Chapter 7
Additional Studies

7.1. Public Consultation

The proposed project site is situated on Plot at Nej in Chikodi, Taluka of Belgavi district in Karnataka; which is not come under Karnataka government specified industrial area (KIADB). Hence, as per Environmental Impact Assessment (EIA) Notification No.S.O.1533 (E)" dated 14th September 2006; and amendment there at the proposed project requires conducting of public hearing. Accordingly, PH was conducted and details of same are presented as follows-

7.1.1 Details of Public Hearing

Date of Public Hearing	**:**	19.06.2019	
Place of Hearing	**:**	Shri Chandreshwari Chemicals Pvt. Ltd., Survey No. 82/1, Nej, Taluk - Chikodi, District - Belagavi	
Advertisement given	**:**	18.05.2019 & 22.05.2019	
News Paper	**:**	'Times of India' & 'Prajavani' (English & Kannada) 'Vijayavani' (Kannada) Copy of PH MoM enclosed at **Appendix H**	
• Members Present			
	1	Dr. S. B. Bomnanahalli Deputy Commissioner & District Magistrate, Belagavi.	Chairman
	2	Shri Vijaykumar T Kadakbhavi Sr. Environmental Officer, KSPCB, Dharwad.	Member
	3	Shri Jagdeesh I. H. Environmental officer, KSPCB, Belgaum-2	Convener

7.1.2 Minutes of Public Hearing Meeting

No.	**Points Presented by Public**	**Response Given by PP**	**Remarks**
1.	Shri. Arun Bone, Nej, He opinioned that as this industry is quite away from the residential village, there will not be any problem for the villagers of the Nej. The permission for the establishment of industry should be given by the authority with a condition that the people of the Nej should get the first preference for the job opportunity.	Project Proponent informed that preference will be given to local peoples.	--
2.	V Sunanda Reddy : Resident of	Point wise reply by Project	

	Nalanda, Dist- Telangana, stated that, 'I am the first Environmentalist in India to support industries. Generally Environmentalist opposes industries, but I support the industries by travelling to other states and participating in the public hearing. There are some suggestions & Request made by him as follows- 1. He requested industry authorities to explore rain water harvesting and to make arrangements to store water. 2. He suggested to conduct industrial skill development, trainings and practices to the youth of local like in Japan and Korea. 3. He requested to form coordination committee to implement CER activities by involving industry officials, Local officers, KSPCB officers and villagers. 4. He requested company to take improve of ground water levels, health condition of residents and to develop medicinal plants within 10Km surrounding area. 5. He requested the industry to take all proper pollution control measures to safeguard Air, Water, noise pollution and Land and to maintain ecological balance and environmental protection. Consultants have prepared a detailed EIA report and he requested public hearing panel committee to recommend to MoEF to issue unconditional permission to the Shri Chandreshwari Pvt. Ltd.'.	Proponent – 1. Rain water harvesting plan is mentioned in Chapter 2. 2. Project Proponent said that he will arrange such skill development sessions. 3. Detailed CER plan & it's implement schedule is given in Chapter 9 on the basis of the suggestions made by respective Functional Area Experts (FAE's) during their survey. 4.	
	Appreciations/Suggestions by Residents/NGO's		
1.	Shri. A B Bendiwade, Shamnewadi, stated that 'We all are very happy about establishment		

	of industry in our village by investing six crore rupees and already stated that there is no any harmful effect to environment. So we hope that the Deputy Commissioner, will give permission to start the industry. The unemployment is a big problem, the industry authority informed that around 40-50 people will get employment by the establishment of this industry. So I have full support for establishment of this industry. Already there are Garment and Textile industries in this area have reduced the unemployment problem. He expressed that if the permission is given to establish this new industry, it will reduce the unemployment problem further'.		
2.	Shri. Bahubali Patil, Bedakihal, expressed that, 'It is really very good thing that Shri Chandreshwari Chemicals Pvt. Ltd. industry will be established. The industrial authorities informed that there will not be any harm for the mother earth. Accordingly, industrialists should follow the environment rules and regulation and also they should install the chemical unit and effluent treatment unit. Here due to the lack of rain, surrounding people are suffering a lot, and such people shall be engaged in this industry. I welcome the industry coming up in this area and also I extend good wishes to the surrounding villages also'.		
3.	**Shri. H MadhuBabu : Telangana Resident**	I have submitted my views in the written format to the respective department during the environment public meeting of Shri Chandreshwari Chemicals Pvt. Ltd., and I support for the establishment of industry.	
4.	**Shri. B V Reddy, Ballari.**	I extend my best wishes to the management of the Shri	

