

HIRA STUDY REPORT

(Hazard Identification and Risk Assessment Report)

FOR

**PROPOSED GRAIN BASED DISTILLERY OF 100 MW CAPACITY
WITH 2.7 MW CO-GENERATION POWER PLANT**

**AT :
MOR,
MOKAMA
DIST. PATNA (BIHAR)**

OF

BRAJENDRA KUMAR BUILDERS PRIVATE LIMITED
ACHUARA
BARH
PATNA - 803302 (BIHAR)

Prepared by



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(Certificate No. NABET/EIA/2124/RA 0224 valid upto 01.05.2024)

Hazard Identification & Risk Assessment Report

1.1. INTRODUCTION

A report is being presented for hazard identification, risk assessment & management study w.r.t. an establishment of Proposed production of 100 KLPD Grain based distillery with 2.7 MW captive Power Generation plant of Brajendra Kumar Builders Pvt. Ltd. at Mor, Mokama, Dist. Patna, State Bihar, will be based on grain such as Maize, Broken rice and the Spoiled Grain as basic raw materials. Other inputs will be water, antifoam agents, Urea, H₂SO₄ and enzymes. Rice husk/Biomass/Bagasse/Coal will be used as fuel in Boiler.. Areas of concerns from hazard and risk point of view in the manufacturing plant are as follows -

1.2. OBJECTIVES AND SCOPE OF THE RH REPORT

1.2.1. Objectives of the Risk and Hazard Analysis

- a) Identify hazards and nature of hazard in the process, storage and handling of hazardous chemicals.
- b) Carry out Qualitative risk analysis for the process and suggest mitigation measures.
- c) Carry out Quantitative risk analysis of the storage of hazardous chemicals and estimate the threat zones for Most Credible and Worst case scenarios.
- d) Suggest mitigation measures to reduce the risk / probability of the accident to the minimum.
- e) Incorporate these measures for ensuring safe operations and safe layout to mitigate hazard and for effectively encounter any accident reduce the damages to the minimum.
- f) Help in preparation of on-site and off-site emergency plans.
- g) Suggest Guidelines for on-site and off - site emergency plans.

1.2.2. Methodology

1.2.2.1. Identify Hazards Based on

- ❖ Process description received based.
- ❖ Identify Hazardous Chemicals handled & stored.
- ❖ Inventory of Hazardous chemicals.
- ❖ Proposed storage facilities for hazardous chemicals.
- ❖ Plot layout plan.
- ❖ Safety measures to be adopted by the company.

1.2.2.2. Hazard Assessment

- ❖ By Qualitative Risk Assessment.
- ❖ By Quantitative Risk Assessment by Hazard index calculations and estimate threat zones by using ALOHA (Areal Locations of Hazardous Atmospheres)

1.2.2.3. Recommendations

- ❖ Recommend mitigation measures based upon the above.
- ❖ Recommending guidelines for the preparation of On-site Emergency plan.

1.2.3. Hazards during Construction Phase

Following would be the hazards during the construction phase of the project -

Table 1.1 Hazards & Mitigation Measures during Construction Phase

No.	Hazards	Mitigation Measures
1	Hazards of working at heights: There will be possibility of workers, slipping or falling down, while from the height due to loss of balance or because of similar reasons. This may result in serious or even fatal injury.	WORK PERMIT system to be implemented, all the safety precautions to be taken by the workers must be mentioned and the supervisor has to ensure that safety harnesses and other PPE are used by the workers.
2	Hazards while using crane or heavy lifting machinery	The crane can topple due mechanical failure of defects in the machinery, not properly hooking the heavy equipment to the crane properly operation, this will result in serious or even fatal injury to the operator and may be to some persons in the nearby vicinity. i. Crane operators must be licensed and trained to operate crane and other heavy duty mobile equipments. ii. All cranes and heavy duty lifting machinery must be maintained and certified for the operation by the competitive authority. iii. All heavy lifting and erection work must be carried out under the supervision of the safety and other officers and preferably during the day time.

3	General Recommendations	i. All necessary (Personal Protective Equipments) PPEs to be issued to all the company and contract workers and wearing those must be encouraged and insisted. ii. All lifting equipment will be shipped complete with load testing & inspection documentation. iii. All inspections will be performed by qualified, certified inspection professionals. iv. Ropes, Chains, Slings must be calibrated annually and regular audited by third party. v. Certifications and related documentation will be maintained.
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1.2.4. Hazards during Operation Phase

Onsite possible hazardous locations are as follows -

Table 1.2 Hazards & Mitigation Measures during Operation Phase

No.	Hazard	Mitigation Measures
1	Boiler Section (Handling of high pressure steam)	A proposed boiler of capacity 30 TPH will be proposed under distillery. Major hazard will be explosion. Mandatory measures have to be in place: Indian Boiler Regulations 1950 (IBR) es for design, piping, maintenance & operation of boiler by certified boiler attendants will be mandatory.
2	Fire and fatal accidents due to lightening	Properly designed and numbers of Lightening arrestors will be installed.
3	Electrocution and fire	Regular maintenance, internal safety audit and external third party safety audit will be done in regular intervals.

1.3. HAZARD IDENTIFICATION IN PROJECT AREA

Potential hazardous areas and the likely accidents with the concerned area have been enlisted below -

Table 1.3 Possible Hazardous Locations on Site with Mitigation Measures

No.	Hazardous Area	Hazard Identified	Mitigation Measures	Mitigation Measures in place / have to be in place for running plant	Comments / Additional Measures
1	Boiler Area	Explosion	IBR for design, maintenance and operation of boilers by certified boiler Attendants is	These measures will be in place during the operation of the boiler.	Will be implemented for the additional boiler capacity.

			mandatory.		
2	All over the plant	Lightening	To be design and install adequate number of best available lightening arrestors.	These measures will be in place for operation of the plant.	Will be implemented for distillery operations.
3	Electrocution	Lose fitting	Regular maintenance, internal safety audit and external third party safety audit in regular intervals.	These measures will be in place for operation of the existing setup.	Will be implemented for distillery operations.
4	Electrical rooms	Fire and electrocution			
5	Transformer area	Fire and electrocution			
6	Cable tunnel	Fire and electrocution			
7	Distillery (Ethanol production)	Fire and Ethanol vapour	HAZOP study is strongly recommended for the production as	--	Will be implemented for distillery operations.

No.	Hazardous Area	Hazard Identified	Mitigation Measures	Mitigation Measures in place / have to be in place for running plant	Comments / Additional Measures
	area)	release	well as Ethanol Storage area and adequate safety instrumentation with alarms and interlocks to be incorporated to make the design and plant operation intrinsically safe.		
8	Distillery (Ethanol storage tank)	Fire	Provision of Dyke wall around storage tanks, Firefighting line around tanks, cooling arrangement for tanks. Layout of tanks would be prepared as per PESO license. Detailed measures have been suggested in the report, in the later part and QRA results & based on failure frequency risk has been calculated. Fire hydrant will be laid around with foam fighting arrangements.	--	Will be implemented for distillery operations.

1.3.1. Mitigation Measures to Avoid Accidents

(A) Preventive Measures for Electricity Hazard

- ❖ All electrical equipment will be provided with proper earthing. Earthed electrode will be periodically tested and maintained.
- ❖ Emergency lighting will be available at all critical locations including the operator's room to carry out safe shut down of the plant.
- ❖ Easy accessibility of firefighting facilities such as fire water pumps and fire alarm station to be considered.

