Risk Assessment

Project Name: Matrix Fine Science Pvt. Ltd

Address: D-8, Paithan MIDC, Paithan, Aurangabad (MH)

Risk Assessment

1 Introduction *{Specific TOR 13}*

Increasing use of hazardous chemicals as raw materials, intermediates and finished products in chemical manufacturing industry has attracted attention of the Government and the public at large in view of the chemical disasters that have occurred in the past. The serious nature of the accidents, which cause damage to the plant, personnel and public, has compelled industries to pay maximum attention to the safety issues and also to effectively manage the hazardous material and operations. It is mandatory for the industries handling hazardous chemicals to maintain specified safety standards and generate an on-site emergency plan and keep it linked with off-site emergency plan. The safety management includes the implementation of preventive methods or accident prevention methods to avoid incident or accident and handling of emergency in case of accident. Special studies were carried out on risk and hazard management for the MFSPL plant at MIDC Paithan, Aurangabad.

1.1 Objective of the Risk and Hazard analysis

1) Identify hazards and nature of hazard in the process, storage and handling of hazardous chemicals.
2) Carry out Qualitative risk analysis for the process and suggest mitigation measures.
3) Carry out Quantitative risk analysis of the storage of hazardous chemicals and estimate the threat zones for Most Credible and Worst case scenarios
4) Suggest mitigation measures to reduce the risk/probability of the accident to the minimum.
5) Incorporate these measures for ensuring safe operations and safe layout and for effective preparation of On-site and Off-site emergency plans
6) Suggest Guidelines for on-site and off - site emergency plan

1.2 Methodology:

A] Identify hazards based on

- Processes description received.
- Identify Hazardous Chemicals handled and stored.
- Inventory of Hazardous chemicals
- Proposed storage facilities for hazardous chemicals
- Plant layout
- Safety measures to be adopted by the company

B] Hazard Assessment:

- By Qualitative Risk Assessment
- By Quantitative Risk Assessment by Hazard index calculations and estimate threat zones by using ALOHO.

C] Recommendations:

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

2. Hazard Identification

Following are the major areas of hazard identified:

1) Reaction and separation sections of production unit.
2) The storage and handling of hazardous raw materials.

2.1 Reaction and separation sections of production unit

Qualitative Risk analysis

The manufacturing processes are described earlier in the **EIA report**. Basically these involve reactions, like condensation carried out in batch reactor, separation and recovery of solvents (Used as reaction media), un-reacted components, neutralization, followed by separation and purification of the product. In such pharmaceutical production plants, in the reaction section, separation sections are the major hazards. The hazards identified are;

1. Fire and explosion
2. Toxic release
3. Exposure to hazardous chemicals

Process and reaction details:

Table No. 1.1: List of new products

Sr. No.	Name of Products	Raw Material	Nature of Reaction
1.	D Alpha Tocopherol	Non-Alpha Tocopherol Para Formaldehyde, H_2, Methanol, Heptane	High pressure catalytic reaction Palladium/Carbon and Benzene Sulfonic Acid
2.	D Alpha Tocopherol Acetate	D Alpha tocopherol, Acetic Anhydride and Sodium acetate	Reaction temp. 50 ^{o}C. Acetic Acid by-product
3.	D Alpha Tocopheryl Succinate	Purified Alpha Tocopherol, Succinic Anhydride in Heptane	Catalytic Reaction with Potassium Acetate as catalyst at 45 ˚C

4.	Vitamin E TPGS	Tocopheryl succinate, polyethylene glycol succinate, Toluene, Methanol and p-Toluene sulphonic acid as catalyst, Zinc dust, Heptane	Reaction at reflux temperature
5.	Steryl Ester	Sterol, Oleic Acid, catalyst 4-Toluene sulphonic acid [PTSA] Heptane (Solvent)	Catalytic reaction in Heptane as solvent. Reaction non-exothermic. Moderate Temp and pressure
6.	Squalane	Crude squalane, Methanol, Palladium on Carbon	High pressure catalytic reaction Palladium/Carbon at 5 Atm and 80 ˚C
7.	Vitamin E Powder	**No Chemical reaction**	

Hazard Identification:

The process for the present range of product involves reactions which are slightly exothermic and with medium temperature and atmospheric pressure conditions and separation of Class A solvents by distillation.

For these processes HAZOP study has been carried out and all the recommendations for safe operation with respect to instrumentation and operating procedures have been implemented.

For the processes for the production of Squalane and D Alpha Tocopherol involves high pressure and medium temperature reactions. Hydrogenation is potentially highly hazardous because of high exothermicity and handling of hydrogen and flammable solvents.

Mitigation measures:

Following Mitigation measures are essential during the design and operation stages.

It is strongly recommended to take all the preventive measures to minimize the probability of the accident to the minimum and make the process and reactor operation as intrinsically safe as possible. Because prediction of realistic estimation of the extent of damage and damage control after the accident is extremely difficult in case of reactor accident.

It was confirmed that the HAZOP study has been carried out for the existing manufacturing processes and the recommendations have been implemented. HAZOP study for new processes will similarly be carried out.

HAZOP study is the most effective and recommended method for identification of hazards in reaction and separation sections and for incorporating necessary changes in SOP's and to provide effective instrumentation alarms and interlocks as mitigation measures to make the process/plant

operation inherently safe.

All the recommendations of HAZOP study particularly for exothermic reactions will be strictly implemented in the plant.

Major Hazard in Reactions

It is known that highly exothermic reactions and even mildly exothermic reactions can lead to the uncontrollable rise in temperatures and pressures in the reactors and ultimately to the conditions of run-away reaction, (mostly in highly exothermic reactions and which use solvents as reaction media or and flammable and explosive chemicals) and this results in catastrophic explosion and fire.

The major reason for occurrence of uncontrollable rise in temperature is accumulation of un-reacted reactants. This has to be avoided at any cost.

For this basic and the most important mitigation measures suggested are:

1. Setting up a (Standard Operating Procedure) SOP for all critical operations, reactions and separations.
2. Once the SOP and operating parameters have been finalized, strictly following it, 24X7, particularly for batch operations without any change of procedure.
3. Must have in built system to check that the procedures (SOP) are not violated at any time, and no short cuts are taken in batch processes. Manufacturing of these product are in majority batch processes.
4. Have following alarm and interlock system (essential for highly exothermic reactions and alarms recommended for all exothermic reactions)
   - Utility failure alarm
   - Agitator failure alarm
   - High temperature alarm
   - Alarm for High rate of addition of limiting reactant which is added at controlled rate.
   - Raw material (limiting reactant) addition rate should be controlled by flow control loop. (FT, FIC, FCV). Controlling parameter being reactor temperature.
   - FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping.

Reactions at high pressure:

For the reactions carried out at more than atmospheric pressures following mitigation measures will be adopted:

- Reactor will be designed at pressure which will be double than operating pressure.
- It is necessary to have Pressure control loop.
- Rupture Disc and safety relief valve will be installed on the reactor to control excess

pressure.

- It is advisable to install reactor in a separate location, away from the main plant covered on three sides with pressure resistant walls and open roof.
- All operations should be PLC based controlled from the control room, located at a safe distance.

For Exothermic Reactions:

Hazards involved are:

In exothermic reactions, in case of accumulation of reactants, it is likely to reach runaway reaction conditions, which can cause serious accident, like explosion and fire.

Mitigation Measures recommended for this and for all exothermic reactions:

Following mitigation measures must be taken to avoid, accumulation of un-reacted reactants.

1. Accurate Flow indication and control of critical reactant added over a period of specific time and at specific flow rate.
2. Reaction High/low temperature alarm with interlock to critical reactant flow rate.
3. Cooling water/ chilled water failure alarm.
4. Agitator failure alarm.

Neutralization/pH adjustment Reactions:

Safety measures to be adopted for neutralization reactions are as follows-

- Cooling system will be provided.
- Two temperature sensors will be provided, in case neutralization reactions are critical to temp variations for yield and quality.

Centrifuge operation: Safety measures adopted in centrifugation areas are as follows-

- Ensuring proper Grounding/earthing of centrifuge, to prevent static electricity built up.
- Flow rate control, while feeding slurry in solvent with low flash point as per standard operating procedure (SOP), if required maintain Nitrogen atmosphere inside the centrifuge.
- Regular maintenance and inspection as per SOP.
- Vibration sensors to cutoff centrifuge.

2.2 Storage and handling of hazardous raw materials:

i] Hazard Identification:

This is another area of major concern for fire, explosion and exposure to and release of toxic liquids and gases and there is risk to persons, outside the factory limits getting affected.

The aim for RH analysis is;

1. To identify the hazardous materials handled and stored at the plant site. Based on the hazardous properties, conditions of storage.
2. Quantify the hazards in case of major fire, explosion or toxic release by visualization of Maximum Credible Accident Scenarios.
3. Incorporate the results of QRA for safe layout of hazardous chemicals storage in tank farm as well as in the warehouse and factory layout, in addition to the requirements of statutory rules and regulations.
4. Suggest mitigation measures to reduce the risk/possibility of the accident to the minimum.
5. Incorporate all these measures to arrive at Safe Disaster Management Plan, On-site and Off-site Emergency preparedness plan, if there is any possibility of off-site emergency. For storage and handling of the potentially hazardous material also.

ii] Hazard Analysis and Risk Assessment

Hazard analysis is the process of determining the release probabilities and quantities, emission or release rates, the routes/pathways by which the released substances could reach the receptors, the fate of the substances in environmental media through which they are transported or moved and the characteristics of the receptors at risk.

iii] Disaster Management

To provide guidelines for Disaster Management Plan (DMP) for on- site emergencies and Emergency Preparedness Plan (EPP) for off - site emergency, based on above i) & ii) studies of proposed plant. The Existing DMP Plan is attached as **Annexure [IX].**

2.3. Characterization of Hazardous Raw Materials:

For the manufacture of above products number of organic/inorganic chemicals are used. Out of these, hazardous raw chemicals have been characterized into

A. Flammable solvents
B. Toxic and hazardous chemicals
C. Corrosive chemicals

A. Flammable solvents/chemicals

1] Flammable Solvents stored in Tanks:

There are chemicals/solvents in the category of flammable liquids. Following Class A Solvents are stored in underground tanks. {**Table No. 1.2**}

Table No. 1.2 Class A Solvents Stored in Underground Tank

Sr. No.	Chemical	Max. qty required per Month	Maximum qty stored m^3	Size of tank in Diameter and Height	Number Tanks	Clear Distance between each tank
1	Heptane	75 KL	100 m^3	L- 5.8 m □-3.5 m	02 (each 50 KL)	Shown in Plant Layout
2	Methanol	50 KL	40 m^3	L- 6 m □-2.15 m	02 (each 20 KL)	
3	Acetone	40 KL	20 m^3	L- 6 m □-2.15 m	01	

These RM are presently being used for the existing processes and the same tanks will be used for storage of solvents required for the manufacture of new products. Only additional Toluene is new solvent required for new products.

1. It was confirmed that one of the Methanol storage tank will be converted and dedicated for the storage of Toluene.
2. It was confirmed that PESO approval for these Class A solvents has been obtained.

2] Hazard in storage of solvents in underground tanks:
Major hazard for underground storage tanks is fire due to;

1) Leakage or failure of unloading hoses

2) Due to improper earthing of tanks and tanker from which solvent is being unloaded.

The other hazard is soil pollution due to leakage of underground tanks due to improper maintenance, use of improper anti- corrosive paint, failure to conduct regular pressure testing and thickness testing.

3] Mitigation measures to be incorporated:

Guidelines for safe storage of flammable solvents in Underground tanks:

1. It is necessary and mandatory to follow the, guidelines, rules and regulation given in Petroleum storage Rules 2002 for maintaining the clear distance between the tanks, distance of tank-farm location in the factory layout.
2. It is necessary and mandatory to obtain approval of CCE (Chief Controller of Explosives)
3. It is necessary to barricade the tank farm and put necessary sign of safety precautions, license number etc.
4. The minimum recommended separation distance from any underground tank to any building line is at least 2 m to avoid undermining the building foundations. It is advisable to increase this distance to 6 m for a basement or pit, to minimize the risk of vapour accumulation.