		Chandreshwari Chemicals Pvt Ltd., They should use Hi- technology equipments as not to cause any harm for the surrounding villagers from the organic compound. By the establishment of this industry the unemployment problem of this area will be solved to same extent and due to this health camp and other works will improve this area. So I have full support for the establishment of this industry.	
5.	**Shri. Ajay Pantooji, Nej.**	I have no objection to start Shri Chandreshwari Chemical Pvt. Ltd., As the environment report is also done we have no objection to start the industry and local people should be preferred in the employment on top priority be given to the local peoples.	
6.	**Smt. Shobha Lamxan Nayak, Nej.**	I have support to establish the Shri Chandreshwari Chemicals Pvt. Ltd.,	
7.	**Smt. Sangeeta Nayak, Nej**	Already management of the Shri Chandreshwari Chemicals Pvt. Ltd., Industry given work for us in their agriculture land. I will support to this industry as the job opportunities will be given to us.	
8.	**Shri. Anjanye Naganehalli, Ranibaenuur.**	I fell very happy that Shri Chandreshwari Chemicals Pvt. Ltd., Public meeting is like a festival. The people of this village have not opposed the project because they believe that if the industry is established then the surrounding people will get the jobs. It is not possible to become IAS, KAS and Doctors for all, there is no possibility of getting Government jobs in any Government. Shri Chandreshwari Chemicals Pvt. Ltd., Industry is establishing with the investment of 6 crore. Under C.S.R, the development of surrounding area will be developed as they have proposed to invest 15 Lakhs/year. People have their full support for the industry. It is our duty to protect	

		the environment and also I request to protect the nature by growing trees.	
9.	**Smt. Manjula, Chitradurga.**	They have sought permission to start Shri Chandreshwari Chemicals Pvt. Ltd industry. As there is no rains, no crops so many agricultural families are suffering a lot. There is misunderstanding that by establishment of this industry it will be harm full for the agriculture, but it is wrong We request to the industry to give opportunity of job to local people. They have to use new technology and machineries as not to affect the environment including trees, animals, birds and farmers in the locality. They have to maintain good relation with public and farmers.	

7.2. Risk Assessment Report

The study of risk assessment report in respect of proposed project was done by Functional Area Expert (FAE) Mr. Vinod Sahasrabuddhe.

7.3. Brief Description Regarding Project

SCCPL's management has planned to go for establishment of Di-ethyl phthalet, & 37% Formaldehyde manufacturing unit. It involves number of equipments like reactors, condensers and distillation columns.

7.4. 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

7.5. Methodology

A] Identify hazards based on

- Processes description received based.
- 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 ALOHA.

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

7.6. 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.

7.6.1. Risk Prone Areas

Based on classification of chemicals the hazard prone areas have been identified as follows:
- Reaction and separation Sections of production unit
- Storage of chemicals in tanks or respective vessels
- Handling of the materials or the process equipment by the operator or worker.
- Transportation of the products and raw materials.

7.6.2. Qualitative Risk analysis

7.6.2.1. Reaction and Separation Sections of production unit

A. Formaldehyde Production:

- **Hazard Identification:**

Since the reaction is exothermic and is carried out at high temp and deals with Methanol air mixture. The probable hazards are explosion, fir and release of toxic gases from the reactor.

- **Mitigation measure**

  From the safety point of view Molybdenum process is safer and has other advantages too.