- ❖ All electrical equipments to be free from carbon dust, oil deposits and grease.
- ❖ Use of approved insulated tools, rubber mats, shockproof gloves and boots, tester, fuse tongs, discharge rod, safety belt, hand lamp, wooden or insulated ladder and not wearing metal ring and chain.
- ❖ Flame and shock detectors and central fire announcement system for fire safety will be provided.
- ❖ Temperature sensitive alarm and protective relays to make alert and disconnect equipment before overheating to be considered.
- ❖ Danger from excess current due to overload or short circuit will be prevented by providing fuses, circuit breakers, thermal protection.

(B) Preventive Measures for Fuel Storage

- ❖ Workers to be trained to be vigilant and keep water hose with ready water supply to extinguish small fires during hot season.
- ❖ Firefighting measures, alarm measures and fire hydrant line to be provided around the Rice husk/Biomass/Bagasse/Coal storage area to immediately and effectively deal with fire. This is already in place.

1.4. BOILER SECTION

Proposed boiler of 30 TPH capacities with Rice husk/Biomass/Bagasse/Coal as fuel is provided on site. Boiler ash is stored and given to bricks manufacturers or used as manure. Workers will be provided with proper clothing and PPEs. The same practice will be followed under proposed distillery.

❖ Mitigation Measures for safe storage

Following mitigation measures to eliminate the fire hazard are suggested as below -

1. It would be ensured while routing high tension voltage lines to avoid storage of Rice husk/Biomass/Bagasse/Coal storage below & near high voltage (H.T.) transmission lines.
2. Avoid routing of electric supply cables & cable trenches near to Rice husk/Biomass/Bagasse/Coal storage and if unavoidable locate these as far away from

stored bagasse or bagasse heaps.

3. Always keep other raw materials & useful material far away from storage of Rice husk/Biomass/Bagasse/Coal area.
4. Installation of Fire Hydrant (self-auto-mode firefighting) system around the area of Rice husk/Biomass/Bagasse/Coal yard. Fire hydrant will be laid around the Rice husk/Biomass/Bagasse/Coal storage area. Fire hydrant system will be designed as per IS code and as per the applicable relevant code.
5. Creating awareness among workers about sudden Rice husk/Biomass/Bagasse/Coal fire and emergency action plan will definitely avoid risks of heavy fire. In this way we can save a valuable fuel & life of human being working near Rice husk/Biomass/Bagasse/Coal.
6. Posting of proper supervision staff with necessary communication facility.
7. Hot work, like welding, gas cutting should not be carried out near Rice husk/Biomass/Bagasse/Coal storage. Or only after issue of proper work permit and making necessary arrangements
8. Daily record of Rice husk/Biomass/Bagasse/Coal storage data must be maintained and proper review of storage conditions must be taken by higher authority.
9. Training to all the involved staff in firefighting in normal & emergency operating system.
10. Proper planning & installation of fire hydrant system around the Rice husk/Biomass/Bagasse/Coal storage yard and should not depend exclusively on fire tender for firefighting.
11. Goggle and mask should be provided for workers in Rice husk/Biomass/Bagasse/Coal yard to prevent ill effect on eyes and inhalation of fine Rice husk/Biomass/Bagasse/Coal dust on the workers in the area.
12. Regular medical check-up of workers would include lung capacity and other relevant tests.

1.4.1. Establishing a Fire Fighting Group

A small spark of fire may result into loss of lives, machines and the damage by fire; may result in high economic losses. This type of losses can be avoided by preventing and controlling the fire instantly for which fire-fighting group will be expanded under proposed establishment of distillery. The following will be done at the earliest with the help of expert firefighting company approved for design and

installation. The fire-fighting group would have house and keep in readiness, the following types of equipment and arrangements will be provided on site under proposed distillery -

- i. CO₂ Extinguishers
- ii. Foam Extinguishers
- iii. Dry powder Chemical Extinguishers
- iv. Fire Tender

The following types of equipment & arrangements are provided on site under existing setup -

Table 1.4 Proposed Fire Fighting Equipments details

No.	Description	Capacity	Quantity (Nos.)
1	Fire Extinguishers		
	DCP	5 Kg	35
	ABC	6 Kg	10
	ABC	1 Kg	05
	CO ₂	4.5 Kg	05
	CO ₂	6.5 Kg	25
	CO ₂	22.5 Kg	02
	M Foam	9 Ltrs.	08
	Total	--	90
2	Fire Hydrant		
	Points	--	50
	Box	--	50
	Hose	--	100
	Nozzle	--	50
	F Key	--	25
	Monitor	--	08
3	Fire Alarm & Smoke Detectors		
	Mill House	--	25
	Boiling House	--	42
	Co-generation	--	55
	Total	--	122
4	Fire Sprinkler System		
	Molasses Tank (1 & 2)	--	130
	Switch yard (Transformer)	--	
	Co-generation (Junction Tower)	--	
	Old & New Rice husk/Biomass/Bagasse/Coal yard (Boundary wall)	--	

No.	Description	Capacity	Quantity (Nos.)
5	Fire Buckets	--	36
6	Sluice Valve		
	Above Ground	--	12
	Under Ground	--	08
	Total	--	20

1.5. DISTILLERY PLANT

Under proposed Distillery of 100 KLPD; product Ethanol will be solely manufactured. This Ethanol will be used for blending with petrol as per EBP, which shall save foreign exchange thereby making India Self Sufficient i.e. Aatmanirbhar Bharat. Total land acquired by the industry is 4.7 Ha. Following factors to be considered while selecting appropriate technology from safety aspect for the proposed distillery unit.

1. Though the initial investment is on higher side, as per Detailed Project Report of the company, the company will adopt modern continuous fermentation technology over batch fermentation technology because of advantages of ease of operation, higher efficiency and consistent results and safe.
2. The company will adopt multi-pressure distillation system for the production of rectified spirit and Molecular sieve technology for the production of anhydrous alcohol.

1.5.1. Hazard Identification: Production of Alcohol (Distillery)

There will be two areas of concerns -

1. **Alcohol Storage:** Leakage leading to fire
2. **Molasses storage:** Heavy leakage of Molasses, total breakage of tank, leading to loss of life and pollution

Major hazard identified in the production unit is release of alcohol vapours and fire. It is recommended to eliminate the risk and hazard at the design stage of the establishment itself by carrying out detailed systematic HAZOP study of the entire process and make the process and operation intrinsically safe. This tool is recommended for ensuring built in plant safety and understanding the plant operations in the best manner with active participation of technical officials from the company for better understanding of the process and philosophy and basics behind design of equipments, instrumentation logic, safety systems and plant operation.

1.5.1.1. Alcohol Storage**Table 1.5 Onsite Proposed Alcohol Storage Arrangements**

Details of Storage
Quantity: 3 Nos., Capacity: @ 1152 m ³ Dimensions: Ht. 14 m x Dia. 10.5 m

❖ Mitigation Measures

1. For the Alcohol storage, tank layout, tank-farm layout, pump locations etc. will be as per the requirements of latest PESO rules and regulations.
2. Statutory approvals for the storage of Alcohol will be obtained, before the plant start up.
3. All tanks will be provided with flame arrestors, moisture traps and overhead condensers with chilled water for prevention of Alcohol loss and environment protection.
4. NFPA rating for Ethanol is NH (Health Factor) = 2, NF (Fire Factor) = 3, NR (Reactivity) = 0, indicating fire as the major hazard in handling and storage of Alcohol.