5. Corrosion is one of the main causes of equipment failure. Hence it is absolutely necessary to provide corrosion protection, to the internal and external surface of the tanks. Protection may be provided by paints or other coatings.
6. Cathodic protection may be used as an additional precaution as per the Indian and /or as per the international standard AP 620.
7. Coatings should be inspected for thickness, continuity and hardness prior to installing the tank.
8. For underground tanks, a bituminous coating can be applied using the appropriate standards.
9. Internal corrosion may result from the accumulation of water in the tank. A means to remove such water may be necessary. Caution is essential when draining water from beneath the product.
10. Reliance on a single valve to retain the tank contents is not sufficient. Two permanent in- line valves to the drainage point are recommended or temporary replacement of the blanking plate by a second valve during the draining operation.
11. Similarly, underground tanks require:
    - Foundations and adequate support (concrete or masonry).
    - To be securely anchored or weighted to avoid flotation from flood water or a high water table.
    - Backfilling with inert material such as rounded pea gravel or with concrete. Large stones or rocks may damage the protective coating on the tank. (Note: concrete is not suitable for double-skin tanks).
    - Protection from loadings from above ground, particularly from traffic. A reinforced concrete slab may be suitable. Alternatively the area around the tank should be fenced off, with the perimeter of the tank clearly marked.
    - An excavation of sufficient size to prevent damage to the tank's protective coating and to allow safe work during installation and backfilling.

Mitigation measures during unloading Material from the tankers:

- Flexible hoses should only be used, taking the precaution to keep the length to the minimum.
- Hoses should be made of a standard material suitable for the application and should be compatible with the materials handled.
- They should be adequately supported (for example by slings or saddles or steel braided) so that the bend radius is not less than the minimum recommended by the manufacturer.
- When they are not in use, flexible hoses should be protected from accidental damage, extremes of temperature and direct sunlight.
- They should be inspected daily for signs of leaks, wear and mechanical damage, and examined and pressure tested annually or according to the manufacturer's recommendations.
- Hoses should be electrically continuous or bridged with an earthing cable to avoid electrostatic charging.
- Static charge generation is prevented by proper mitigation measures as per rule 78 (7):

No tank (vehicle) shall be loaded at rate exceeding 1 meter /sec at the delivery end of the filling pipe until filling pipe is completely submerged in petroleum and there after loading rate may be increased gradually but should not exceed 6 meters per second in any case.

- Precautions and measures to be taken as petroleum rules 2002 Rule 44 to 49, for installing mitigation measures, the layout of tank and tank farm, loading and unloading bay.
- Bonding and earthing: Static electricity is generated when movement separates charge which can then accumulate on plant and equipment and on liquid surfaces. If the plant is not earthed or the liquid has a low electrical conductivity, then the charge may be generated faster than it can dissipate. Eventually, there may be an electrical discharge or spark. If this has sufficient energy it could ignite a flammable gas or vapour.
- To minimize the accumulation of electrostatic charge and prevent incendive sparks, all metal parts of the storage installation should be bonded together and earthed.
- A maximum resistance to earth of 10 ohms is recommended. It should be possible to disconnect the earthing facilities for periodic test measurement.
- For Further advice on earthing and bonding is it is recommended to follow the relevant Indian or International standards. in BS 7430.40
- If the liquid has a particularly low electrical conductivity and is being stored above its flashpoint, it may be advisable to store it under a blanket of nitrogen or inject it with a static dissipating additive; if used, these degrade with time and the concentration and effectiveness should be monitored.
- It is advisible to install an alarm system which warns and interlocks unloading operations of Class A solvent.
- Note on Transportation of Class A Solvents is attached as **Annexure {I}**. Rules and regulations given Chapter III of Petroleum Rules 2002 will be followed:
- Important are illustrated below:
  - Part I General 28 to 32.
  - Part IV 62 for bulk transportation by tankers 67 to 70 for drums transport.

B] Hazardous/Toxic Chemicals

The hazardous and toxic chemicals will be stored in smaller quantities in 200 liter standard drums or other standard sized containers of proper Material of Construction in the warehouse.

The details with respect to Maximum quantity to be stored, corresponding NFPA ratings with respect to toxicity, TWA/ TLV values, Boiling points, and other relevant details are given in the **Annexure [II].**

Acetic Anhydride: Out of these, Acetic Anhydride needs approval from narcotics authorities.

- All the necessary permits will be obtained. Acetic Anhydride will be kept away from other chemicals in lock and key.

- There will be adequate separation from other chemicals.
- Proper PPEs and spill kit should be available.
- Written instructions on the actions to be taken in case of spillage and emergency will be displayed near the storage
- Precautions to be taken are given in **Annexure {III}** for Acetic Anhydride.

Hydrogen cylinder storage:

Hazard: Leakage, fire and explosion

Mitigation Measures:

Cylinders should be stored in open space, in vertical position and should be secured with chain. Hand Trolley should be used for internal transport of cylinders. All ignition sources should be eliminated and no hot work should be carried out near the cylinders. Detailed precautions to be taken for the storage and handling of cylinders are given in the **Annexure {IV}**.

Storage of Class A solvent in drums:

1 MT Isopropyl Alcohol is stored in drums in the warehouse.

Following are the hazards identified:

Hazards are spillage, which may lead to fire and spreading the fire to other solvents stored in other drums and can lead to serious fire and explosion.

Mitigation measures: Legal requirement:-

- Storage of Class A solvents must have license issued by the CCE as per the rules, all the conditions specified there in have to be fulfilled.
- Fire-fighting around the storage of Class A solvents is recommended.

Other mitigation measures suggested to avoid fire are given below:

Main hazards

The main hazards from the storage of flammable liquids are fire and explosion, involving either the liquid or the vapour given off from it. Fires or explosions are likely to occur when liquid or vapour is released and comes into contact with a suitable ignition source, or alternatively, when a heat or fire source comes into contact with the container.

Common causes or contributory factors of such incidents include:

- Lack of awareness of the properties of flammable liquids.
- Operator error, due to lack of training.
- Inadequate or poor storage facilities.
- Hot work on or close to flammable liquid containers.
- Inadequate design, installation or maintenance of equipment.

- Decanting flammable liquids in unsuitable storage areas.
- Exposure to heat from a nearby fire.
- Dismantling or disposing of containers containing flammable liquids.

Combustion of liquids: Combustion of liquids occurs when flammable vapours released from the surface of the liquid ignite.

The extent of a fire or explosion hazard depends on the amount of flammable vapour given off from a liquid which is determined by:

A. Temperature of the liquid.
B. The volatility of the liquid.
C. How long the liquid is exposed for; and the air movement over the surface.

Other physical properties of the liquid give additional information on how vapour/air mixtures may develop and also on the potential hazards. These physical properties include: flashpoint; auto-ignition temperature; viscosity; lower explosion limit; and upper explosion limit.

Effect of Flash Point:

Generally, a liquid with a flashpoint below the ambient temperature of the surroundings will give off sufficient vapour to mix with the air and be ignited.

The lower the flashpoint of a liquid, the higher the risk

Health hazards

Flammable liquids can pose a health hazard if they are ingested; come into contact with skin or eyes or their vapours are inhaled. For example, **methanol is toxic as well as flammable**. Information on the health hazards of a particular liquid, and on any specific precautions required, should be obtained from the material safety data sheet (MSDS) or from the supplier.

Maintenance and modifications:

Many incidents involving flammable liquids occur during maintenance and repairs. The likelihood is increased if the work is done by staff or outside contractors who have little knowledge of the hazards associated with flammable liquids. You should only employ experienced contractors. A guide which gives sound practical advice for selecting and managing contractors should be used while employing a contractor.

Hot work Permit:

It is absolutely essential to establish hot work permit system for any hot work to be carried out in the factory, especially in the areas which store flammable solvents of Class A. And this should be strictly followed for any hot work carried out. It is essential that no maintenance work is done until: the potential hazards of the work have been clearly identified and assessed; the precautions needed have been specified in detail; the necessary safety equipment has been provided; and adequate and clear instruction has been given to all those concerned.

In most cases, a permit-to-work (PTW) system should be used to control maintenance operations in areas where flammable liquids are stored or used. PTWs are formal management documents. They should only be issued by those with clearly assigned authority to do so and the requirements stated in them must be complied with before the permit is issued and the work covered by it is undertaken. Individual PTW's need to relate to clearly defined individual pieces of work. PTW's should normally include: the location and nature of the work intended; identification of the hazards, including the residual hazards and those introduced by the work itself; the precautions necessary, for example, isolations; the personal protective equipment required; the proposed time and duration of the work; the limits of time for which the permit is valid; and the person in direct control of the work.

Information and training:

Adequate training and knowledge of the properties of flammable liquids are essential for their safe storage.

You need to inform all staff on the site about the hazards of storing flammable liquid and about the need to exclude sources of ignition and heat from the designated storage areas. Those responsible for the operation of the store also need to receive specific training in how to deal with spillages and leaks and emergency procedures.

Periodic retraining will normally be required. The training should include the following aspects:

- The types of flammable liquid stored their properties and hazards.
- Use of protective clothing.
- Housekeeping.
- Reporting of faults and incidents, including minor leaks and spills.
- Emergency procedures, including raising the alarm, calling the fire brigade and the use of appropriate fire-fighting equipment.

You will need written procedures for controlling the risks from the storage of flammable liquids, and these should be used as the basis for training.

Following are the major mitigation measures:

- Good Ventilation in the storage area.
- No ignition source.
- To be stored in good containers. No spillage. Control of spillage.
- Adequate separation from each other and other storage areas and process areas.

Storage of Acids in drums/carboys

Following acids are stored in drums/carboys:

- Sulphuric Acid, 50 carboys
- Acetic Acid 30 carboys and
- Oleic Acid 10 drums. Non Hazardous

It is suggested to adopt following mitigation measures:

There must be separate secured place in the warehouse for the storage of acids

- The drums are properly segregated, chained to keep these drums in place.
- The required number of safety eye wash and showers has been installed.
- Spill kits are available outside the warehouse.
- Adequate safety signs, critical information about the chemicals and instructions on what to do in case of emergency. It was informed that the valid statutory license for the storage is in place.

3. Warehouse Design:

The present warehouse will be used for the storage of additional raw materials and it will be suitably modified for the same.

Warehouse for the storage of chemicals in drums of the area will be constructed. This will be constructed as per the IS code 3594 and other relevant standards

Major points are from the code are given below:

- Roadways around warehouse should be min 5 meters wide and compound gates min 4.5 m wide.
- Floor areas: warehouse should be divided to have max 750 sqm area by separating walls. Dimensions LxW not exceeding 40 m.
- Floors should have 2 hrs fire resistance.
- Buildings used for storage of hazardous and extra-hazardous goods should be preferably of single storied structure and in no case should exceed 2 stories in height.
- In no case should a storage building exceed 1m in height.
- Floor Drainage: The floors should be of watertight construction and Scuppers of not less than 20 cm sq cross sectional area should be provided at no more than 6.0 m intervals or as required to take care of maximum water discharge from hydrant/sprinkler system.
- External Drainage External drains of not less than 25 cm width and 30 cm depth should be provided along the side of each building and so constructed that any flow of water from the building be directed to a suitable ground tank or reservoir or public drainage system in the vicinity not leading to a natural water source. No external drainage of warehouses storing hazardous goods should be connected to public drainage system which leads directly to a natural water source.
- Every storage/warehouse building should have a minimum of two exit doorways and at the rate of one exit doorway per every 30 m length of the external walls of the building.
- The means of exit as well as the exit ways, travel distances etc, should be as per the guidelines given in IS 1641 : 1988 If used for storage of hazardous goods, it should conform to Type I of IS 1642 : 1989.