- **Safety**

Both processes operate with a gas mixture kept outside the explosion limits, and very often reducing the oxygen amount with inert gas dilution for additional safety. But in case of leak and contact of the reacting gas with the outside air, no harm derives in the

"MO" process, but a dangerous explosive mixture is formed in the "S" process. Also the total amount of methanol present in the plant is much lower in the "MO" process than in the "S" process. Thus, Molybdenum process is more and intrinsically safe against fire and explosion. However, Molybdenum process is chosen for high production capacities and is economically viable**.**

It is understood that this technology for the production of Formaldehyde has been chosen over the other used technology of using Molybdenum as catalyst, from the low production capacity and economic considerations.

It is understood that the process know how and basic engineering package will be obtained from a reputed and experienced supplier.

- **Recommendations while choosing Process know-how and Basic engineering package supplier:**

1) Scope of supply of Process know-how and basic engineering package should include conducting HAZOP studies.
2) It is preferable to carry out HAZOP study in presence of production, engineering, and safety personnel of the plant. So that, in addition to the process know-process why and thus the process is better understood.
3) Basic engineering know–how documents, in addition to normal documents must contain Safety Manual.
4) Training of operating staff and safety in-charge must include safety training, in addition to the normal plant operation, catalyst change over procedure and safety precautions to be taken during change-over.
5) The Know –how and basic engineering documents should contain PFD, as built P&I diagram, Operations manual, maintenance manual, instrumentation logic, safety manual, and other standard documents.
6) Check tank layout and location of Methanol storage tank in the factory and ensure that it is as per the rules and the requirement of PESO rules 2002.
7) Obtain CCE's approval for the same.

B. Diethyl Phthalate (DEP) Production

- **Hazards:**

General hazards associated with chemical reaction at moderate temp and atmospheric pressure are: Uncontrolled rise in temperature, Exposure to chemicals release reactants.

- **Mitigation measures:**

- It is suggested to carryout HAZOP /or understand clearly the circumstances under which the temperature mat rise uncontrollably. Provide temp indicators, high alarm, CW and general utility failure alarm, agitator failure alarm.
- Display clearly in local language actions to be taken in case of any of the parameter going abnormal and/or in case of alarm.
- Provide mechanical seals for pumps and reactor agitator for prevention of fugitive emissions of reaction vapours and ethanol, methanol leakages.

7.6.2.2. Storage and Handling of Hazardous Raw Materials

- **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 of 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.

- **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.

- **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.

7.6.2.3. 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 1. Flammable solvents, 2. Toxic and hazardous chemicals, 3. Corrosive chemicals.

A. Flammable Solvents stored in Tanks:

Methanol Class A Solvent is stored in 2 underground tanks of 50 Cu. M capacity of 3 M diameter and 7.5 meter length.

- **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) Improper earthing of tanks and tanker from which solvent is being unloaded.
3) The other hazard is soil pollution due leakage of underground tanks due to improper maintenance, use of improper anti- corrosive paint, failure to conduct regular pressure testing and thickness testing.

- **Mitigation measures recommended 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:**

1) Flexible hoses should only be used, taking the precaution to keep the length to the minimum.

2) Hoses should be made to a standard suitable for the application and should be compatible with the materials handled.
3) 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.
4) When they are not in use, flexible hoses should be protected from accidental damage, extremes of temperature and direct sunlight.
5) 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.
6) Hoses should be electrically continuous or bridged with an earthing cable to avoid electrostatic charging.
7) 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.
8) 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.
9) Bonding and earthing: A 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.)
10) To minimize the accumulation of electrostatic charge and prevent incendive sparks, all metal parts of the storage installation should be bonded together and earthed.
11) A maximum resistance to earth of 10 ohms is recommended. It should be possible to disconnect the earthing facilities for periodic test measurement.
12) For Further advice on earthing and bonding is it is recommended to follow the relevant Indian or International standards. in BS 7430.40
13) 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.
14) It is advisible to install an alarm system which warns and interlocks unloading operations of Class A solvent.

B] Solvent stored in Over-grond tank:

Ethanol is stored in one 130 Cu. M overground tank of 6 Meter dia and 4.7 M height.
Hazards:

- **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:**

1. Lack of awareness of the properties of flammable liquids.
2. Operator error, due to lack of training.
3. Inadequate or poor storage facilities.
4. Hot work on or close to flammable liquid containers.

