noted and discussed to find out the lacunae or for the further improvement in the written plan.

1.6.4. Offsite Emergency Plan

If any accident or incident occurred in the premises, man will need help from outside sources because of the magnitude of emergency then it termed as Offsite Emergency. This offsite emergency cannot be controlled only by using the internal resources and need timely help from the outside companies or from the government authorities to tackle such type of emergencies to avoid the loss of property, human health

or environment in and around the premises. An offsite emergency management plan involves government bodies as well as nearby industries for necessary help and to control the emergency.

1.6.5. Objectives of disaster management

- To control the incident or accidents from the happening
- To eliminate the emergencies if possible
- Prepare for the emergency handling
- To see whether required activities are performed in the right order by the individuals or not
- To find out the required changes for co-ordinated activities
- To reduce the time of activities to control the emergencies
- To minimize the effects of the incident on person, property, and environment
- Continuous improvement

1.6.6. Onsite Emergency Preparedness Plan

Main elements of on-site Emergency Preparedness Plans are:

- Leadership and emergency management cell
- Defined role and responsibilities of the key personnel
- Emergency actions to be executed by the Members of the Committee
- Protective and rescue equipment
- Medical care Unit
- Training and periodic review
- Periodical Mock drills, its monitoring, and analysis to find out the shortcoming for the improvement
- List of available firefighting equipment, its maintenance, and records
- Training to the committee members and feedback on requirements if any
- Line of command
- Requirement of Siren and alarm system
- Written document
- List of available resources with the Company
- List of resources available from outside during the emergency
- Important phone numbers of authorities

1.6.6.1. Disaster Management Cell

Disaster Management Cell (DMC) consisting of authorized head that will be responsible for the handling of emergency situations. All the details of team members will be available at the site; their contact details will be displayed in the plant and will be informed to other employees. DMC will make the employees understand and aware of the hazards and associated risks that may give rise to an emergency situation at the plant. DMC will train and inform the employees regarding their role and responsibilities during emergency and dos and don'ts. Following team of personnel will be required to fulfill their responsibilities to tackle the emergency.

TEAM A

The distillery In-charge/Occupier along with the manager of each section will be responsible for the handling of any kind of emergency in the factory. They will inform the concern employees or authorities about the emergency situation and action that need to be initiated. They will take initiative in directing the action of the people.

TEAM B

After knowing the emergency situation, in-charge of individual section/department will communicate with In-charge (Disaster Main Controller) for any specific instruction and then he will guide other employees of the section to leave the workplace after taking safe shut down. They will be asked to assemble at Assembly point upwind of the Factory. After reaching the assembly points they should watch the activities undertaken by Team A and wait for further instruction if any form the Manager. The Manager / Supervisor will act as an Incident Controller at his Section or the Emergency location and need to wait for further instruction from Disaster Main Controller

TEAM C

The maintenance In-charge and other maintenance head from each department such as Mechanical Engineering, Electrical Engineering, Instrumentation and Civil Engineering along with Safety and Fire will form this Team who will actually fight the situation to control the emergency. All the required equipment and firefighting accessories will be available at their disposal. They will have all safety appliances in their custody/use and they will act to minimize the effect of incidence. They will keep informing the progress to DMC and for want of any help. After the emergency is under control, they will inform the DMC and DMC will inform all other Teams involved that emergency is under control. The DMC shall appraise the situation and if found Ok, he will inform control room to declare all clear sound/siren so that employees can resume the duties.

TEAM D

This Team is mainly concern with the security and outside news and will take the instruction from the DMC. It will consist of a security department and welfare officer who will be available at the office with all necessary records including names of Team Members and other required help from outside. They will have the list of people along with their addresses and telephone numbers. They will keep the records of important offices of the Government authorities such as Directorate of Industrial Safety and Health, Boiler Inspector of the factory, Commissioner of Police, local Police station, Fire Brigade, company Doctors, private Doctors and another important contact which will be helpful during and after the emergency.

All required facilities shall be made available at a particular location in the Factory for emergency use. All the personnel involved in an emergency shall proceed or will be brought to the factory. Based on the information gathered and provided by the incident controller of a particular section where there is emergency if required emergency shall be declared by the DMC by giving instruction to Team D to sound the particular Siren. After listening to the sound of Siren, concern person will understand the type and of emergency and will come prepared at the site of the incident.

During emergency and as per the information received by the DMC from IC, the Team members from the Rescue team shall look out for the casualties if any on the site and will provide necessary help. The

required medical and other help shall be provided based on the requirement and assessment of the gravity of the situation. The team will also carry out the headcount if required and as per the instruction of DMC or the Occupier. Further, the detail shall be provided to outside agencies by the nominated authorized person from the Factory to avoid the mismatch of the situation so that right message goes to the media. During an emergency, care shall be taken to avoid the panic situation within and outside the factory premises or in the general public.