General Additional measures suggested for improving Warehouse Safety

Measures suggested for improvement in the design of warehouse:

- Dividing warehouse into fire compartments, by suitably designed firewalls to limit the spread of fire.
- Limiting the quantity of hazardous chemicals stored.
- It is safe practice to store explosive, self igniting, oxidizing and organic peroxides separately, preferably in different compartments.
- Storage of chemicals should be planned by categorizing these based on their hazardous properties, like toxicity, flammability, explosibility for which MSDS (**Annexure{VIII}**) needs to be critically studied.
- Based on the above, proper segregation of materials should be achieved.
- Installation of smoke, fire and toxic gas leak detectors.
- It should be easily possible to reach and attend toxic chemical leakage.
- There should be enough space, and pathways for easy approach and escape.
- Having all flameproof fittings inside the warehouse.

4. Storage of Fuel:

Present storage of 40 MT coal an area of 300 sqm is provided and the same sufficient for additional storage of coal for future expansion.

Quantitative Risk Analysis (QRA) for solvents stored in underground tanks:

The most probable scenario for fire is fire occurring after the leakage of solvents during tanker unloading into the tanks:

5. Quantitative Risk Analysis

Basis for QRA calculations

- All the flammable solvents are stored in as mentioned earlier, in the underground tanks. All necessary safety measures are in place.
- Fire/ accident can occur only while there is leakage in the hose connecting tanker and the underground tank, during unloading. Road tanker of 10 cum capacity is assumed.
- Road tanker dimensions maximum diameter = 8 ft. i.e. 2.5 m and length = 1.88 m, approx 2 m.
- MCA scenario is assumed to be leakage through 10 mm diameter hole in the unloading hose of 50 mm diameter.

Worst case 50 mm pipe getting disconnected from the tanker during unloading operation

Atmospheric Data

Wind: 5 m/sec from WE at 3 meters

Ground Roughness: open country	Cloud Cover: 5 tenths
Air Temperature: 35° C	Stability Class: B

No Inversion Height Relative Humidity: 5%

Source Strength
Leak from hole in unloading hose

Flammable chemical is burning as it escapes from tank
Tank Diameter: 2.5 meters Tank Length: 2.04 m

Tank Volume: 10 cubic meters

Tank contains liquid Internal Temperature: 35° C

Chemical Mass in Tank: 6,590 kilograms

Tank is 85% full

Circular Opening Diameter: 1 centimeters

Table No. 1.3: Summary of the results For Acetone

Scenario	Leakage	Release duration	Qty kgs	Flame length Meters	Puddle dia meters	Threat zone in meters	Threat zone in meters	Threat zone in meters
						10KW/sq m	5 KW/sq m	1.2 sq km
Scenario 1	10 mm hole n hose	60 minutes	212	3.3	1.2	<10	< 10	<10
Scenario 2	50 mm hose disconnected	60 min	5306	10	6.1	12	17	25

Table No. 1.4: Summary For Toluene

Scenario	Leakage	Release duration	Qty kgs	Flame length Meters	Puddle dia meters	Threat zone in meters	Threat zone in meters	Threat zone in meters
						10KW/sq m	5 KW/sq m	1.2 sq km
Scenario 1	10 mm hole n hose	60 minutes	224	3	1	<10	< 10	<10
Scenario 2	50 mm hose disconnected	60 min	5609	10	4.9	17	21	29

QRA for Isopropyl Alcohol stored in 200 liter drum:

QRA was done for the following conditions:

Atmospheric Data: (Manual Input Of Data)

Wind: 6 Meters/Second From We At 3 Meters

Air Temperature: 35° C Stability Class: B

No Inversion Height Relative Humidity: 5%

5.1 Result of QRA

MCS: When the 200 drum is 85 % full and there is leak of 5 mm at 28-30 cms for 1 hr from the bottom and there is pool fire.

WCS: under the same conditions, when the drum is 85% full, the drums topples and the lid (closure) of 5 cm comes off and there is pool fire. The results are:

Table No. 1.5: WCS and MCS Results

Worst Case Scenario		Most Credible Scenario	
Amount leaked	144 Kg in 3 minutes	Amount leaked	52.6 Kg in 3 minutes
Flame Length	7 meters	Flame Length	1 meters
Puddle spread diameter	5.5 meters	Puddle spread diameter	0.7 meters
Distance (10.0 kW/sqm potentially lethal within 60 sec)	11 meters	Distance (10.0 kW/sq m potentially lethal within 60 sec)	Less than 10 meters
Distance (5.0 kW/sqm 2nd degree burns within 60 sec)	14 meters	Distance (5.0 kW/sq m 2nd degree burns within 60 sec)	Less than 10 meters
Distance 2.0 kW/sqm pain within 60 sec)	19 meters	Distance 2.0 kW/sq m pain within 60 sec)	Less than 10 meters

6. Fire hydrant system design and layout:

Fire hydrant piping has been designed and laid for the around present manufacturing facility as per the IS/ NFPA standards. In the factory layout the hydrant piping and hydrant locations have been marked.

The main hydrant pump, standby pump, jockey pump and other details are given in the **Annexure {V}**.

Code & Standards for design and implementation

1. Fire Extinguishers: IS:15683
2. Hose Reel: IS 884:1985
3. Hydrant System: IS 2871
4. Sprinklers: IS 15105

5. Smoke Detection System: IS 11360-1985.

7. On-site Emergency Plan and DMP:

The present facility has well prepared On-Site Emergency plan, prepared as per the factory act.

The same will be modified before the commissioning of the expansion plants for production.

The modified On-site Emergency plan will take into the account the present RH report safety and mitigation measures suggested.

The same On-site Emergency Plan will be linked to the DMP of the Paithan MIDC and district DMP.

8. Occupational Health Center (OHC):

The company has full-fledged OHC marked in the factory layout. OHC has the facilities as per the requirement of the factory act, in commensurate with the strength the strength of the workers as given in the Factory Act Under rule 73 W, applicable for all factories carrying out hazardous processes. Pre-employment and Periodic Medical tests are carried out for the workers, contract workers and staff as per the requirement of the act. And records are available. Details of facilities are given in **Annexure {VI}.** The company has the provision for workers for regular medical checkup in the form of Form No.7 (**Annexure {VII}**.)

If required, the OHC facilities will be augmented for expanded capacity.

9. EHS policy:

The company has well defined EHS policy and is displayed at prominent location in the factory. The EHS policy is attached as **Annexure {XI}**.

Annexure {I}: Note on Transportation of Class A Solvents

Transportation of Raw Material/Safety Guidelines for transportation of Solvent & Hazardous Chemicals

Following recommendations will be followed while fixing the transport agency for transporting Class A solvents and other hazardous chemicals:

Recommendations for transport of Class A chemicals and hazardous chemicals

Class A Solvents transport: Rules to be followed and precautions to be taken. The Petroleum Act and the Petroleum rules 2002 clearly specify in PART IV "TRANSPORT ON LAND BY VEHILES" UNDER RULES 62 TO 86 mandatory for the transportation of Class A chemicals.

A. Rule No 63: Chief Controller of Explosive (CCE) Approval required for tank and vehicle used for transportation.
B. Rule No 64: deals with tank capacity limits and solvent filling limits in the tank.
C. Rule No 65: clearly specifies that the vehicle approved for Class A solvent will not be used for transportation of any other purpose.
D. Rule No 69: No other article can be transported in the vehicle transporting Class A chemical.
E. Rule No 70: makes it mandatory to have spark arrestor fitted to the exhaust pipe of the vehicle and engine air intake fitted with effective flame-arrestor.
F. Rule No 71: specifies Electrical installation requirement for the tanker.
G. Rule No 72: specifies that it is mandatory to carry Fire Extinguisher of minimum 10 kg capacity.
H. Rule No 73: specifies that it is mandatory to have at least one person with knowledge attending the vehicle 24X7 during parking.
I. Rule No 74: specifies regarding parking of vehicle in the public place.
J. Rule No 76: specifies for loading and unloading of the tanker.
K. Rule No 78: specifies precautions against static charge, the most important being (7) of the same.
L. Rule No 79: specifies precautions against electrical hazard: No loading or unloading unless the engine is switched off.
M. Rule No 83: specifies tanker loading and unloading to be restricted between sunrise and sunset.
N. Rule No 84: prohibits smoking /open flame etc.

Common Guidelines for transport and handling hazardous chemicals and Class A solvents:

- It will be ensured that during the transportation contents are not spilled. Personnel including the driver and cleaner are properly trained about the hazardous properties of the material being carried and for transport of hazardous material.
- Tanker must be RTO approved and tested and approved by CCE for Class A solvents. Frequently tested for integrity. Certificate must be available.

- Vehicle must have safety equipment/PPEs and antidote if necessary.
- It is mandatory that driver possess a valid driver's license.
- The maximum speed limit is prescribed.
- Driver will be instructed to park the tanker at safe place and they should be available in the near vicinity.
- TREM (Transport Emergency) cards are to be provided to the drivers.

Annexure [II]: List of Hazardous Chemicals Liquid Stored in Drums

Sr. No.	Chemical	Liquid/ Gas at storage Conditions	Nf value	Nh Value	Nr Value	Max. qty required Per month	Maximum qty stored MT/Kgs/ liters	Size of Drum /carboy	Number of drums/ carboys	Nature of Haxazrd. Toxic/Reactive/ Fire (From NFPA rating)
1	Acetic Anhydride	Liquid	2	3	1	1.8 MT	2 MT	210 lit drum	9 Drums	flammable
2	Sulphuric Acid	Liquid	0	3	2	2 MT	2 MT	35 Lit carboys	50 Carboys	Corrosive, water reactive
3	Oleic Acid	Liquid	1	0	0	2 MT	3 MT	210 Drums	10 Drums	irritant
4	Acetic Acid	Liquid	2	3	0	1 MT	1.0 MT	35 Lit carboys	30 carboys	Flammable, irritant
5	Hydrogen gas	Gas	4	0	0	0.6 MT	1.0 Mt	Cylinders	Cylinders	Extremely flammable
6	Para Formaldehyde	Solid	2	3	0	6.26MT	7MT	Fiber drum	Fiber drum	Irritant
8	Isopropyl alcohol	Liquid	3	1	0	1 MT	1 MT	210 Lit MS drums	5 Nos of drums	Flammable
9	Potassium Acetate	Solid	1	2	0	1MT	1.5MT		HDPE Bags	Irritant
10	Potassium Hydroxide	Solid	0	3	1	5 MT	7MT	HDPE bags of 50 kg	140 bags	corrosive
12	Sodium acetate anhydrous	Solid	1	2	0	0.32MT	0.4MT	HDPE bags	Fiber Drums	Irritant
13	Polyethylene glycol 1000	Solid	1	0	0	40MT	40MT	HDPE bags	Fiber Drums	Irritant
14	Succinic anhydride	Solid	1	2	2	26.14MT	27MT	HDPE Bags	HDPE Bags	Irritant

Annexure {III}: Storage of Acetic Anhydride

Taken License from Narcotic Department

Storage Location: East – South corner of Warehouse

Safety Measures:-

1) Isolated area in existing warehouse with lock & Key arrangement.
2) Well ventilated area.
3) Authorized entry only.
4) Display signs & SOP for handling, Do's & Don'ts.
5) Fire Extinguishers, Fire Hydrant system, Smoke Detection system.
6) Training of Handling of Material.
7) SOP for dispensing.
8) Proper use of PPE's.
9) Flame proof electrical fittings.
10) Sand buckets & Spill kits.

Annexure {IV}: Safety Measures in handling Cylinders

Risks and Hazards from Gas Cylinders.