5. Inadequate design, installation or maintenance of equipment.
6. Decanting flammable liquids in unsuitable storage areas.
7. Exposure to heat from a nearby fire.
8. 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.**

- **Mitigation Measures:**

1) Based on standard recommendations for moderate hazard is it is recommended to have Alcohol storage tanks should be in open in dyke walls and must have spill collection and control (recycle) arrangement to pump into another tank.
2) The storage tank will be in open with dyke walls.
3) Dyke wall dimensions should be such that clear volume is at least 1.2 times the tank capacity.
4) Clear distance between tanks will be provided as per the requirement of Petroleum Rules.
5) Location of pumps, location of tank farm in the factory should be as per the requirements of Petroleum rules.
6) Necessary approval from Chief Controller of Explosives will be obtained for the alcohol storage and factory lay out.

- **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 operations20 in areas where flammable liquids are stored or used. PTWs are formal management documents (see Figure 3). 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 PTWs need to relate to clearly defined individual pieces of work. PTWs 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 liquids, 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:

1. The types of flammable liquid stored, their properties and hazards.
2. Use of protective clothing.
3. Housekeeping.
4. Reporting of faults and incidents, including minor leaks and spills.
5. 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:**

1. Good Ventilation in the storage area.

2. No ignition source. To be stored in good containers. No spillage. Control of spillage.

Rules and regulations given Chapter III of Petroleum Rules 2002 will be followed:
Important are illustrated below:

1. Part I GENERAL 28 to 32
2. Part IV 62 for bulk transportation by tankers.

C] Storage of Sulphuric Acid

Maximum 5000 Kgs Sulphuric Acid is stored in 200 liter capacity carboys 25 numbers.

- **Hazard Spillage causing pollution and body harm in case of contact.**
- **Mitigation measures:**

1. Storage of Carboys should be in a separate shed, preferably open.
2. Carboys transport must use trolleys, and carboys secured safely.

3. The carboys must be stored together and in a stable position. If required chained.
4. Manual transfer from carboys to the user place or smaller container must be done by using suitable hand pump.

- **Safety Precautions for handling of Sulfuric acid**

Sulphuric Acid can be handled and used safely by following proper precautions based on known effects of the chemical on personnel and equipment. Sulfuric acid is a very strong acid which can severely burn skin and eyes and may be fatal if swallowed.
Fumes from sulfuric acid systems including SO2, SO3 and hydrogen are irritating and dangerous.
They can injure the lungs and mucous membranes if inhaled.

- **Safety Clothing and Equipment**

The principal health hazard from sulfuric acid is through contact of the acid with body tissues, which can be severely burned, depending upon the length of contact and strength of acid. Adequate protection should be provided to persons working with sulfuric acid.

- **The personal protective equipment required for handling sulfuric acid:**

- Full face shield, hard hats, goggles and protective gloves are usually required during routine operations which involve the handling of sulfuric acid. (Never wear contact lenses when handling sulfuric acid.)
- Gloves should always be inspected prior to their use, and, if damage is suspected and not visible, they should be tested with air pressure.
- Special arm protectors or glove inserts can also be worn to prevent this from happening.
- For full protection during tank car or transport unloading and during maintenance, each workman should be fully clothed. He should wear goggles under a full face shield, a hard hat, rubber safety boots, a rubber covered jacket and pants, and rubber gauntlet gloves. Tops of the boots should be covered by the trousers.
- For emergency situations, a complete rubber suit and rubber hood, with rubber gauntlet gloves and rubber safety boots, are recommended.
- In situations where fumes or mist from sulfuric acid are present, a NIOSH approved respirator should be worn.
- Self-contained breathing equipment approved by NIOSH should always be on hand and is required to be worn when working in areas of reduced oxygen content such as when servicing empty sulfuric acid tanks. Protective clothing should be washed and preferably neutralized after each use and checked to insure that it is free of pinholes and tears.
- The maintenance of all protective clothing and equipment should be a continuing operation to ensure their ready availability for use in an emergency.