1.5.1.1.1 Qualitative & Quantitative Risk Analysis by ALOHA (Areal Location of Hazardous Atmosphere) Software**SITE DATA:****SITE DATA:**

Location: PATNA, BIHAR, INDIA, INDIA

Building Air Exchanges Per Hour: 0.32 (unsheltered double storied)

Time: December 27, 2023 2329 hours ST (using computer's clock)



SITE THREAT ZONE

CHEMICAL DATA:

Chemical Name: ETHANOL

CAS Number: 64-17-5 Molecular Weight: 46.07 g/mol

ERPG-1: 1800 ppm ERPG-2: 3300 ppm ERPG-3: N/A

IDLH: 3300 ppm LEL: 33000 ppm UEL: 190000 ppm

Ambient Boiling Point: 172.9° F

Vapor Pressure at Ambient Temperature: 0.13 atm

Ambient Saturation Concentration: 129,454 ppm or 12.9%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 5 miles/hour from E at 10 meters

Ground Roughness: open country Cloud Cover: 5 tenths

Air Temperature: 34° C Stability Class: F

No Inversion Height Relative Humidity: 50%

A. SOURCE STRENGTH:

LEAK FROM HOLE IN VERTICAL CYLINDRICAL TANK

Flammable chemical is burning as it escapes from tank

Tank Diameter: 10.5 meters Tank Length: 14 meters

Tank Volume: 1,212 cubic meters

Tank contains liquid Internal Temperature: 34° C

Chemical Mass in Tank: 988 tons Tank is 95% full

Circular Opening Diameter: 6.5 centimeters

Opening is 8.5 centimeters from tank bottom

Max Flame Length: 17 yards

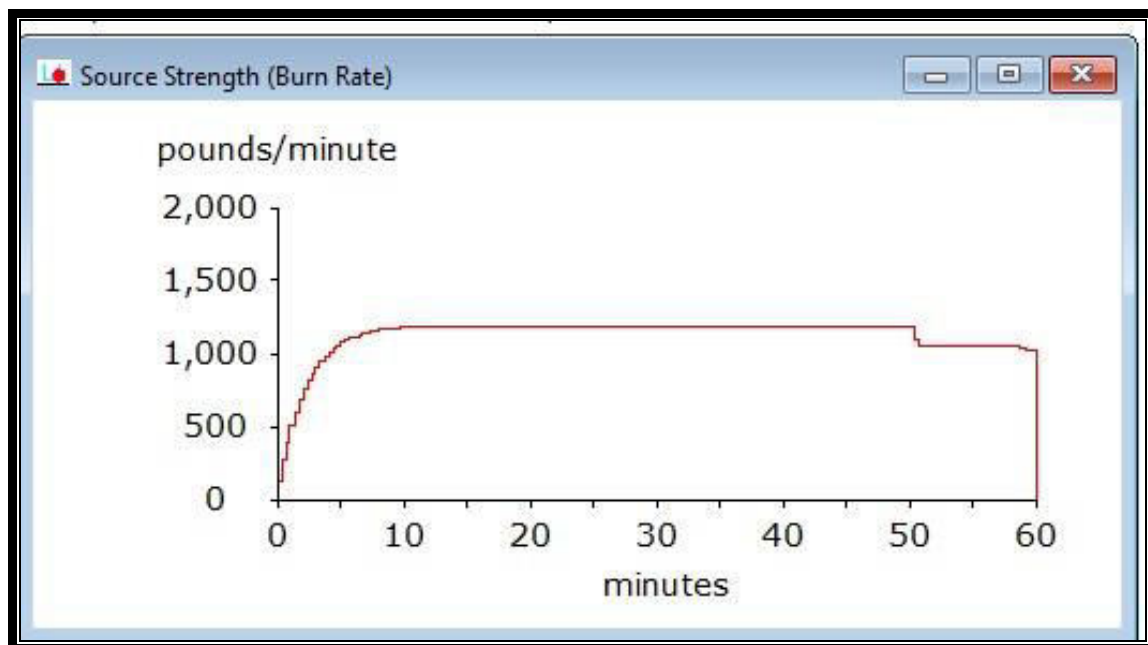
Burn Duration: ALOHA limited the duration to 1 hour

Max Burn Rate: 1,180 pounds/min

Total Amount Burned: 67,036 pounds

Note: The chemical escaped as a liquid and formed a burning puddle.

The puddle spread to a diameter of 22 yards.



SOURCE STRENGTH

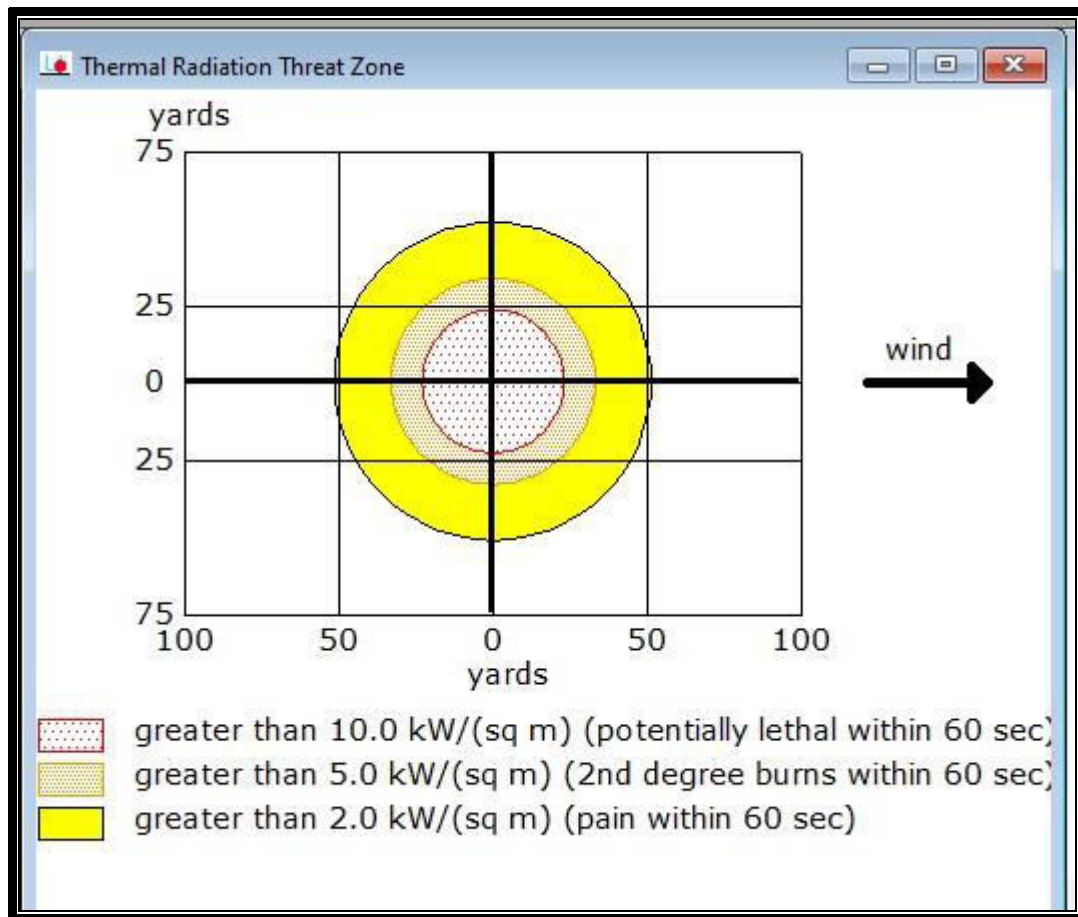
THREAT ZONE:

Threat Modeled: Thermal radiation from pool fire

Red : 23 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

Orange: 33 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Yellow: 51 yards --- (2.0 kW/(sq m) = pain within 60 sec)