Gas cylinders can be hazardous due to both their physical (size and weight) and chemical characteristics. Hazards from gases are also subject to the chemical properties of each gas. These may be one or more of the following:

1. Fire or explosion from the release of flammable gases near ignition sources (e.g. acetylene or LPG). Refer to MSDS for Upper and Lower Explosive Limits (UEL and LEL)
2. Spontaneous combustion from oxidizing gases (e.g. oxygen or nitrous oxide)
3. Exposure limits for all gases, especially toxic or corrosive gases (e.g. anhydrous ammonia); refer to SDS for Time Weighted Exposure Limit (TWA) and Short Term Exposure Limit (STEL), Asphyxiation from non-toxic, non-flammable gases by displacement of oxygen (e.g. nitrogen, carbon dioxide or argon) Incorrect storage
4. Lekage
5. Each compressed gas cylinder has unique hazards based on its contents. Some are filled with inert gases – especially those used in arc welding.
6. Many gases are flammable, explosive, toxic, or a combination.
7. Bulk Cylinder Storage Gas stores should be located outdoors, preferably in a secure, cage protected from sunlight.

Storage of cylinders:

Storage indoors is not recommended unless the building has been designed for that purpose with appropriate fire rated walls and ventilation. Where gases are stored indoors, additional safety considerations and control measures need to be given consideration.

Specific Storage precautions Requirements in manifolds: Cylinders in Use Store cylinders in an upright position1. If cylinders have been lying on their side, place the cylinder in the upright position and wait 60 minutes before using. If Acetylene has been laid on its side, then it is recommended that the cylinder is not used for 12-24 hours.

Secure cylinders using a purpose built non-abrasive coated chain, strap or cable that will not scratch the cylinder markings and paint work or a racking system.

Completely close the valves, and keep the valve protection devices, such as caps or guards, securely in place when cylinder is not in use.

1. Store cylinders in a dry, well-ventilated area. Place them in a location where they will not be subject to mechanical or physical damage, heat or electrical circuits to prevent possible explosion or fire.
2. Keep cylinders away from pedestrian traffic.
3. Full and empty cylinders should be stored separately in clearly marked areas.
4. Objects should not be stored on top of gas cylinders
5. Gases denser than air need to be stored with caution to avoid storage where these gases can collect in low lying areas.
6. Gas cylinders should not be located where they may block stairs, exits, ladders or walk ways. Ensure an up to date and accurate inventory is kept. Keep inventory quantities as low as possible.
7. Segregate Incompatible Gases

Using Gas Cylinders

- Always use gas cylinders in well ventilated areas.
- Do not use gas cylinders in confined spaces unless qualified to do so and the appropriate PPE is used.
- Know the gas you are using and possible reaction products.
- Additional mechanical ventilation may be required.
- Seek expert assistance in designing and installing mechanical ventilation systems. Ensure the correct regulator is used for the purpose.
- Ensure there is a suitable emergency response procedure in place.
- Wear appropriate PPE for the gas been used, refer to MSDS. Ensure connections, fittings and lines are leak tight and suitable for use.
- Ensure that flammable and oxidizing gases are not used near ignition sources.
- Disconnect empty cylinders from equipment to avoid backflow issues. Always close the cylinder valve when not in use.
- Do not use an empty cylinder as a waste receptacle. Fit non-return valves in line if required.
- Do not use a gas cylinder that shows evidence of damage or corrosion. The gas cylinder is a rented item; its integrity is the responsibility of the gas supplier. If the cylinder contents cannot be clearly identified, DO NOT use it.

Leaks

Leaks from gas cylinders are potentially very dangerous, depending on the properties of the gas. If a gas cylinder is found to be leaking than appropriate measures should be put in place to limit risk.

If a flammable gas is found to be leaking then it should be treated as if the cylinder were on fire.

Leaking toxic gases are extremely dangerous. Immediately evacuate the area and follow the normal school/faculty emergency response procedures. The fire brigade shall be called and informed of the type of leaking gas. DO NOT re-enter the area until it is deemed safe to do so by professionals.

Precautions proposed to be taken for Storage of Hydrogen gas Cylinders:

Maximum storage (proposed) 1 MT in cylinders, Storage area: Beside of Plant-2,

Dimensions: 20 feet X 20 feet (400 sq. feet)

Safety Measures

1) Isolated storage with well ventilated & proper shed
2) Lock & Key Arrangement
3) Hydrogen gas leak detection system
4) Display signs & SOP for handling of H_2 gas, Do's & Don'ts
5) Proper stands with chain supports.
6) Use of cylinder trolley for handling
7) Training
8) Fire Extinguishers & Fire Hydrant system
9) Use of PPE's
10) Emergency plan
11) Flame proof electrical fittings
12) Proper non sparking tools

Annexure {V}: Detail of Hydrant Pump

1) Jockey pump Detail

Motor :-

1) Make : Crompton Greaves
2) HP : 12.50
3) RPM : 2910
4) Frame : ND 132 M

Pump :-

1) Make : KSB
2) RPM : 2946
3) Head : 70
4) Rate of Flow : 10.8 $M^{3/}$ H
5) Type : ETN – 050 – 032 – 250 GI.

2) Main Pump Detail

Motor :-

1) Make : Crompton Greaves.
2) HP : 75
3) RPM : 2960
4) Frame Size : ND 250 M

Pump :-

1) Make : KSB
2) RPM : 2967
3) Head : 70
4) Rate of Flow: 171 $M^{3/}$ H
5) Type : ETN – 100 – 080 – 250 GI.

3) Diesel Generator

Motor :-

1) Make : Kirloskar
2) HP : 90
3) RPM : 1800
4) Frame Size : ND 250 M

Pump :-

1) Make : KSB
2) RPM : 2967
3) Head : 70
4) Rate of Flow: 171 $M^{3/}$ H
5) Type : ETN – 125 – 100 – 400 GI

Hydrant points	:	34 Nos.
Water + Foam Monitors	:	10 nos.
Hose Boxes	:	34 Nos.
Hose reel	:	8 Nos.

Detail of Sprinkler System Pump

4) Jockey pump Detail

Motor :-

1) Make	:	Crompton Greaves.
2) HP	:	10 HP
3) RPM	:	2910
4) Frame	:	ND 132 M

Pump :-

6) Make	:	KSB
7) RPM	:	2946
8) Head	:	70
9) Rate of Flow:		10.8 $M^{3/}$ H
10) Type	:	ETN – 050 – 032 – 250 GI.

5) Main Pump Detail

Motor :-

5) Make	:	Crompton Greaves.
6) HP	:	75
7) RPM	:	2960
8) Frame Size:		ND 250 M

Pump :-

6) Make	:	KSB
7) RPM	:	2967
8) Head	:	70
9) Rate of Flow:		171 $M^{3/}$ H
10) Type	:	ETN – 100 – 080 – 250 GI.

Sprinkler system provided for All tank farms including UGT, Office building, Lab Area.

Annexure {VI}: OHC Details

Location: Behind Security gate

Total Area: 12.5 sqm. Following items in OHC.

1. A glazed sink with water.
2. Two buckets or containers with close fittings lids.
3. clinical thermometers (digital).
4. One wash bottle (1000 cc) for washing eyes.
5. One electric hand torch.
6. Medical Oxygen cylinder with necessary attachments & stand.
7. One Blood Pressure apparatus (Digital).
8. One Peak-flow meter for lung function measurement.
9. Four plain wooden splints 900 mm X 100 mm X 6 mm.
10. Four plain wooden splints 350 mm X 75 mm X 6 mm.
11. Two plain wooden splints 250 mm X 50 mm X 12 mm.
12. White bed sheet & white pillow cover (each 2Nos.), blanket -1.
13. Stethoscope.
14. Weight machine.
15. Height measurement tape.
16. Generic medicines like Disprine, Combiflam, Cycloplam, Chestan Cold, eye/ear drops etc.
17. First aid box.
18. Screen for eye vision checking.
19. A wheeled stretcher with folding and adjusting devices.
20. Single bed, Table, 2 chairs.
21. Doing periodical medical examination of Employees by certifying surgeon & Maintain Form No.-7.

Annexure {VII}: Form No. 7 for Medical checkup of existing worker

From:
Dr. P.R. MORE
M.B.B.S., A.F.I.H.
Certifying Surgeon,
Dist. AURANGABAD

FORM NO - 7
(Prescribed Under 18 (7)
HEALTH REGISTER
[In respect of persons employed in occupations declared to be dangerous operations under Sections - 87

To,
Name of the Company
MATRIX FINESCIENCES, PAITHAN MIDC, AURANGABAD

Note:- (i) Column 8 - Detailed Summary of reason for transfer or discharge should be stated
(ii) Column 11 Should be expressed as Fit / Unfit / Suspended

SR. NO	Employee No	Name of Worker	SEX	AGE LAT BIRT	DATE OF EMPLOYMENT OF PRESENT	Date of Leaving or Transfer to the Other Work	REASON FOR LEAVING TRANSFER	NATURE OF JOB	Raw Material or By Product Handled	Date of Medical Examination by Certifying an result of Medical Examination 10/08/2017	If suspended from work state period of	Rectified Fit to Resume Duty on with Signature	If Certificate of Unfitness of or suspension	Signature with date certifying
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	47	DHANANJAY R. DESHMUKH	M	28						FIT FOR JOB				
2	84	SHASHIKANT B. BHOLE	M	40						FIT FOR JOB				
3	106	GORAKH DINATH PAWAR	M	34						FIT FOR JOB				
4	43	NILESH P. BHUSAL	M	52						FIT FOR JOB				
5	82	RAJASHRI K. MUNDHE	F	24						FIT FOR JOB				
6	69	MANMATH R. CHOTIMATH	M	38						FIT FOR JOB				
7		MAHESH S. KULE	M	25						FIT FOR JOB				
8	97	ISHAD S. MALIK	M	22						FIT FOR JOB, WEIGHT REDUCTION				
9	73	ANIL H. ANAF	M	27						FIT FOR JOB				
10	101	JAGDISHWAR P. GORLA	M	26						FIT FOR JOB				
11	58	RITESH S. RALT	M	32						FIT FOR JOB				
12	85	SANDIP S. KALAMKAR	M	29						FIT FOR JOB				
13	108	GAJANAN H. SHENDADE	M	24						FIT FOR JOB				
14	72	AMOL S. LOHAR	M	29						FIT FOR JOB				
15		SWAPNIL B. ILHE	M	24						FIT FOR JOB				
16		RAMESHWAR C. BHUTEKAR	M	32						FIT FOR JOB				
17	53	K. P. GUNIAL	M	54						FIT FOR JOB				
18	70	SIDDHANT D. SINGH	M	27						FIT FOR JOB				
19	93	RAVINDRA M. AMBADE	M	30						FIT FOR JOB				
20	72	SANDIP D. BOBADE	M	24						FIT FOR JOB				
21	56	CHANCHAL K. PAWAR	F	25						FIT FOR JOB				
22	89	PRIYANKA P. APARAWPAR	F	24						FIT FOR JOB				
23	44	RAJU P. GEDAM	M	37						FIT FOR JOB				
24	104	YOGESH D. THOTE	M	24						FIT FOR JOB				
25	73	MOHIUDDIN F. NASARI	M	52						FIT FOR JOB				
26	61	SHARAD T. SUTAR	M	35						FIT FOR JOB				
27	38	KALIM A. INAMDAR	M	33						FIT FOR JOB, WEIGHT REDUCTION				
28	32	MANISHA V. LOHAR	F	26						FIT FOR JOB				
29	63	SUREKHA B. DARANDALE	F	26						FIT FOR JOB				
30	13	ROSHAN A. KAKDE	M	29						FIT FOR JOB				
31	76	PANKAJ P. PANDE	M	44						FIT FOR JOB				
32		ANNASAHEB T. DARMADHIKARI	M	28						FIT FOR JOB				
33	42	SANJAY H. REPALE	M	51						FIT FOR JOB				
34	14	RAJESH R. JANJALKAR	M	45						FIT FOR JOB				
35	71	SONAL G. MALVADE	M	26						FIT FOR JOB				
36	86	PRAVIN B. KLSARE	M	21						FIT FOR JOB				
37	53	MILIND S. SAVJI	M	36						FIT FOR JOB				
38	88	GANESH A. NAWALE	M	24						FIT FOR JOB				
39	5	YOGESH B. NAJAN	M	26						FIT FOR JOB				
40	87	DEEPAK R. MANDORE	M	23						FIT FOR JOB				
41	102	SOPAN E. NAWALE	M	26						FIT FOR JOB				
42		RAMESHWAR R. KUMAWAT	M	28						FIT FOR JOB				
43	36	AMIT D. PATEL	M	28						FIT FOR JOB				
44	39	KISAN B. SHINDE	M	24						FIT FOR JOB				
45	40	SANTOSH B. TAMBE	M	37						FIT FOR JOB				
46	34	VISHAL A. DESHMUKH	M	23						FIT FOR JOB				
47	103	CHETAN V. SHAHARAO	M	23						FIT FOR JOB				
48	34	VISHNU H. RATHOD	M	32						FIT FOR JOB				
49	35	SHRIRAM M. GHONGADE	M	36						FIT FOR JOB, ORAL HYGIENE				