- **First Aid**

- **Bodily Contact**

Contaminated clothing should be removed under the shower and the application of water should be continued for at least 15 minutes. If burns can still be felt, consult a physician. Do not use burn ointments or alkali's as they may hinder further treatment
If acid enters the eyes, they should be washed thoroughly with water for at least 15 minutes. Consult a physician at once. If a physician is not immediately available, it is advisable to continue the irrigation for another 15 minutes.

- **Ingestion**

In case of ingestion and if the individual is conscious, have him drink large amounts of lime water or milk of magnesia. If these are not readily available, drink large amounts of water immediately to dilute the acid. Consult a physician at once. Do not give emetics or baking soda. Inhalation If exposed to mist or vapors arising from sulfuric acid, the individual should be removed at once to an uncontaminated area and a physician called. The individual should be kept under observation until the possibility of developing a delayed pulmonary reactions is no longer present. If oxygen inhalation apparatus is available, oxygen may be administered under the direction of a physician.

- **Safety Showers and Eyewash Fountains**

Continuous flow safety showers and eyewash fountains should be conveniently located and clearly marked. Their location and use should be known and understood by all personnel. Periodic inspections, preferably on a weekly basis, should be made to insure that they are in proper working order at all times. It is recommended they be equipped with both visible and audible alarms so that those in the areas are alerted when someone may need assistance. Water temperature should be approximately 27 °C (80 °F) to permit long periods of washing without adding to the victim's discomfort.

- **Showers and eyewash fountains should meet the following criteria:**

a. Water should be in the form of a quick acting safety shower, protected against freezing, and installed wherever sulfuric acid is handled.
b. Showers should provide deluge water rather than spray.
c. Eyewash fountains should also be provided.
d. The pathways to these water supplies should always be kept free and clear.

- **Spill and Vapor Control Accidental spills of sulfuric acid**:

Environmental effects resulting in damage to plant and animal life can occur from releases of sulfuric acid.
Every effort should be taken to prevent discharge of this chemical into the environment.
Regulatory and/or disaster control agencies should be notified, as may be applicable, of significant releases into the environment water, and neutralized with a lime slurry, limestone, soda ash or other alkaline material.
Care must be taken when adding water or a neutralizer to a spill of sulfuric acid, as the chemical reaction will be immediate and can be quite violent. Fumes from the reaction can be extensive and, if not handled properly, will add to the severity of the situation. To minimize the reaction and fuming, the spill can be covered with earth, sprayed with water and neutralized. The resulting slurry or residue can be removed and transferred to an approved disposal site. Any remaining material can then be further neutralized and flushed with water in accordance with local regulations.
Major spills may be handled in a similar manner, however, special assistance and/or procedures may be required. In this case, evacuate the area, contain the spill or stop the leak if possible.

D] Storage of Formaldehyde:

Maximum 100 MT 37% Formaldehyde is stored in 2 overhead tanks of 3.5 Meter dia and 3.5 Meter height. (35 Cu. M capacity each)

- **Hazard:**

Exposure to the workers while handling and to other working staff in case of leakage
Potential Chronic Health Effects: Hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC

The permissible exposure limit (PEL) for formaldehyde in the workplace is 0.75 parts formaldehyde per million parts of air (0.75 ppm) measured as an 8-hour time-weighted average (TWA).
Harmful Effects on Workers Formaldehyde is a sensitizing agent that can cause an immune system response upon initial exposure. It is also a cancer hazard. Acute exposure is highly irritating to the eyes, nose, and throat and can make anyone exposed cough and wheeze.

Concentrations of 100 ppm are immediately dangerous to life and health (IDLH).

Airborne concentrations of formaldehyde above 0.1 ppm can cause irritation of the respiratory tract. The severity of irritation intensifies as concentrations increase.