THERMAL RADIATION THREAT ZONE

THREAT AT POINT:

Thermal Radiation Estimates at the point:

Downwind: 50 meters Off Centerline: 75 meters

Max Thermal Radiation: 0.488 kW/(sqm)



RED THREAT ZONE



ORANGE THREAT ZONE



YELLOW THREAT ZONE

B, SOURCE STRENGTH:

BLEVE OF FLAMMABLE LIQUID IN VERTICAL CYLINDRICAL TANK

Tank Diameter: 10.5 meters Tank Length: 14 meters
 Tank Volume: 1,212 cubic meters
 Tank contains liquid
 Internal Storage Temperature: 34° C
 Chemical Mass in Tank: 988 tons Tank is 95% full
 Percentage of Tank Mass in Fireball: 100%
 Fireball Diameter: 612 yards Burn Duration: 28 seconds

THREAT ZONE:

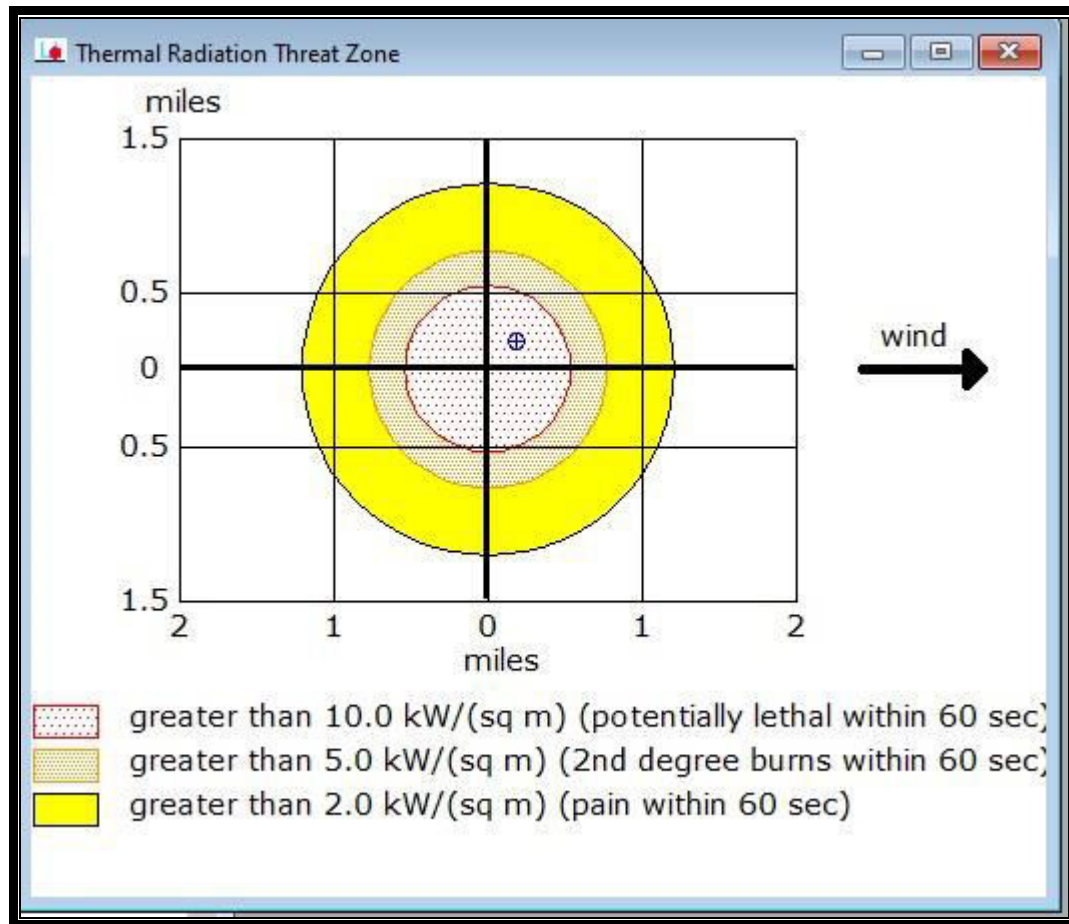
Threat Modeled: Thermal radiation from fireball
 Red : 946 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
 Orange: 1355 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
 Yellow: 1.2 miles --- (2.0 kW/(sq m) = pain within 60 sec)

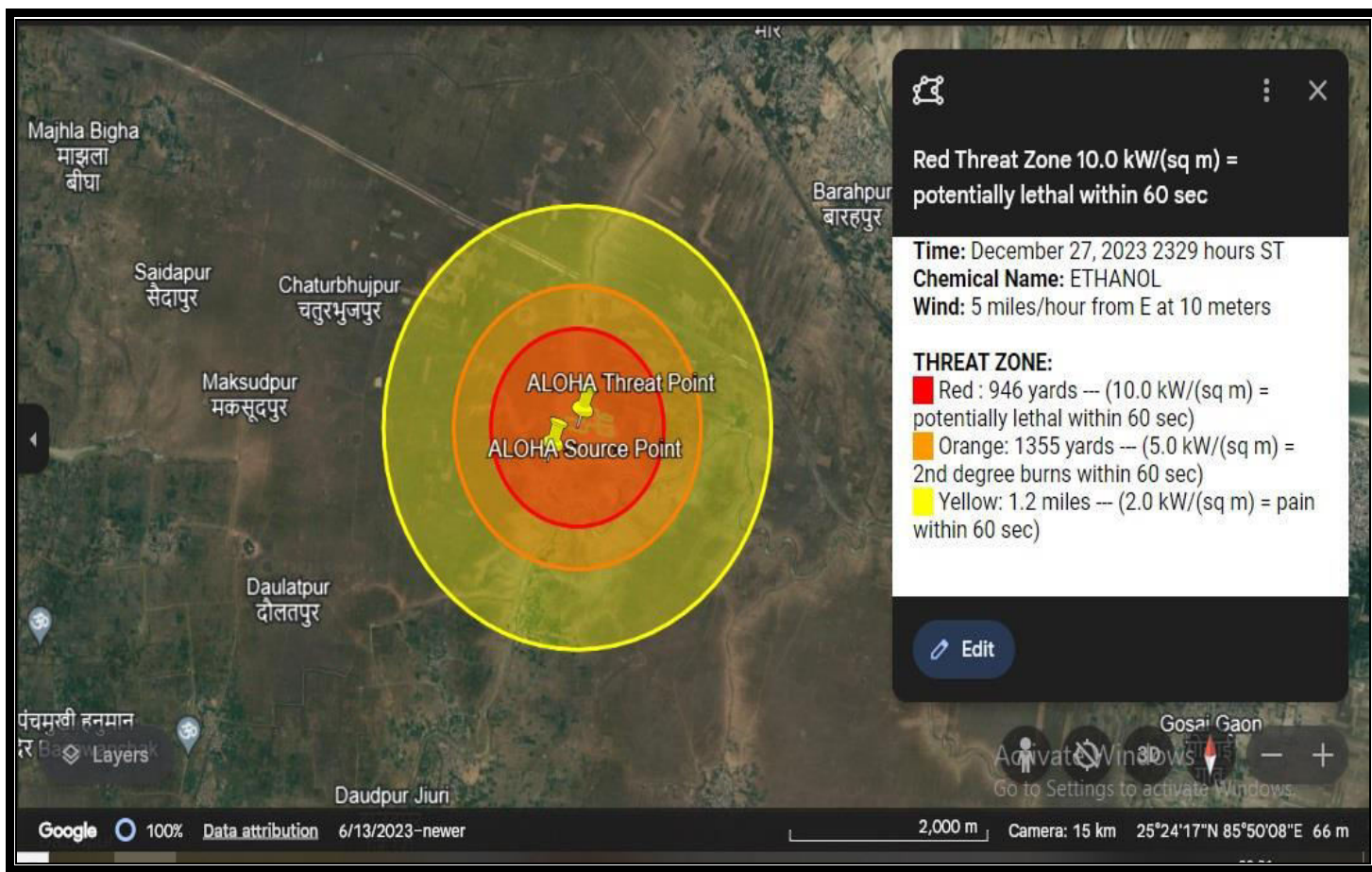
THREAT AT POINT:

Thermal Radiation Estimates at the point:

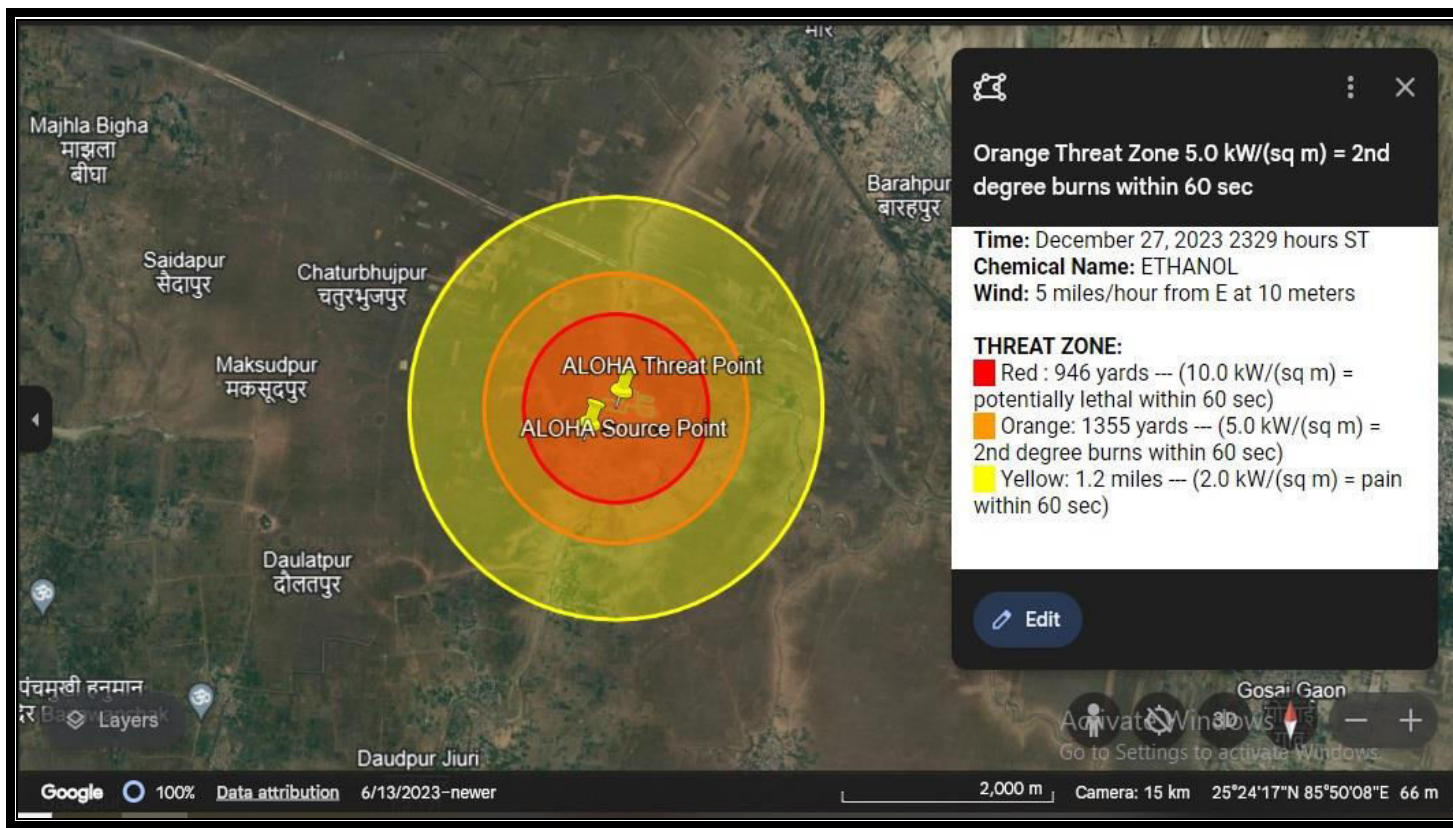
Downwind: 300 meters Off Centerline: 300 meters

Max Thermal Radiation: 31.1 kW/(sq m)