कारखाने अधिनियम १९४८ च्या कलम १० (२) प्रमाणे औरंगाबाद जिल्ह्यासाठी दिनांक २/४/१६ पासून १/४/१८ पर्यंत प्राधिकृत प्रमाणक शल्यचिकित्सक क्र. ACS04 PM/2016

[signature]

कारखाने अधिनियम १९४८ च्या कलम १० (२) प्रमाणे औरंगाबाद जिल्ह्यासाठी दिनांक २/४/१६ पासून १/४/१८ पर्यंत प्राधिकृत प्रमाणक शल्यचिकित्सक क्र. ACS04 PM/2016

Annexure {VIII}: Material Safety Data Sheet for Products & Raw Material

{Products}

Sr. No.	Raw materials/ products	Formula	State	Odor	Mol. Wt (g/mole)	Flash Point (^{0}C)	Melting Point (^{0}C)	Boiling Point (^{0}C)	LD_{50} (mg/kg)	Stability	Hazard	Color	Sp. Gr. (g/cc)	UEL %	LEL %	Odor threshold (ppm)
1	D Alpha Tocopherol	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA
2	D Alpha Tocopherol Acetate	$C_{31}H_{52}O_3$	Liquid	NA	472.75	NA	10	>343	500	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	NA	NA
3	D Alpha Tocopheryl Succinate	$C_{33}H_{54}O_5$	Solid	Odorless	530.79	NA	73-78	NA	7001	Stable	Slightly Irritant to skin, eye	White-Off-white	< 1	NA	NA	NA
4	Vitamin E TPGS	$C_{33}O_5H_{54}(CH_2CH_2O)_n$	Solid	Odorless	1513	NA	36 - 40	196 - 200	7,000	Stable	Slightly Irritant to skin, eye	Off-White-Light Yellow	1-1.5	NA	NA	NA
5	Steryl Ester	$C_{47}H_{82}O_2$	Paste	Mild characteristic	679.15	> 200	30-35	NA	> 2000	Stable	Slightly Irritant to skin, eye	Off-white-Light Yellow	0.93	NA	NA	NA
6	Squalane	$C_{30}H_{50}$	Liquid	Agreeable	410.72	200	-75	285	5000	Stable	Skin, eye irritation	Colorless	0.855	NA	NA	NA
7	Vitamin E Powder	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA

{Raw Materials}

Sr. No.	Raw materials	Formula	State	Odor	Mol. Wt (g/mole)	Flash Point (^{0}C)	Melting Point (^{0}C)	Boiling Point (^{0}C)	LD_{50} (mg/kg)	Stability	Hazard	Color	Sp. Gr. (g/cc)	UEL %	LEL %	Odor threshold (ppm)
1.	**D Alpha Tocopherol**															
1.	Mixed Tocopherol	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA
2.	Palladium Charcoal	Pd	Solid	NA	106.42	NA	1555.5	3167	NA	Stable	Irritation to eye, skin, inhalation, ingestion	NA	NA	NA	NA	NA
3.	Para Formaldehyde	HCHO	Liquid	Pungent	30.02	50	-15	98	42	Stable	Irritant to skin, eye Corrosive	Colorless	1.08	36.5	6	100
4.	P-Toluenesulfonic Acid(Catalyst-2)	$C_{12}H_{18}N_2$-O_3-S	Solid	Odorless	270.35	NA	128.5	NA	2490	Stable	Irritant to skin, eye Inhalation & ingestion	White	1.245	NA	NA	NA
5.	Methanol	CH_3OH	Liquid	Alcohol	32.04	NA	-97.6	64.5	NA	Stable	Flammable	colorless	0.7915	36.50	6.72	NA
6.	Heptane	$C+H_{16}$	Liquid	Hydrocarbon. Gasoline-like	100.21	-4	-90.7	98.4	NA	Stable	Skin, eye irritation	Colorless	0.6838	6.7	1.05	150
2.	**Steryl Ester**															
1.	Refined Phytosterol (98%)	NA	Solid	weak, characteristic	NA	NA	130 to 145	NA	> 3,000	Stable	NA	white to off-white	NA	NA	NA	NA

Sr. No.	Raw materials	Formula	State	Odor	Mol. Wt (g/mole)	Flash Point (^{0}C)	Melting Point (^{0}C)	Boiling Point (^{0}C)	LD_{50} (mg/kg)	Stability	Hazard	Color	Sp. Gr. (g/cc)	UEL %	LEL %	Odor threshold (ppm)
2.	Oleic Acid	$C_{18}H_{34}O_2$	Liquid	Lard-Like	282.47	188.89	16.3	286.11	25000	Stable	Irritant to skin, eye Inhalation & ingestion	Colorless to light yellow	0.895	NA	NA	NA
3.	P-Toluenesulfonic Acid	C_{12}-H_{18}-N_2-O_3-S	Solid	Odorless	270.35	NA	128.5	NA	2490	Stable	Irritant to skin, eye Inhalation & ingestion	White	1.245	NA	NA	NA
4.	Heptane	C_7H_{16}	Liquid	Hydrocarbon. Gasoline-like	100.21	-4	-90.7	98.4	NA	Stable	Skin, eye irritation	Colorless	0.6838	6.7	1.05	150
5.	Potassium Hydroxide	KOH	Liquid	Odorless	NA	NA	48	271-293	>90	Stable	Corrosive	Clear to slightly turbid	1.51	NA	NA	NA
6.	Sulphuric Acid	H_2SO_4	Liquid	Odorless	98.08	NA	-35 to 10.36	270-340	2140	Stable	Corrosive	Colorless	1.84	NA	NA	NA
3.	**Tocopheryl Acetate**															
1.	D-alpha Tocopherol	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA
2.	Acetic Anhydride	$(CH_3CO)_2$	Liquid	Strong	102.09	49	-73.1	139.9	1780	Stable	Irritant to skin, eye Inhalation & ingestion	Light	1.08	10.3	2.7	0.1
3.	Sodium Acetate	CH_3COONa	Solid	Odorless to	82.03	NA	324	NA	3530	Stable	Irritant to skin, eye Inhalation &	Colorless.	1.528	NA	NA	NA

Sr. No.	Raw materials	Formula	State	Odor	Mol. Wt (g/mole)	Flash Point (^{0}C)	Melting Point (^{0}C)	Boiling Point (^{0}C)	LD_{50} (mg/kg)	Stability	Hazard	Color	Sp. Gr. (g/cc)	UEL %	LEL %	Odor threshold (ppm)
				acetic							ingestion	White				
4.	**Tocopheryl Succinate**															
1.	d-Alpha Tocophero	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA
2.	Succinic Unhydryed	$OCCH_2CH_2COO$	Solid	NA	100.08	NA	120	261	1510	Stable	Irritant to skin, eye Inhalation & ingestion	White	1.234	NA	NA	NA
3.	Potassium Acetate	CH_3COOK	Solid	NA	98.14	NA	292	NA	3250	Stable	Skin, eye irritation	NA	1.57	NA	NA	NA
4.	Heptane	C_7H_{16}	Liquid	Hydrocarbon. Gasoline-like	100.21	-4	-90.7	98.4	NA	Stable	Skin, eye irritation	Colorless	0.6838	6.7	1.05	150
5.	**Tocopheryl Polyethylene Glycol Succinate (Vitamin E TPGS)**															
1.	d-Alpha Tocopherol Succinate	$C_{33}H_{54}O_5$	Solid	Odorless	530.79	NA	73-78	NA	NA	Stable	Skin, eye irritation	White to Off-white	< 1	NA	NA	NA
2.	Polyethylene Glycol	$H(OCH_2CH_2)NOH$	Solid	Mild	1000	177	37	>200	NA	Stable	Skin, eye irritation	White	1.12	NA	NA	NA
3.	p-toluenesulphonic Acid	$C_{12}H_{18}N_2O_3S$	Solid	Odorless	270.35	NA	128.5	NA	2490	Stable	Irritant to skin, eye Inhalation & ingestion	White	1.245	NA	NA	NA
4.	Toluene	$C_6H_5CH_3$	Liquid	Aromatic ,	NA	40	NA	231	2.6 to 7.5	Stable	Irritant	Clear	0.86	7.1	1.2	0.2-5.0

Sr. No.	Raw materials	Formula	State	Odor	Mol. Wt (g/mole)	Flash Point (^{0}C)	Melting Point (^{0}C)	Boiling Point (^{0}C)	LD_{50} (mg/kg)	Stability	Hazard	Color	Sp. Gr. (g/cc)	UEL %	LEL %	Odor threshold (ppm)
				hydrocarbon					gm/kg							
5.	Methanol	CH_3OH	Liquid	Alcohol	32.04	NA	-97.6	64.5	NA	Stable	Flammable	colorless	0.7915	36.50	6.72	NA
6.	Heptane	C_7H_{16}	Liquid	Hydrocarbon. Gasoline-like	100.21	-4	-90.7	98.4	NA	Stable	Skin, eye irritation	Colorless	0.6838	6.7	1.05	150
6.	**Squalane**															
1.	Crude Squalene	$C_{30}H_{50}$	Liquid	Agreeable	410.72	200	-75	285	5000	Stable	Skin, eye irritation	Colorless	0.855	NA	NA	NA
2.	Ni Catalyst	Ni	Solid	Odorless	58.71	NA	2730	1455	NA	Stable	Skin, eye irritation	Silvery	8.908	NA	NA	NA
7.	**Vitamin E 50 Powder**															
1.	Mixed Tocopherol	$C_{29}H_{50}O_2$	Liquid	Typical Vegetable oil	430.71	260	2.5 - 3.5	210	> 9,000	Stable	Slightly Irritant to skin, eye	Yellow	0.94	NA	5 - 15	NA
2.	Silica	SiO_2	Solid	Odorless	60.09	NA	1610	NA	10000	Stable	Skin, eye irritation	White	2	NA	NA	NA

Annexure {IX}: Disaster Management Plan

1 Introduction

A. Normally it is not possible to completely eliminate emergency situations but it is definitely possible to control them. An emergency, if not controlled may cause a disaster and may disaster create a catastrophe. Hence advance planning and proper training to each and every employee in this emergency function is very essential to prevent any mis-understanding and disorder during an emergency.

Keeping above in view, this plan titled **"On Site Emergency Control Plan"**, outline the basic course of action to be followed by **Matrix Fine Sciences Pvt. Ltd., Paithan**. Employee in case of major fire or explosion, chemical spillage, release of toxic gas, flammable or hazardous chemical or any other similar condition which may occur either in or around the plant premises.

The highest ranking technical person present in the plant at the time of the emergency will have the overall responsibility of supervising and co-ordinating the course of action to be taken tackle the emergency. Everyone concerned should be thoroughly familiar with his responsibilities as mentioned in this plan.