1.6.6.2. Key Personnel

The actions necessary in an emergency will clearly depend upon the prevailing circumstances. Nevertheless, it is imperative that the required actions are initiated and directed by nominated people, each having specified responsibilities as part of the coordinated plan. Such nominated personnel is known as Key Personnel.

The Key Personnel is:

- Site Controller (SC)
- Incidental Controller (IC)
- Liaison and Communication Officer (LCO)
- Fire and Security Officer (FSO)
- Team Leaders (TL)

1.6.6.3. The requirement of Equipment and Materials

- Based on an actual assessment of emergency, there can be a requirement of Extra First Aid personnel to deal with casualties and need to be provided from outside
- All types of PPEs
- Emergency engineering works, provision of extra or replacement of light, isolation of equipment, temporary bypass electrical lines etc.
- Assembly point, emergency control center, signboards
- Moving Tankers or other vehicles from the area of risk
- Fire protection and firefighting facilities
- Emergency lighting and standby power
- Emergency equipment and rescue equipment
- Material safety data sheets for hazardous chemicals
- Plan showing hazardous material storage area
- List of emergency equipment
- List of safety equipment
- List of important telephone numbers and addresses
- Nearest hospitals and ambulance service center
- Nearest fire station
- Govt. Officials
- Transport provider
- Names and address & contact telephone number of key personnel

The onsite emergency plan will be documented and circulated to all concerned for knowledge, study, to understand and easy follow up. The emergency plan will be rehearsed and practiced at regular intervals i.e. Mock drills shall be conducted at the suitable interval to test the efficiency of the plan, personnel, equipment and coordinated efforts to increase the confidence level of personnel during emergencies.

1.6.6.4. Training

- Training on fire fighting
- Training on spill control
- Training on toxic release control
- Training on good housekeeping
- Training on use of PPEs

1.6.6.5. Communication

Following means of communication will be made available,

- Telephones
- Walkie-talkies
- Mobiles
- Public announcement system
- Emergency Siren

1.6.7. Offsite Emergency Plan

In case the hazard spreads outside the premises Team A under the instruction of DMC will communicate to the District Magistrate, Commissioner of the Police and inform the situation as Off-Site Emergency. Types of emergency facilities/actions required from outside bodies are,

- Firefighting facilities required: Factory will have its own firefighting facilities but during an emergency, fire brigade may be called from nearby areas or other establishments
- Police help shall be required during an emergency for control of people, traffic and security arrangements
- Medical help required: seriously injured personnel may be referred to the Hospital/Primary Health Centre depending upon injuries

1.6.8. Information to authorities

- Emergency situations will be informed to 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 and practice
- District Magistrate, Commissioner of the Police and District Control Room if exist

1.6.9. General Natural Disaster Management Measures

Seismic zone for the proposed project site comes under zone III (6 to 8 Richter scale)

- Factory Management shall train their staff to manage emergencies arises from fire, flood, lightning, and leakages.

- As soon as the emergency warning receives from the District Disaster Management Authority, the raw material, as well as finished products, shall be kept to a minimum to avoid spillage or misuse
- All the material and products shall be stored properly to avoid the damage or mixing with other
- All the employees will have the list of important phone numbers and contact details to help in getting the required help in time. These numbers shall be displayed at a distinct location within Factory premises
- Company's designated person from Team A will be the main contact person for all the employees for any type required help from outside
- District level disaster management units
- Health & Family Welfare
- Medical
- Nearest Fire station
- Nearest Doctors & Ambulance
- Forest & Environment Department
- Police Station
- Village head & Panchayat
- Company's Emergency Management Cell Members
- Transport
- Electricity
- PWD
- Substation details from where Company takes power
- Civil Supplies
- Animal Husbandry
- Agriculture

1.7. CONCLUSION

Project proponent will implement all preventive measures to tackle all type of emergencies arising out of operation or malfunction of individual unit's. The required resources for Onsite and Offsite emergency management plan will be properly planned and provided to implement the plan effectively. The factory shall give the highest priority towards Health and safety of the employees and people residing in nearby areas. Management shall conduct the training to the nearby villagers to appraise them about their role during an emergency. All nearby people shall be given training on do's and don'ts during an emergency situation.

Distillery Industry (Ethanol Plant) is associated with potential hazards to the employee and environment. As the hazards involved during operation and production activities will be known to the Management, all required mitigation measures shall be implemented in time to avoid the emergency situation from the arising. Unfortunately, if there is any emergency onsite or offsite, it will be tackled effectively due to the availability of required resources at the site. Similarly, all the concern staff and members of the Teams shall be trained appropriately to tackle the emergencies in the plant. By knowing the type of emergency situation that may arise during the operation of the plant, appropriate control measures will be implemented to reduce the gravity of the emergencies. Similarly, to avoid the emergency situation, all required mitigation measures will be implemented as recommended.