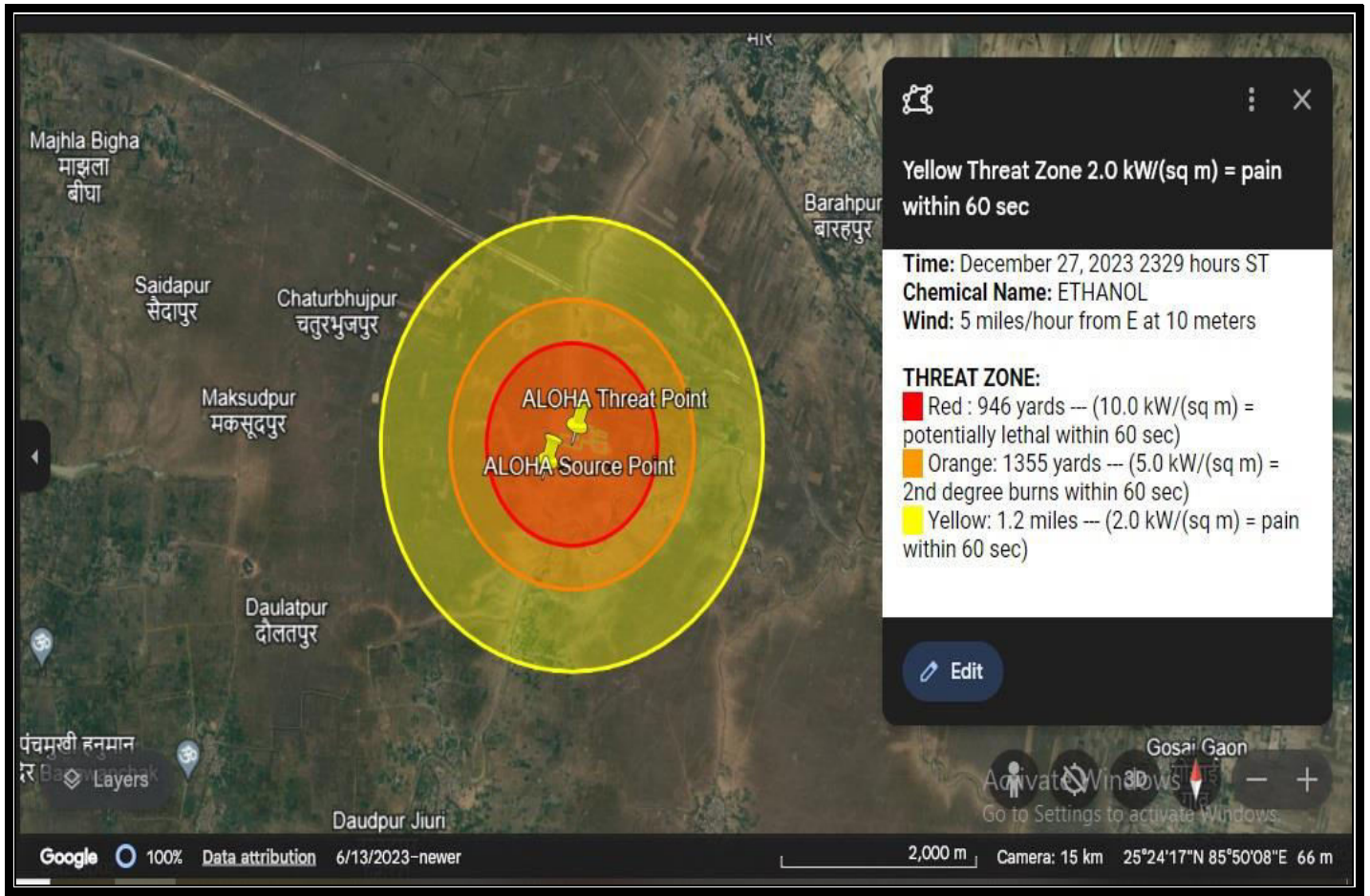
**BLEVE THERMAL RADIATION THREAT ZONE**



BLEVE RED THREAT ZONE



BLEVE ORANGE THREAT ZONE



BLEVE YELLOW THREAT ZONE

❖ Mitigation Measures

From, the above data of ALOHA QRA exercise, certain mitigation measure are framed as follows -

1. Based on standard recommendations for moderate hazard, it is recommended to have alcohol storage tanks in open in dyke walls and must have spill collection and control (recycle) arrangement to pump the contents into another tank.
2. Clear distance between the alcohol tanks to be provided as per the requirements of Petroleum Rule, 2002, Table 1; SCHEDULE II.
3. Location of pumps, piping arrangements and location of tank farm in the industry should be as per the requirements of Petroleum Rule, 2002.
4. Above-ground tank construction should be as per BIS: 803.
5. Tank height should not be more than 1.5 times its diameter.
6. Necessary approval / LICENCE from Chief Controller of Explosives will be obtained for the proposed alcohol storage arrangements. Appropriate & adequate firefighting system, inside the plant and around the storage tanks will be designed as per IS or international code and Fire NOC will be obtained from State Govt. Authorities.
7. Design of fire-fighting arrangements around alcohol storage will be as per OIS 117 standard or equivalent standard with sprinkler system for tank cooling and foam based firefighting arrangement.
8. For transportation of alcohol, Class A flammable solvent rules as given in Petroleum Act will be followed.
9. Periodic mock drills and other exercises will be conducted in the industry under trained and experienced supervision.

❖ Conditions to be followed by Industry (Petroleum Rules, 2002)

1. The licensed premises shall not without permission in writing from the Chief Controller, be used for any purpose other than the storage and distribution of petroleum and purposes directly connected therewith.
2. The Petroleum shall be kept only in the storage tanks and storage filling sheds or other approved places within the installation specified for the purpose on the plan attached hereto.
3. The tank or tanks shall be supported on well-designed foundations and shall be either buried underground or installed in the open and surrounded by wall or embankment not more than 2 metres high and made of earth, steel, concrete or solid masonry capable of withstanding fully hydrostatic load.

Earth wall of over 1M high shall have not less than 0.6 M wide flat section on top provided that a wall or embankment higher than 2 M maybe allowed by the licensing authority where there are special circumstances which, in his opinion warrant such increase.

4. The ground within the enclosure shall not be lower than the level of the ground outside the enclosure and shall be finished to form a slope of not less than half a percent from the tank towards the drain or sump. Provided that nothing in this clause shall apply in the case of an enclosure which is connected to and efficient oil interceptor of sample capacity through an underground drainage system having proper slope.
5. The drainage from the enclosure shall be controlled by a valve which shall be accessible under fire conditions and be capable of being operated from outside the enclosure. All surface water drainage from the enclosure shall be passed through an efficient oil interceptor.
6. Where two or more tanks are installed in one enclosure, the total capacity of the tanks in the enclosure shall not exceed 60,000 Kilolitres in the case of conventional fixed -roof and 1,20,000 Kilolitres in the case of floating roof tank or those of special design (where there is a combinations of fixed and floating roof tanks in the same enclosure then the total capacity of fixed-roof tanks and floating roof tanks shall not exceed 60,000 kilolitres). Such an enclosure shall be sub-divided by masonry channels of ample dimensions or by intermediate wall of not less than 0.6 M in height to prevent spills from one tank endangering any other tank in the same enclosure. For the purpose of this clause, a group of small tanks each not exceeding 9 M in diameter and in all not exceeding 5,000 Kilolitres in capacity shall be treated as one tank.
7. Where petroleum Class A or petroleum Class B is stored in the enclosure or petroleum Class C is stored along with petroleum Class A or Class B, the capacity of the enclosure shall be hundred percent of capacity of the largest tank in the enclosure after deducting the volume up to the height of the enclosure wall, of all other tanks in the same enclosure. Where petroleum Class C is only stored in the enclosure the height of the enclosure wall shall be not less than one metre.
8. Except for necessary pipes and valves and approved electric lights, the space within and enclosure and not occupied by tank or tanks shall be kept entirely clear and unoccupied.
9. All tanks shall be fitted with vent pipes leading into the open air, the open end being covered with two layers of fine copper or other non-corrodible metal wire gauze of not less than 11 meshes per linear centimeter and fitted with a hood or the tank shall be fitted with an approved relief valve or other approved means of preventing dangerous internal or external pressures. The vent pipe and the relief valve of one tank shall not be interconnected with those of any other tank.

10. Cast-iron valves are not permitted on any tank and all valves in an installation must be permanently marked in a manner clearly indicating the direction of opening and shutting the valve.
 11. Pumps shall be of a type and placed only in the position shown on the plan attached thereto and they shall together with all connections and fittings be so constructed and maintained as to prevent leakage of petroleum.
 12. Storage or filling sheds for containers shall be constructed of suitable unflammable material. The shed shall rest foundation walls and shall be surrounded by a wall or embankment of substantial construction so as to form a sump or enclosure not less than 0.25 M and not more than 1M deep. The sump or enclosure thus formed shall be of sufficient capacity to contain without leakage not less than one-fourth of the maximum quantity of petroleum likely to be present in the shed at any one time. The sumps and enclosures must be kept clean and free from any accumulation of inflammable liquids.
 13. Every enclosed shed for the storage or filling of petroleum Class A and Class B otherwise than in bulk shall be adequately ventilated near the ground level immediately above the walls constructed to prevent leakage of petroleum and also near or in the roof.
 14. Tank vehicles shall be filled, discharged or stabled only in the positions approved for the purpose and shown on the plan attached hereto. An extract of rules 62 to 86 printed in bold letters in the local language and in Hindi and English shall be prominently displayed at each such position.
 15. A tank vehicle which does not fully comply with the requirement laid down in Part IV of chapter III of these rules shall not be loaded, unloaded or stabled within the licensed premises.
 16. Every facility for the storage, loading, unloading or pumping of petroleum shall at all times maintain from any other facility, building, boundary fencing or protected works the distances specified in the Tables 1, 2 and 3 of the Petroleum Rule 2002.
 - a. Table 1 and Table 2 in the case of installation where the total quantity of petroleum Class A and petroleum Class B stored above ground in bulk exceeds 5,000 Kilolitres or where the diameter of any tank for the storage of such petroleum exceeds 9 M.
 - b. Table 3 in the case of installation where only petroleum Class C is stored or where the total quantity of petroleum Class A and petroleum Class B stored above ground in the bulk does not exceed 5,000 Kilolitres and the diameter of any tank for storing petroleum Class A or petroleum Class B does not exceed 9 M.
- ❖ When ethanol / petroleum is stored in an installation at or near wells, pumping stations, petro-chemical plants or distilleries, no storage tank, the capacity of which exceeds 250 Kilolitres and no petroleum storage of filling sheds/area shall be placed nearer than 90 M to any boiler, furnace of fire. In such an

installation all tanks shall be situated in a compact area (a) under a single control, (b) enclosed or capable of being enclosed by one continuous fence and (c) on which there shall be no protected works.