B. **M/s Matrix Fine Sciences Pvt. Ltd**. Is situated at Plot No. D-8, MIDC Paithan, Aurangabad. The company manufactured Nutraceuticals and Natural food products. The management is providing the entire infrastructure necessary for efficient running of the plant.

The best efforts are made to make the factory safe. The best available technology is adapted to the extent possible in Design, Installation, Operation and Maintenance of different processes, plant equipment and machines. In spite of all the precautions taken, the accident can happen sometime and at that time, we must be fully prepared with emergency and disaster control plan to meet the situation & prevent loss of emergency and property. With this objective in mind, this contingency plan is prepared to minimize loss of life, damage to property and environment and bring the situation under control as quickly as possible.

M/s Matrix Fine Sciences Pvt. Ltd., Paithan (Aurangabad) having Factory License No. 2(m)(i) 19280 valid up to 31 Dec. 2021.

2 What is on site emergency ?

An emergency which may cause serious injuries, loss of life, extensive damage to property or environmental or serious disruption inside the plant, or the events that are commonly having serious implications like major fire hazards, causing serious burns to personnel or resulting in collapse structures or release toxic substances in the environment.

3. Objective

The main objectives of the on-site emergency plan is effective mobilization of resources in

order :

3.1 To save lives.
3.2 To rescue Victims.
3.3 To minimize injury.
3.4 To identity the dead.
3.5 To contain the incident and to minimize the extent of the damage to the resources and the business.
3.6 To inform relatives of casualties.
3.7 To secure the safe rehabilitation of affected areas.
3.8 To provide reliable information to Government officials and Police.
3.9 To alert the community around of the actual danger.
3.10 To preserve relevant records, equipments, and sample this may be needed as evidence for subsequent investigation.

4. List of Emergency

4.1 Fire
4.2 Gas / Vapors leakage
4.3 Dil. Sulfuric Acid leakage
4.4 Flammable solvent vapor leakage / spillage
4.5 Leakage / spillage of Heptane /Methanol / Acetone
4.6 Hazardous solvent leakage / spillage
4.7 Food Poisoning
4.8 Natural Disaster
4.9 Emergency at ETP operation
4.10 Natural calamities like storm, flood, earthquake, etc.,
4.11 Sabotage act of terrorism, civil commotion, etc.

5. Hazard potential areas at Matrix Fine Sciences Pvt. Ltd.:

Following emergency can occur at various location in the plant (See enclosed plant of factory showing Hazard potential Areas)

5.1	Fire & Explosion at :	-	Under Ground solvent storage yard
		-	Raw Material Storage Tank Farm Area
		-	Production Building (Plant 1 & 2)
		-	Boiler House
		-	Thermo pack area
		-	Scrap yard
		-	Raw Material & Engg. Store
		-	L.P.G at contractor fabrication work shed
		-	Diesel storage tank
5.2	Release & spillage of toxic / Flammable substance :	-	Raw Material & Engg. Store
		-	Organic Solvents and its vapours at Production Building (Plant 1 & 2)
		-	Raw Material storage tank farm area
5.3	Food Poisoning – Contamination of water	-	Canteen

- Drinking water point in the canteen

6. Maximum inventory of hazardous substance:

Sr.No	Name	Category	Max. Storage cap.	Mode of storage
1	Dil. Sulfuric Acid	T , C	1.0 KL	HDPE carboys
2	Caustic Lye	C	0.5 KL	HDPE carboys
3	Methanol	F ,	40 KL	UGT Area
4	Acetone	F,	20 Kl	UGT Area
5	Heptane	F ,	100 Kl	UGT Area
6	Hydrochloric Acid	C , W	0.4 KL	HDPE carboys
7	Potassium Hydroxide	C	4.5 MT	HDPE bag with LDPE liner
8	Catalyst	-	0.6 MT	HDPE carboys

C= Corrosive, F=Flammable, E=Explosive, T=Toxic, W=water Reactive, O=Oxidizing

7. Name of the Products as per MPCB consent & Utilities used

Sr. No.	Products	Utilities Required					
		Steam	Cooling	Hot oil	Vacuum	Brine	As per MPCB consent valid MT/year
1	Phytosterol	Steam	Cooling	Hot oil	Vacuum	Brine	190
2	Bio Diesel	Steam	Cooling	Hot oil	Vacuum	Brine	4400
3	Tocopherol	Steam	Cooling	Hot oil	Vacuum	Brine	365
4	Oil Residue	Steam	Cooling	Hot oil	Vacuum	Brine	340
5	Tocotrieols	Steam	Cooling	Hot oil	Vacuum	Brine	550

Vacuum and Nitrogen are common utility for the transfer of reaction mass from one place to another.

8. <u>Facilities Available To Tackle The Emergencies:</u>

8.1 200 KL water tank is available for firefighting purpose.

8.2 Fire hydrant line, Fire Hoses, Fire Hydrant Pumps -Main pump & Diesel engine are available for supply of water for fire extinguishing.

8.3 Jockey pump available for maintaining Fire Hydrant line pressure.

8.4 Two way external service point provided near Main Gate (outside).

8.5 Fire extinguisher installed in plant as per Annexure No – VII.

8.6 20 nos. Of trained manpower is available in the plant to extinguish any fire and attend emergency through the shift as per annexure – V

8.7 Required number of personal protective equipment (ppes') are available in the plant as per process like:

- Cartridge type face mask
- Safety Helmet
- Safety Goggles, safety Face shield
- PVC Apron

- Hand gloves & safety shoes etc.

8.8 Well equipped Occupational Health Center with necessary facilities are available for FIRST AID.
8.9 Eye fountain and safety shower are installed as per requirement.
8.10 Electrical Emergency siren
8.11 Material safety data sheet of all chemical used in the plants are available in concern department and OHC center.
8.12 Smoke/fire detection system provided in plant and regularly monitored.
8.13 DG set of 750 KVA capacities is available In the plant. All departments have flame proof torches.
8.14 Wind direction indicator is provided at Plant 2 & Administration building.

9. Preventive Measures

Following preventive measures are taken after thorough "Engineering Considerations" and process & Storage conditions in order to avoid / minimize accidents.

9.1 Safety valves and pressure gauge are provide on pressure vessel & their jackets.
9.2 Inert gas purging system provide to flammable solvent using reaction vessel to avoid reactivity and fire Hazard.
9.3 Earthing and Bounding to all solvent carrying pipe lines and equipments
9.4 Testing & Examinations of all equipment as per MFA- 1948
9.5 Smoke & Fire detector installed in plant & RM Store.
9.6 Auto fire Hydrant system is provided.
9.7 Auto sprinkler system at RM & Engg. Store.
9.8 All electrical fittings are flame proof.
9.9 Work permit system in place.
9.10 Flame arrestors are provided to storage tanks & condenser vents.
9.11 Regularly testing of earth pits & equipment earthing continuity.
9.12 Provide of lightening arrestors.

10. Emergency Measures:

10.1 Sudden stoppage of work, or failure in energies distribution system due to a serious breakdown, would cause severe potential risks to the plant as well as surrounding therefore, has to be dealt with a high degree of technical competency by the plant personnel. The actual course of action would depend on the real cause of the stoppage and the state of interrupted operations. A few guidelines are furnished below to give desired direction to the actions which would have to be taken.

10.2 Interruption in the processes:

Process shutdown may only be under taken as per the specific route causes like stage of reaction mixture parameters and deviation expressly ordered by plant In-charge or Manager Production. In case the cause of reaction deviation from normal process stoppage has to be under taken and under such situation, SAFETY takes absolute priority over yield and output.

10.3 Check List For Hazards (Sudden Stoppage Of Work)

10.3.1 All the charging line valves attached to the equipment must be checked to ensure that they are closed.

10.3.2 All the valves on heating side like steam, hot oil must be checked to ensure that they are closed.

10.3.3 As far as possible utility services to be made available to bring interrupted operation with safe & stable stages.

10.4 Action To Be Taken In Case Of Fire

All concerned person should take following steps in case of fire:

10.4.1 Person who spots fire should not get panicky.

10.4.2 Fire he should spot exact location of fire and the situation, then shout "Fire. Fire.. Fire…" at the top of his voice. Then he inform to plant supervisor, Unit Head , Safety In-charge and Security on intercom at once. (Internal communication telephone numbers- annexure – II)

10.4.3 On conforming the information from respective plant In-charge the emergency, security shall put the emergency siren by consulting Unit Head.

10.4.4 On hearing siren / alarm all trained person should reach at the site of the incident at the earliest.

10.4.5 Immediately extinguish the fire with help of fire extinguisher available at site. Only trained and experienced squad employee as per (Annexure No. V) should attend the emergency.

10.4.6 Affected person if any should be removed from the place and first aid shall be given quickly by trained persons.

10.4.7 Other people who are not concerned with actual fire fighting operation should evacuate the place and gather on the assembly point.

10.4.8 The area should be condoned off and no un-authorized person should be allowed to reach near the place of fire. And security person should be cross check the employee by head counting at assembly point.

10.4.9 If necessary isolate power supply of affected area.

10.4.10 If necessary plant may be shutdown in safe manner.

10.4.11 The flammable material should be shifted to a safe place.

10.4,12 Whenever necessary cool nearby structure/ equipment/ storage vessel to reduce effect.

10.4.13 During the fire fighting operation , take position on windward side so that fumes / smoke dose not affected to you.

10.4.14 If required, use self contained breathing apparatus.

10.4.15 If fire gets uncontrollable, help from respective sources like Fire Brigade etc should be called.

10.4.16 Clear road from traffic obstructions.

10.4.17 Brief the fire fighting personnel about cause of fire and whenever use of water is considered dangerous.

10.4.18 When fire is extinguished, do not leave the place immediately re-check the place thoroughly to prevent restart of fire.

10.4.19 Used fire extinguisher to be sent for refilling and unused ones should be put back in its original location. Water tank should be refilled to its capacity. Used fire hose should be put back in its original location.

10.5 General Action To Be Taken In Case of Gas / Vapors Leakage :

10.5.1 On conforming the information from respective plant In-charge the emergency, Security shall put the siren by consulting Unit-Head.

10.5.2 The affected area should be evacuated and cordoned off immediately.

10.5.3 Check the wind direction and determine neighboring farms, villages, are in danger, inform Unit Head / General Manager / Safety officer / safety Head / Plant in-charge / Executive Pers. & Admin. If dangers is immense inform concerned Unit.

10.5.4 Inform on Intercom to :

Security Dept.

Managing Director	9765486789
Unit Head	7767812127
Safety Head	7719814447
Production Head	7767812751
Executive Pers. Admin.	8698980888

Occupational Health Center

10.5.5 Only emergency squad personnel approach the area using suitable personal protective equipment like self contained breathing apparatus or gas mask.

10.5.6 Ensure that only essential personnel are in the affected areas. Others should assemble at assembly point. Approach from the windward side so that escaping gas / vapors is carried downwind and you are not exposed to it.

10.5.7 Rescue the persons who are trapped / injured. Ask them to put wet cloth on nose and mouth for evacuation.

10.5.8 Source of leakage should be traced out and the system is isolated from other equipments.

10.5.9 Affected persons should be provided with necessary medical aid.

10.5.10 If leakage is from cylinder, it should be turned so that the leakage is in the form of gas and not liquid, in case of H2 gas should be use curtain to dissolve H2 gas and to control further accident.

10.6 Flammable Solvent Vapor Leakage / Spillage

10.6.1 Heat and ignition source in vicinity should be removed immediately.

10.6.2 Keep M. Foam / ABC / DCP type fire extinguisher ready.
10.6.3 Plug the leakage.
10.6.4 If there is any doubt, consult MSDS particular solvent.
10.6.5 Petrol / diesel engine driven vehicle should not be allowed to enter Plant area.
10.6.6 Ensure that flammable material do not enter storm water drain.
10.6.7 Spilled material should be absorbed by spill kit or dry sand or clay.
10.6.8 Contaminated sand or clay should be disposed to CHWTSDF.