- **Mitigation Measures:**

Workers should use PPEs, masks when handling or transferring Formaldehyde**.**
SCBA should be readily available near the storage of FD and near the place of use. **Any leakage must be dealt and attended after wearing proper PPEs, mask or preferably SCBA.**

- **Precautions in handling p-Toluenesulfonic acid monohydrate:**
  - NFA rating is Nh=3, Nf=1 and Nr=1
  - It is hygroscopic and causes burns on skin contact.
  - Must be kept away from the contact with water and moisture in tightly closed container

7.6.3. Quantitative Risk Assessment (QRA)

A. QRA for Methanol:

- **Basis for QRA calculations**

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

- **Scenario:**

1. **There is 10 mm hole in the unloading hose.**

2. **The unloading 50 mm diameter hose gets disconnected during tanker unloading and there is pool fire**

Under Scenario 2: Threat zone predicted for Flammable Area of Vapor Cloud
Model Run: Gaussian
Red : 14 meters --- (43080 ppm = 60% LEL = Flame Pockets)
Yellow: 19 meters --- (7180 ppm = 10% LEL)

- **Threat zones predicted are:**

TABLE 7.1 Threat Zone Predictions

Scenario No	Maximum Flame length	Total qty burned	Puddle dia	10 Kw/sq cm	5 Kw/sq cm	2 Kw/sq cm
1	2 meters	204 Kgs	2.1 meters	Less than 10 Meters	Less than 10 M	Less than 10 M
2	6 meters	5089 Kgs	10.6 meters	12 Meters	14 Meters	19 Meters

3. **There is a leakage in the tank, goes unnoticed and there is pool fire and Methanol tanker (from which Methanol is getting unloaded) gets heated and there is vapour cloud formation, which catches fire and there is explosion when there is 20% tanker mass in the fireball.**

B. QRA for Ethanol:

Ethanol is stored in one 130 Cu. M tank of 6 Meter diameter and 4.7 Meter height. QRA is done with following assumed conditions:

- **ATMOSPHERIC DATA**: (MANUAL INPUT OF DATA)

- Wind: 5 meters/second from NE at 3 meters
- Ground Roughness: open country
- Cloud Cover: 0 tenths

- Air Temperature: 35° C
- Stability Class: C
- No Inversion Height
- Relative Humidity: 5%

- **Scenario 1: There is leak at the bottom of the tank in the flange of 5 mm diameter when the tank is 85% full and there is pool fire:**

The threat zones predicted are

1. Total Amount Burned: 52.2 kilograms in one hour
2. Puddle diameter is 0.8 meters
3. Flame length is 1 meter
4. Heat conc. (10.0 kW/(sq m) = potentially lethal within 60 sec) Less than 10 meters
5. Heat conc. (5.0 kW/(sq m) = 2nd degree burns within 60 sec) less than 10 meters (10.9 yards)
6. Heat conc. (2.0 kW/(sq m) = pain within 60 sec) less than 10 meters (10.9 yards)

- **Scenario 2: There is leakage in the tank when tank is 85% full, there is fireball cloud and BELEV when** 20 % tank mass is Mass in Fireball:

Threat zones are –

1. Fireball Diameter: 151 meters
   Burn Duration: 10 seconds
2. Pool Fire Diameter: 156 meters
   Burn Duration: 2 minutes
3. Flame Length: 65 meters

Threat Modeled: Thermal radiation from fireball

1. Red : 277 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
2. Orange: 396 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
3. Yellow: 622 meters --- (2.0 kW/(sq m) = pain within 60 sec)

Conclusion: The situation under these circumstances will be very serious and will result in fatal injuries to number of people.
This emphasizes the need for vigilance, avoiding ignition source and initiate immediate action to control the leak as soon as it is noticed.
Take action to cool down the tank by water spray.

7.7 On-site Emergency Plan:

The company will prepare On-site emergency plan as per the guidelines given below and as per the requirement of Factory act and will take into the consideration this RH report.

- **Guidelines for the preparation of On-site Emergency Plan:**

This can be made as per the following guidelines suggested below:
On-site and Offsite emergency plan) will be prepared as per the factory act and will be prepared as per Rule no. 12 of factory act (control of Industrial Major Accident Hazard Rules, 2003) as per the guidelines given in Schedule 6.