❖ **Accidental Release, Safety Measures for Storage & Handling of Ethanol**

Keeping away from heat, sparks and open flame, care will be taken for avoidance of spillage, skin and eye contact, well ventilation, use of approved respirator if concentration of ethanol in air is above acceptable level will be promoted. For Storage and handling following precautions will be taken -

- ❖ Keeping away from oxidizers, heat and flames.
- ❖ Cool, dry & ventilated storage and closed containers.
- ❖ Grounding of the container & transferring of equipment to eliminate static electric sparks.
- ❖ Establishing a Fire Fighting Group

❖ **Hazard Identification: Molasses Storage**

Table of Ethanol Tank Details

Details of Storage
Quantity: 3 Nos., Capacity: @ 1152 m ³ Dimensions: Ht. 14 m x Dia. 10.5 m

Cooling system for tank will be provided for safety purpose. There will be gutter provision made around the tank for collection of molasses in accidental leakage.

❖ **Mitigation Measures**

It is necessary to take following mitigation measures to prevent bursting of tanks and heavy leakage and loss of life.

1. Molasses should be stored in good quality and leak proof mild steel tanks.
2. Adequate safety factor should be incorporated into the design of wall thickness considering deterioration that will occur due to corrosion over a period of time.
3. Regular internal and external inspection should be scheduled for checking wall thickness of the tanks. Dyke / Bund walls should be constructed around the tank or tanks.
4. It must be ensured while finalizing the dyke dimensions and thickness that clear volume inside the dyke walls is equal or more than 1.2 x Volume of tank storage capacity.

5. Continuous mixing of molasses through external pump circulation should be done.
6. If there is increase in temperature beyond 30⁰C, external cooling of tanks shall be provided by heat exchanger in the circulation line.
7. Frequent temperature monitoring, manually or by recorder should be done.
8. If there is leakage -
 - a. Leakage should be washed out and diluted and should be recycled as far as possible or must be properly treated in ETP.
 - b. Replacing of leaky gaskets, joints, should be done strictly by following work permit system.
 - c. Leakage of pipelines, welding repairs should be attended / carried out outside the plant. The necessary hot work permit should be issued after taking necessary precautions and firefighting measures for onsite hot work, by the concerned authority before any hot work is undertaken.
 - d. Leakage through pump gland shall be reduced to the minimum by installing mechanical seals.
 - e. To attend all major leakage in tanks the following procedure should be followed -
 - (i) Transfer the material to other tank.
 - (ii) Prepare the tank for welding repairs by making sure that it is positively isolated with blinds from other vessels and ensuring that it is free of the chemicals and gases by purging air and carrying out air analysis before any hot work is undertaken and this should be done by skilled workers. For this purpose, safety permit should be given.

❖ **Hazard Identification: Grain Storage**

Table Raw Material - Onsite Proposed Grain Storage Details

No.	Mode of Storage	Details of Storage
1	Grain (MT/day)	Broken Rice : 230 TPD Maize : 260 TPD

It is necessary to take following mitigation measures to prevent bursting of tanks and heavy leakage and loss of life.

❖ **Mitigation Measures**

1. Grains should be stored in good quality and leak proof metal sheet silos.
2. Adequate safety factor should be incorporated into the design of wall thickness considering deterioration that will occur due to corrosion, bulging, rupture etc. over a period of time.

3. Regular internal and external inspection should be scheduled for checking wall thickness of the tanks.
4. Dyke / Bund walls should be constructed around the tank or tanks.
5. It must be ensured while finalizing the dyke dimensions and that thickness that clear volume inside the dyke walls is equal or more than 1.2 x volume of tank storage capacity.
6. Continuous grain loading / unloading through bucket elevators / external devices should be done.
7. Frequent Temperature monitoring, manually or by recorder is strongly advised.
8. If there is leakage -
 - a. Leakage / spills should be dry washed & should be recycled as far as possible or must be properly treated and reused.
 - b. Replacing of leaky gaskets, joints, should be done strictly by following work permit system.
 - c. Leakage of pipelines, welding repairs should be attended / carried out outside the plant. The necessary hot work permit should be issued after taking necessary precautions and firefighting measures for onsite hot work, by the concerned authority before any hot work is undertaken.
 - d. Leakage through pump gland shall be reduced to the minimum by installing mechanical seals.
 - e. To attend all major leakage in tanks the following procedure should be followed -
 - (i) Transfer the material to other tank / silos.
 - (ii) Prepare the tank for welding repairs by making sure that it is positively isolated with blinds from other vessels and ensuring that it is free of the chemicals and gases by purging air and carrying out air analysis before any hot work is undertaken and this should be done by skilled workers. For this purpose safety permit should be given.

1.6. PRODUCTION PLANT

Proposed production of 100 KLPD distillery with 2.7 MW captive Power Generation plant will be based on grain such as Maize, Broken rice and the Spoiled Grain as basic raw materials. Other inputs will be water, antifoam agents, Urea, H_2SO_4 and enzymes. Rice husk/Biomass/Bagasse/Coal will be used as fuel in Boiler. Raw Material and Other input requirements are detailed as under;

❖ Mitigation Measures

Following mitigation measures are suggested for avoiding dust inhalation -

1. Major transport of dry bagasse would be carried out by belt conveyors transfer from the production area to the storage area and from the storage area to boiler feed. All the workers handling dry bagasse would use nose masks to avoid inhalation of dust.

2. Regular medical check-up of workers would include lung capacity and other relevant tests.
3. Provision of cover shed for stocked bagasse.

❖ Fire hazard

In dried form bagasse it is used as fuel for boiler. Small spark or ignition will cause fire and will spread rapidly leading to injury and loss of life and damage to the environment & property. The mitigation measure same as discussed in boiler section.

1.6.1. Water Requirement

Total Water requirement of proposed distillery project will be 1633 KLD. Fresh water requirement will be 665 KLD, out of which 650 KLD water will be used for (6.5 KL/KL of Product) for Industrial and allied purposes and balance 15 KLD will be used for domestic purposes. Water requirement for first run would be 1633 KLD, of which 983 KLD (~ 60 %) will be Recycled. Water requirement of 665 KLD will be fulfilled through proposed borewells inside premises. The permission for withdrawal of water will be taken from the CGWA/CGWB.

CO-GENERATION PLANT

The steam produced will be used for power generation through turbine and the extracted steam will be used for internal consumption for plant and Distillery operation. The boiler and Co-generation unit incorporates all the necessary instrumentation, alarms and interlocks and operated through DSC system to ensure the safe operation.

Hazard identification: Heavy high pressure steam leakage, resulting in noise pollution and in the worst case explosion involving boiler.

❖ Mitigation Measures

1. Boiler would be as per IBR design standards, maintained & approved by IBR authority's rules and regulations. This is mandatory to avoid leakage of steam & boiler explosion.
2. Boiler cleaning and maintenance has to carry yearly and has to be approved and cleared by Boiler inspector / authorities.
3. All high pressure steam piping drawing and piping fittings used has to be IBR standards and approved by IBR authorities.