10.7 Fire or Leakage At Hydrogen Gas Cylinder Storage Area.

At the hydrogen cylinder storage area. The main potentials for disaster are fire and gas leakage. The major leakages may lead to fire but the risk to health & environment is relatively low. Various facilities provide in the area beside routine fire fighting facilities to handle the risks of fire and leakage's are as follows :

10.7.1 In case of any fire on cylinder, all the inlet and outlet valve is in the plant area should be closed immediately.
10.7.2 Supply gas cylinder should be stopped immediately
10.7.3 Use plenty of water to cool other cylinder.

10.8 Leakage Of Hydrochloric Acid / Caustic Lye / Dil. Sulfuric Acid.

10.8.1 Area should be evacuated immediately and cordoned off.
10.8.2 Affected person should be thoroughly washed using clean water and give necessary medical aid.
10.8.3 Personnel entering the area should wear personal protective equipment.
10.8.4 Leaked tank / container should be emptied immediately by transferring remaining quantity into another tank / container.
10.8.5 Leakage source should be traced out and plugged. If required vacuum may applied to control leakage.
10.8.6 If possible spilled material should be contained in dyke wall transferred into container.
10.8.7 If not then the same should be absorbed by dry sand or dry clay.
10.8.8 Sand / clay contaminated with alkali / acid should be first be neutralized then send to CHWTSDF.
10.8.9 Sand / clay contaminated with oil should be disposed in ETP drying beds.
10.8.10 Absorbing in saw dust or other combustible material should be avoided.
10.8.11 If spilled material gets into trench of electric cables, it should be drained with natural gradient and washed with large quantity of water continuously de-energizing the first.
10.8.12 If spilled material gets into the storm water drain. It should be washed with large quantity of water and collected in Effluent treatment Plant. The collected liquid should be either neutralized or oil layers should be removed manually.

10.9 **Action to be taken in case of Hazardous solvent leakage / spillage :**

10.9.1 Area should be evacuated immediately and cordoned off.

10.9.2 Only trained and Experienced emergency squad person approach the area with prescribed safety norms.

10.9.3 Affected person should be thoroughly washed using clean water and given necessary medical aid.

10.9.4 Personnel entering the area should wear suitable personal protective Equipment.

10.9.5 Leakage drum should be immediately transferred into another drum /container. Or leakage point should be traced out and plugged.

10.9.6 Do not Bring Heat source nearby.

10.9.7 If possible spilled material should be contained in dyke and transferred into container. (Normally hazardous waste Drums are kept on impervious flooring under DYKE area so as to contain accidental leaks/spills.)

10.9.8 If not then the same should be absorbed by dry sand or dry clay.

10.9.9 Sand /clay Contaminated with Hazardous waste should be first collected in specific drums then incinerated.

10.9.10 If spilled material gets into the storm water drain. It should be washed with large quantity of water and collected in Effluent treatment Plant. The collected liquid should be either neutralized or oil layers should be removed manually.

10.10 **Action to be taken in case of Food Poisoning :**

In case of suspected food poisoning or contamination of water, following guidelines may be followed :

10.10.1 Quick ask the conscious casualty what has happened, remember that he may loose consciousness at any time.

10.10.2 Immediately take action to prevent further distribution / use of contaminated food / water.

10.10.3 Place the casualty in the recovery position.

10.10.4 If conscious, give him plenty of fluids to drink.

10.10.5 Do not induce vomiting.

10.10.6 If consciousness is lost, follow the standard “Artificial Resuscitation procedure” if in doubt, arrange removal to hospital.

10.11 **Action to be taken in case of Flood Heavy rains and storm :**

10.11.1 Engineering Department to ensure that all electrical hazards are eliminated.

10.11.2 Housekeeping department in consultation with HR department to ensure dewatering. Arrangement of portable dewatering pumping may be done, if required.

10.11.3 Store in-charge in coordination with the security department to ensure that the raw materials / finish goods pallets are fully covered and properly tied with tarpaulin.

10.11.4 If required finish goods and raw material shifting from the area that is flooded to be carried out under the surveillance of the store in charge.

10.11.5 All those not concerned, stay inside strong and safe building till instructed by the authorized , keep the door and window closed.

10.11.6 Production in-charge to follow emergency shutdown procedure, if directed by main controller.

10.12 **Action to be taken in case of Earthquake**

10.12.1 Do not panic and keep calm. Employee to quickly evacuate to the Assembly Point.

10.12.2 Avoid using lift and staircase only be used for evacuation.

10.12.3 All movement should be made along main wall of the structure, if trapped should remain near the main wall of the structure or the main pillar.

10.12.4 If trapped, employee should refrain from standing on the terrace or peep out of the window or door; they should remain calm and concentrated near the main wall.

10.12.5 Security department in consultation with HR department should do the head count immediately at the assembly at the assembly area and number of trapped inside the building should be ascertained to effect evacuation after the tremor stabilizes.

10.12.6 Concerned outside agencies for appropriate aid to be contacted at the earliest

10.13 **Action to be taken in case of Riot**

10.13.1 Close all the gates to restrict the entry of the unauthorized persons.

10.13.2 Local police to be intimated immediately.

10.13.3 All employees to be keep calm and act as instructed by the authorized.

10.13.4 Security department should help the local police to control the situation.

10.13.5 Lodge FIR with the local police.

10.14 **Actions to be taken in case Terrorist Attack**

10.14.1 The employees should not get panic and remain inside the building. Close all windows and doors.

10.14.2 Evacuation should never be considered, unless a major fire has erupted and evacuation is inevitable.

10.14.3 Effect immediate rescue and treatment. Provide proper communication and controlled guidance.

10.15 **Assembly Point:**

10.15.1 Whenever any emergency is declared, employees are required to assemble at either of following two locations, as per the decision of the Unit Head / General Manager / Plant In-charge/Executive Pers. & Admin..

- **Assembly point no. 1---------- Near Security Gate**
- **Assembly point no. 2---------- Open Plot Area**

10.15.2 Each assembly point used during the emergency should be manned by a nominated person of personal dept. To record the names and department of those reporting there this information should be communicated to the MAIN CONTROLLER without delay

11.0 Emergency Control Center

11.1 Administration building / Security cabin

11.2 This is the place from where the operation to handle the emergency are directed and co–ordinate it will be attended by the works MAIN CONTROLLER KEY PERSONNEL THIS SENIOR OFFICER OF THE FIRE AND POLICE SERVICES ETC.

11.3 The Emergency control centre is equipped with following.

11.3.1 Adequate numbers of emergency phones

11.3.2 STD Facilities & "E –mail "

11.3.3 Telex and FAX facilities.

11.3.4 EPBX system which will enable immediate contact to any location inside the factory.

11.3.5 The Drawings and plans of factory illustrate

11.3.5.1 Area where there as large inventories of hazardous material eg. Tanks, reactors, Drum storage, compress gas cylinder are storage etc.

11.3.5.2 Location of safety equipment storage.

11.3.5.3 Fire water system and alternative source of water.

11.3.5.4 Factory entrance and road system

11.3.5.5 Assembly point and treatment center.

11.3.6 Note pad, pens, pencils etc.

11.3.7 Required number of PPE's and fire extinguishers.

12.0 Emergency Siren System

12.1 At the time of any emergency like fire, gas, leakage etc. Our Security officer / guard will blow on siren for 1 minutes long to make alert and awareness to all employee working in plant and inform to all key person.

12.2 After the control the situation again siren blow on for 01 minute continuous it means situation is normal so all employee also are as a allotter will restart the job in concern department.

12.2.1 **Codification Of Sirens**

Sr. No.	Sirens	Indicates	Authority
1.	01 MINUTE LONG	ON SITE EMERGENCY (ALRTE)	INCIDENT CONTROLLER

2.	1 minute continuous	Emergency controlled (all clear)	Site controller

NOTE :

1) Emergency siren to be sounded only if required.
2) All employee in areas other than affected to continuous work unless disaster siren blown.
3) No emergency organization member will leave the emergency sopt unless 'all clear' siren blown.

12.3 Safety HOD will display the pictorial board is near siren point, in plant will make awareness to all employee.

13.0 Training And Education

Experience with On Site Emergency planning has proved need of traning and rehearsal. Major emergency procedure should be laid down clearly and convincing to everyone on site particularly key personnel and essential workers.
It is obvious than in house or outdoor training is essential. The duties and responsibilities of each person and the emergency procedure to be followed by him should be very clear.

a. Refresher training on "On-Site Emergency Control Plan."

Training is conducted in house. Trainer will explain the plan to all associated concern employees.

Expert from outside will explain the plan to all associated concern employees. Expert from also may be invited to impart training.

14.0 Mock Drill Rehearsal

14.1 Inform to all the HOD about mock drill.

14.2 Fix the date for mock drill.

14.3 Observer will not be involved in exercise. They will monitor the mock drill.

14.4 Emergency siren will be raised.

14.5 After hearing the siren / alarm, emergency procedure will be followed as mentioned in the OECP.

14.6 Observer will note down the activities with respect to the time.

15.0 Updating The Plan

15.1 As and when required the On Site Emergency Control plan will be updated. After each drill the plan be thoroughly received to take account of shortcoming and accordingly plan will be updated.

16.0 Emergency First Aid Center

16.1 First aid center is located at ground floor, near Security gate, one Doctor is visiting two days in a week for general inspection. Trained peoples for first aid are available in each shift.

16.2 All likely useful medicines along with oxygen cylinder and face mask are available with occupational health center.

16.3 **First Aid Medical Facilities.**

The company has provided "First- aid" boxes at security office. Following are the contents of first aid.

1. Tincture iodine.
2. Eno pouch.
3. Burnol.
4. Soframycin (ointment)
5. Sterilized cotton wool.
6. Band-aid
7. Antiseptic solution(Dettol)
8. Cotton bandage.
9. Paracetamol tablets.
10. Iodex.
11. Pair of scissor.

16.4 The factory has also arrangement with **Sai Hospital Paithan** for getting consulting service for employee and in case of an emergency injured can be directly admitted there.

17.0 Backup Emergency Power

17.1 Backup Emergency Power, which provides emergency lighting only, is available at a limited number of essential location within the plant.

17.2 One diesel- powered generator is maintained capacity 750 KVA

17.3 Main hydrant pump can be run on Diesel-powered generator.

18. Identified Key Personnel:

	Main Controller	Intercom No & Cell No
1.	Managing Director	9765486789
2.	Safety Dept.	7767066112
3.	Safety Head	7719814447
4.	G.M Operation	7767812127
5.	H.R. Head	8698980888
6.	Maintenance In-charge	7767812676

7.	Production Head	7767812751
8.	AGM- Operations	7719034447
9.	Purchase	9657720655

19 Duties Of Key Personnel:

Once the alarm is raised, the work emergency procedure will be activated. As part of them, nominated key personnel will have specified responsibilities. They should appoint their deputies to act in their absence or incapacity. The scope of individual responsibility is specified on following pages:

19.1 The work Main controller: plant In-charge, Safety Head, safety officer, Maintenance Manager, Personal and Admin in consultation with safety officer.

19.1.1 He should go to the emergency control center as soon as he is aware of emergency and take over whoever is deputing for him. His duties include:

19.1.2 Get complete information of incident.

19.1.3 Remain there and try to establish contact with incident controller and ask him about help he may need to tackle the emergency.