- **Objectives of Onsite Emergency Plan will be:**

a) To control emergency situation arising out of possible hazards identified in the factory fire, explosion, and toxic leakage.
b) To identify all possible hazards, its consequence, areas affected.
c) To estimate areas affected.
d) Define actions to be taken in case of emergency.
e) Identify persons responsible to take necessary actions to deal with situation.
f) To localize emergency and if possible eliminate it.
g) To avoid confusion, panic and handle the emergency in a planed manner.
h) To minimize loss of life and property to the plant as well as to the neighborhood.
i) To carry out rescue operations
j) To treat injured persons and transfer to the nearest hospital for treatment.
k) To restore normalcy.

- It will specify names of key personnel as:

❖ Chief Controller (Generally he is Factory Chief)
❖ Incidence Controller (Generally he is plant in charge where emergency has occurred or shift in charge after General Shift), Under Chief Controller, three teams are formed
  - RESCUE TEAM
  - SERVICE TEAM
  - WELFARE TEAM

❖ Liaison Office

The nature of responsibilities of these Key personal & Teams are clearly defined. Reporting chain of command will be clearly defined.

- Following documents will be required and will form essential part of the Onsite and offsite Emergency Plan

1. Factory layout showing location of all plants, location of hazardous storage, location of Emergency control center.
2. Factory layout showing designated assembly areas
3. Block diagram of manufacturing processes.
4. List of hazardous chemicals stored.
5. MSDS of all hazardous chemicals.
6. List of Anti dots.
7. List of Key Factory personnel with contact numbers and addresses.
8. List of employees trained in fire fighting with contact numbers.
9. List of employees trained in first-aid and rescue operations.
10. List of Telephone numbers and addresses of outside government and other agencies mainly
    - Nearest Police station
    - Nearest Fire Brigade Station
    - Ambulance services
    - Nearest Government and other Hospitals
    - Blood Bank
    - MSEB
    - MPCB
11. Emergency Action Plan in case of all possible hazards identified.
12. Procedure for reporting emergency will be clearly defined.
13. Actions to be taken by personnel where emergency has occurred and
14. Actions to be taken by personnel at other location will be clearly defined.

15. Precautions/Actions to be taken after emergency will be clearly defined.

7.8 Training and Mock Drill:

It is absolutely necessary to train & carryout mock drills for success of emergency plan during actual emergency. Emergency procedures should be laid down clearly and convincingly to everyone on site, particularly the KEY PERSONNEL & ESSENTIAL WORKERS.

7.9 Disaster Management Plan:

This will be prepared after the preparation of On-site emergency Plan in co-ordination with industries round and local Government authorities.

7.10 Occupational Health Center (OHC)

The company will establish OHC as per the Factory act, Rule 73, depending upon the workers employed. The rule clearly states the provisions and facilities to be made available, requirements of medicines and first aid to be kept in stock, requirement for pre-employment and regular medical check-up, trained man-power required to be employed in OHC, the need for 24X7 Ambulance availability.

Since the workers will be dealing with hazardous and toxic chemicals following is suggested:
It is clear that the parameters for periodic health check up for workers has to be based on and decided on the hazardous chemicals handled in the process (Raw material, intermediates, solvents, products), their toxic properties and the extent to which shop floor workers, including contract labours, operators, officers are exposed to these chemicals
Detailed information on the groups of hazardous chemicals, chemicals included in the group, their use, target organs, (organs which are affected by the exposure to these chemicals) and corresponding medical tests to be carried out is available.
It is expected that the parameters based on such or similar tables, hazardous properties of chemicals (available in MSDS) have to be finalized by the OHC doctor in consultations with the safety officials of the company.
Frequency of periodic examinations will depend upon the exposure, TLV values, extent of these chemicals in air, based upon air monitoring.
Periodic medical examination, in comparison with pre medical checkup results will reveal the ill effects on the worker's health. This will help early detection of the disease and the effect on organs tec. This should be used for suitable corrective action to prevent further deterioration. Suitable medical treatment should be initiated for the worker.
If air monitoring shows presence of hazardous chemicals more than TLV values, suitable action needs to be initiated immediately to improve process conditions/ pollution measures.
For less hazardous industries, same health parameters as per pre employment check up should be included in periodic medical checkup.

7.11 EHS policy:

Company will have clearly defined EHS policy and it will be known to all employees and will be properly displayed.