4. Steam piping fabrication and welding has to be carried out by approved welders with X- ray tests etc.
5. As mentioned above all the precautions and mitigation measures as per the statutory rule would be strictly observed.
6. Important interlocks such as boiler water control, fans tripping on backfire, steam pressure, noise will be provided for boiler.
7. Turbine and power generation plan will be of PLC operated sequential start up and shutdown procedure built in. The plant will be equipped with standard instrumentation, alarms, and interlocks, trips, such high speed trip, bearing vibration, bearing oil circulation, oil temperature, and turbine alignment.

1.7. HAZARD IDENTIFICATION: PHYSICAL HAZARDS

Table 1.14 Physical Hazards with Mitigation measures

Physical Hazards	Cause s	Mitigation measures
Slips	Handling with machines	• Proper training • Usage of PPE • Machine guarding
Falls	Working in heights	• Proper roping • Usage of PPE • Relevant training to the workers
Skidding	Oils spills, Water leaks on floors	• Maintaining good housekeeping practices • Wearing helmet • Arrange proper sign boards
Noise	Machineries	• Isolation of machineries • Regular maintenance of machineries • Usage of ear plugs • Work rests
Confined	Tanks, Water	• Warning signs

Physical Hazards	Causes	Mitigation measures
spaces	cisterns, Bins, Crawl spaces	• Proper ventilation • Self-contained breathing apparatus or appropriate PPE
Heat stress	Boilers, Hot work activities (Fabrication & Welding etc.)	• Encourage breaks or appropriate work rest cycle • Proper training

1.8. ON-SITE EMERGENCY PLAN

Plant will has an on-site emergency plan for the existing facilities. Plant will prepare on-site emergency plan for the proposed integrated complex facilities. This has to be implemented completely taking into consideration the safety audit report and conducting regular mock drills. Industry will modify the same for the proposed distillery, after carrying out Quantitative Risk Analysis and taking in to consideration Quantitative Risk Analysis results.

❖ Safety Measures during regular and shut-down

It must be remembered that shutdown plant will also and sometimes more prone to accidents. Hence it will be suggested that all workers, regular and contract workers should be issued proper PPE, like helmet, safety shoes etc. as necessary. All work, hot work, working at height etc. during working and shutdown period should be carried out with proper work permit and under proper supervision.

DISASTER MANAGEMENT PLAN (DMP)

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.

DMP is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of DMP, it should be widely circulated and a personnel training is to be provided through rehearsals/drills.

To tackle the consequences of a major emergency inside the plant or immediate vicinity of the plant, a Disaster Management Plan has to be formulated and this planned emergency document is called “Disaster Management Plan”. The objective of DMP is to make use of the combined resources of the plant and the outside services to achieve the following -

- ❖ Effective rescue and medical treatment of casualties
- ❖ Safeguard other people
- ❖ Minimize damage to property and the environment
- ❖ Initially contain and ultimately bring the incident under control
- ❖ Identify any dead
- ❖ 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

In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy. DMP should include Emergency Preparedness Plan, Emergency Response Team, Emergency Communication, Emergency Responsibilities, Emergency Facilities, and Emergency Actions.

1.9. OCCUPATIONAL HEALTH ASPECTS & MEDICAL PROVISION

PLANT will have OHC center for the proposed plant. The facilities of the present OHC and the periodic tests to be carried out will be modified for proposed activity workers and officers in view of the above details and in consultation with the registered medical practitioner. It will be ensured that the existing OHC and other medical facilities at the site as per the factories act and number of employees. Details to be provided in OHC are given in the factory act depending upon the number of workers / staff working in the factory.

- I. Under Rule 73 - V - All workers employed must be medically examined by qualified medical practitioner before employment and once in a period of six months and records be maintained.
- II. Under Rule 73 - W - All factories carrying out hazardous processes must have OHC with services and facilities
 - A) **For factories employing up to 100 workers:** (i) Medical officer on retainer ship basis,
 - ii) Minimum 5 workers trained in first aid, at least one shall be available during all working hours, iii) Fully equipped first aid box (What it should contain is also specified later)
 - B) **For factories employee 150 to 250 workers:** (i) OHC with min. floor space of 15 sq. meters ii) part time medical officer iii) one qualified and trained dresser-cum-compounder throughout all working hours. iv) Equipped first aid box
 - C) **For factories employing more than 300 workers:** (i) Full time medical officer up to 500 workers,

and one more full time medical officer for every additional 1000 workers or part thereof, (ii) OHC with 2 rooms, (iii) one compounder and one ward boy 24 by 7,

(iv) OHC to be equipped all emergencies OHC is equipped

with -

- i. Requirement of Ambulance van for any factory carrying on hazardous process shall be provided and maintained as defined under 73-X.
- ii. For factories with less than 250 workers, management must have an arrangement for getting ambulance van at short notice it also details out what facilities ambulance van should be equipped with.
- iii. MSDS for all hazardous chemicals at site.
- iv. Pre-employment medical checkup and six monthly medical check-up for all employees, including contract workers and record must be available.
- v. Since the operation involve storage and handling of toxic chemicals, affecting liver, kidneys, lungs, medical test must include the specific tests to check functioning of these vital organs.
- vi. The company carries out medical checkup for workers as per the requirement; the health checkup parameters can be modified in consultation with the qualified medical doctor.

1.10. EFFECTS OF ALCOHOL ON HEALTH

Following is the additional information and suggestions with regard alcohol exposure -

It reacts vigorously with oxidizing materials. TLV for 8 hr. is 1000 ppm (ACGIH). Minimum identifiable concentration has been reported as 350 ppm. Exposure to concentrations of 5000

- 10000 ppm results in irritation of eyes and mucous membranes of the upper respiratory tract. Effects of exposure to higher concentration of alcohol in the atmosphere are given in the following table -

Table 1.15 Effect of Ethanol

mg/l	Ppm	Effects in human
10-20	5,300 - 10,640	Some transient coughing & smarting of eyes & nose, not tolerable
30	15,960	Continuous lacrimation & marked coughing; could be tolerated with discomfort.
40	21,280	Just tolerable for short period
> 40	>21,280	Intolerable

To prevent injury to workers, standard PPEs will be provided. In addition, sufficient number of Self-contained breathing apparatus will be provided to be used in case of major alcohol leakage to avoid exposure to higher levels of Alcohol. All precautionary methods will be adopted by the company to reduce the risk of exposure of employees to occupational safety and health hazards.

❖ MEDICAL CHECK-UP

Pre & post medical check-ups will be done of all the employees. Employees will be regularly examined and the medical records will be maintained for each employee. Pulmonary function test and periodical medical checkup shall be done once in every year. The same is followed by PLANT under existing unit. Following tests will be conducted for each worker -

- ❖ Lung Function Test
- ❖ Radiology - X-ray
- ❖ Pulmonary Function Test
- ❖ Audiometric Test
- ❖ Vision Test
- ❖ General clinical examination with emphasis on respiratory system
- ❖ Pre-employment examinations
- ❖ Periodical medical examinations at the time of employment and after completion of employment.

Standard medical facilities as required by Factory rule are expected to be provided in the OHC for the proposed plant, some important are illustrated below -

1. Well-equipped First Aid Boxes will be provided in each Section of the factory.
2. Snake bite Lancet
3. In case of need, factory will be having dispensary to give effective medical facility to workers. In dispensary, sufficient stock of medicines will be available to provide to workers in case of any major emergent situation.
4. Ambulance will be made available 24x7 in the factory to deal and take the injured workers to the district hospital.

EHS POLICY

The Company will prepare EHS policy and displayed as per the stipulated norms for the proposed integrated complex facilities.