19.1.4 Guide him about actions to be taken.

19.1.5 If required call key personnel and services like:

19.1.5.1 Fire Brigade

19.1.5.2 Ambulance

19.1.5.3 Water supplier

19.1.5.4 Police

19.1.6 Establish communication and liaison with agencies like:

19.1.6.1 Police

19.1.6.2 Dish office

19.1.6.3 MSEB

19.1.6.4 MPCB

19.1.6.5 MIDC

19.1.7 Guide and control the traffic movement in the works.

19.1.8 Ensure that casualties are attended .

19.1.9 Ensure that the relatives of casualties are informed.

19.1.10 Arrange for personnel to be relived in time and ensure that they are provide with food and drinks.

19.1.11 Control the clean up and rehabilitation of affected areas after the emergency.

19.2 Safety Officer

19.2.1 Proceed towards the scene of incident.

19.2.2 Assess the situation and guide supervisor and other in containing the situation

19.2.3 Liaise With The Main Controller, Incident Controller, Security Officer, And Emergency Control Room in fire-fighting operation, evacuation procedure and co-ordoning off the area and other measures depending upon situation.

19.2.4 Inform works main controller regarding progress of the situation and give technical guidance from safety point of view as may be warranted.

19.2.5 Liaise with outside agencies like fire Brigade, Ambulance etc.

19.2.6 Investigate cause of incident and make a preliminary report with practical remedial measures to prevent similar emergencies / incident.

19.2.7 Initiate a draft of report to be sent to Government department.

19.2.8 Liaise with Factories Inspector with the permission of works main controller.

19.3 The Incident Controller

19.3.1 Production manager / Manager – Engineering / plant In-charge, supervisor.

19.3.2 On hearing of the emergency, he should rush to the accident site and take charge of overall situation and instrument to use of appropriate fire extinguisher. Annexure – VI List of Fire Extinguisher.

19.3. His duties are:

19.3.3.1 Assess the size and nature of emergency

19.3.3.2 Decide if major emergency existing or is likely to happen.

19.3.3.3 Inform the works main controller about the gravity of the situation and if required as for help.

19.3.3.4 Direct all operations within the affected areas with the priorities for safety of personnel minimize damage to plant property and environment.

19.3.3.5 Direct the shutdown and evacuation of plant and areas like to be adversely affected by the emergency

19.3.3.6 Ensure that all key personnel and outside help is called in and reach the spot

19.3.3.7 To ensure timely rectification of unsafe conditions which caused the emergency.

19.3.3.8 To ensure that the endangered area is isolated by shutting door and windows.

19.4 Engineering Department

19.4.1 Engineering In-charge & Electrician should report to supervisor to / incident controller.

19.4.2 If required isolate power supply and other utility services, especially hot oil and steam supply.

19.4.3 If required arrange for alternative power source i.e. D.G.

19.4.4 They will try their level best to ensure that cooling water, brine, N_2 and pneumatic supply remain normal in emergency.

19.4.5 Be near accident spot to assist incident controller.

19.5 Personnel Department

19.5.1 Report at Assembly Point at emergency control center and follow the instruction of works Main controller.

19.5.2 To take roll call at Assembly Point and identify missing personnel.

19.5.3 Inform incident controller & work controller of missing personnel.

19.5.4 To ensure that casualties receive adequate attention and are hospitalized. Inform their relatives.

19.5.5 Initiate action to inform statutory authorities as may be of works Main controller.

19.5.6 Liaise with government officials with permission of works Main controller.

19.6 Security Officer / Supervisor:

19.6.1 Once hearing emergency call blow siren and he should immediately rush to the spot along with guards

19.6.2 One guard to remain at the gate to control entry of traffic and attend the calls.

19.6.3 Only company officials to be allowed IN. No visitor except fire brigade, doctor, police and other Government officials to be allowed inside.

19.6.4 Help in extinguish fire, evacuate of trapped employee and cordoning off the accident site.

19.6.5 Help in shifting to injured to the hospital by arrange transport.

19.6.6 Search the area for casualties.

19.6.7 Post a guard at accident site in order to prohibited to unauthorized entry & to see that area undisturbed till the investigation is over.

19.6.8 Liaise with police authorities the permission of works Main controller.

19.6.9 Keep main gate and approach road clear so that if outside emergency vehicle are needed, the road will not blocked.

19.7 Shift In-charge / Plant Supervisor

19.7.1 Inform the senior officials immediately.

19.7.2 Seek help from Security and Safety department.

19.7.3 Assess the situation and order general evacuations.

19.7.4 Rescue persons trapped / injured and arrange for their fires aid.

19.7.5 Shutdown plant in a safe manner after consulting Main incident controller and try to control emergency.

19.7.6 Ensure that steam / hot oil is closed cooling system is ON, the vacuum is broken and all input valves have been closed.

19.7.7 Direct fire fighting team about cause of fire and about the area where water cannot be applied.

19.7.8 Record all evidence.

19.7.9 Be in control of situation till senior officials arrive. Submit detailed report to them.

19.7.10 Co-ordinate with security and Personnel Department in roll call and timely shifting of injured to hospital.

19.7.11 Send duly filled in Departmental accident form to safety and personnel Department.

19.7.12 Supervisors of the building / departments should ensure that all trained fire fighting and first aiders go to the endangered building and all employee are present their respective work place.

19.7.13 Be in touch with supervisors of the endangered building for any assistance needed by them.

19.8 Emergency Squad Personnel

19.8.1 Only emergency squad (trained personnel) are allowed in emergency area to handle any emergency.

19.8.2 Determine the cause of emergency.

19.8.3 Use suitable Personal Protective Equipment during handling of emergency.

19.8.4 Use suitable fire extinguisher in case of fire.

19.8.5 Don't allow others to come near emergency area.

19.8.6 Adopt laid down procedure for handling emergency and evacuation purpose.

19.9 First Aid Trained Personnel

19.9.1 Personnel trained in first aid procedure should reach the accident spot immediately as per annexure- V

19.9.2 Identify injured and help in evacuating operation.

19.9.3 Assess the cause and nature of injury.

19.9.4 Give first aid accordingly.

19.9.5 If condition is serious accompany them to hospital as may be directed.

19.10 Contractors / Visitors

19.10.1 If incident is within your area of work, stop all work and report to gate office.

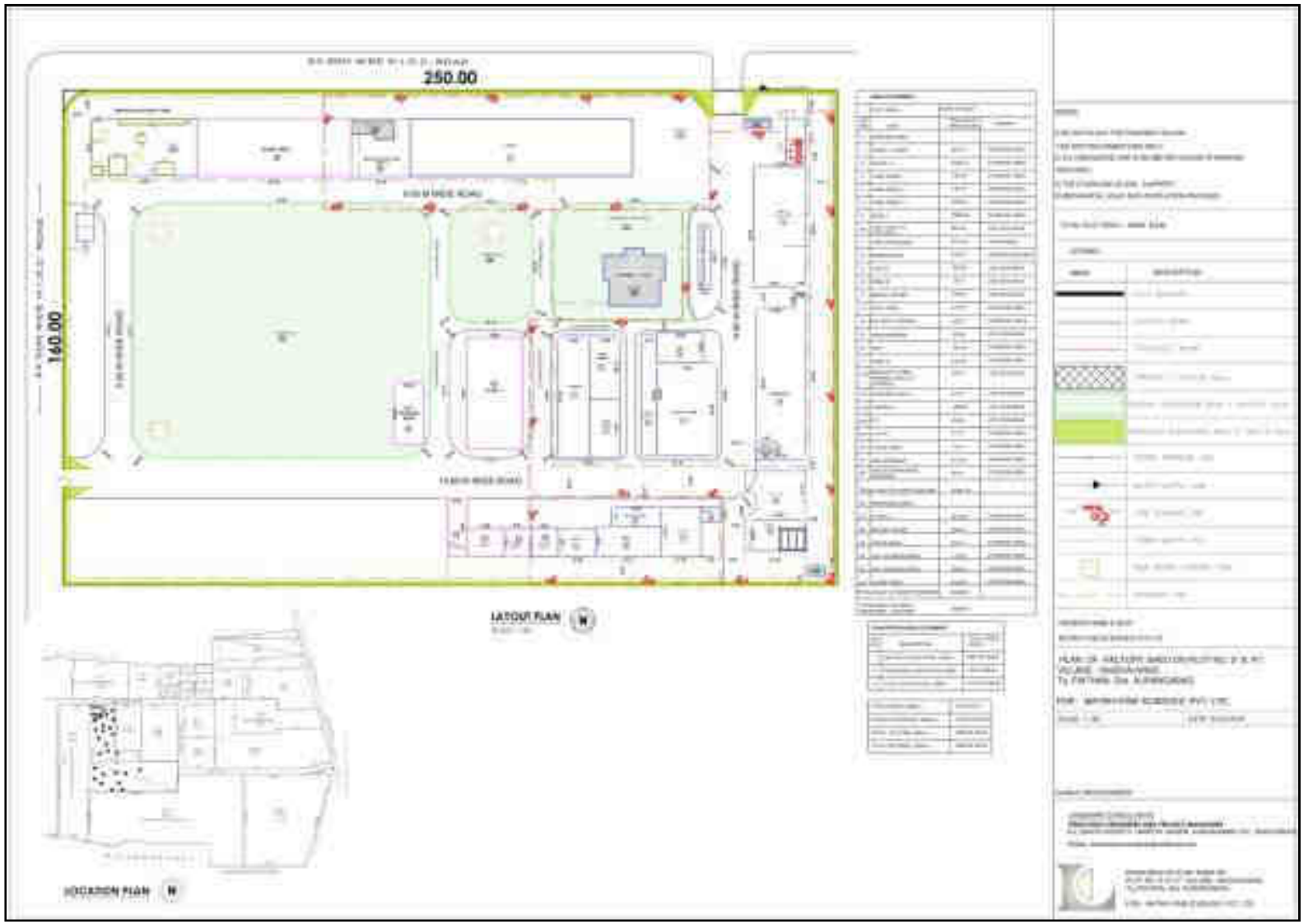
19,10.2 Take a roll call of your workers and inform Security and Personnel department immediately if any person is missing.

19.11 General Mass

19.11.1 If the danger is not in your building and are not trained either in first-aid or fire fighting keep doing your own job(over crowding may endangered building)

19.11.2 If danger exist in some corner of your building and you not trained either in first aid or fire fighting, stop / close your reactor or machine as per S.O.P. and assemble at specified safer zone. Stay there till the clear siren is given.

Annexure {X}: Fire Hydrant System for Matrix Fine Sciences Pvt. Ltd.



Annexure {XI}: EHS Policy

Matrix Fine Sciences Pvt. Ltd.

Regd Office : 12, [illegible] Nagar, Railway Station Road, Aurangabad- 431 005 [illegible]
Factory Address : [illegible]
E-mail : [illegible]
Website : www.matrixfinesciences.com Mob. : +91 [illegible] Tel. : +91 2431 [illegible]
CIN : [illegible]

IMS POLICY (QUALITY, ENVIRONMENTAL, OCCUPATIONAL HEALTH AND SAFETY POLICY)

We, at **Matrix Fine Sciences Pvt. Ltd.**, are committed to demonstrate excellence through compliance and continual improvement in Quality, Environmental, Occupational Health and Safety performance.

This will be achieved within the frame work of our Integrated Management System:

- Commitment to Customer Satisfaction, Environment Protection, prevention of pollution, prevention of injury and ill health.
- Identification, assessment, elimination, minimization or control of Environmental impacts and OHS Risks pertaining to all areas of operations, activities, products and services efficiently and effectively.
- Commitment to comply with applicable legal and other requirements to which the organization subscribes.
- Setting and periodically reviewing the Quality Environment and OHS objectives and targets in the areas of reduction in injuries, optimizing the consumption and conservation of natural resources.
- Strengthening QEHS awareness, skills and competence of our employees, business associates through on-going training and proactive communication.
- Creating, maintaining, encouraging and promoting sound QEHS practices and behaviors to meet changing business and regulatory needs.
- The policy will be reviewed periodically.
- Company is also committed of continual improvement towards Non GMO Status of its facility and reviewing the same periodically.

We shall communicate this policy to all persons working for and on behalf of the organization and also make it available to the public on request.

Revision No.: 01

Date: 05/06/2017

Managing Director