Risk Assessment

7.1 Risk Assessment

Industrial accidents result in great personal and financial loss. Managing these accidental risks in today's environment is the concern of every industry including chemical fertilizers, because either real or perceived incidents can quickly jeopardize the financial viability of a business. Many facilities involve various manufacturing processes that have the potential for accidents which may be catastrophic to the plant, work force, environment, or public.

Risk analysis involves the identification and assessment of risks; the neighboring populations are exposed to as a result of hazards present in the plant operation. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of populations etc. The risk analysis is often confined to maximum credible accident studies. In this chapter, the identification of various hazards, probable risks in the proposed SSP/LABSA (Powder and granular) manufacturing plant, maximum credible accident analysis, consequence analysis are addressed, which gives a broad identification of risks involved. Based on the risk assessment, disaster management plan has been presented.

The main objective of risk assessment study is to propose a comprehensive but simple approach to carry out risk analysis and conducting feasibility studies for industries, planning and management of industrial prototype hazard analysis study in Indian context.

Quantitative Risk Assessment (QRA) may be carried out to serve the following objectives:

- Identification of safety areas
- Identification of hazard sources
- Generation of accidental release scenarios for escape of hazardous materials from the facility
- Identification of vulnerable units with recourse to hazard indices
- Estimation of damage distances for the accidental release scenarios with recourse to maximum credible accident (MCA) analysis
- Estimation of probability of occurrences of hazardous event through fault tree analysis and computation of reliability of various control paths
- Assessment of risk on basis of above evaluation against the risk acceptability criteria relevant to the situation
- Suggest risk mitigation measures based on engineering judgment, reliability and risk analysis approaches
- Delineation /update DMP
- Safety Reports: with external safety report/ occupational safety report,
- The risk assessment report may cover the following in terms of the extent of damage with resource to MCA analysis and delineation of risk mitigations measures with an approach to DMP.
- Hazard identification – identification of hazardous activities, hazardous materials, past accident records, etc.
- Hazard quantification – consequence analysis to assess the impacts
- Risk mitigation measures
- Disaster Management Plans

7.1.1 Hazard Identification

Identification of hazards in the proposed plant is of primary significance in the analysis, Quantification and cost effective control of accidents involving chemicals and process. A classical definition of hazard states that hazard is in fact the characteristic of system/plant/process that presents potential for an accident. Hence, all the components of a system/plant/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events which can be termed as an accident.

7.1.2 Hazard Assessment and Evaluation

A preliminary hazard analysis is carried out to identify the major hazards associated with storage and the process of the plant. This is followed by consequence analysis to quantify these hazards. Finally the vulnerable zones are plotted for which risk reducing measures are deduced and implemented.

Physical and Health Occupational Hazards in any large scale Chemical /Hydrocarbon Processing

Industry (CPI/HPI) can be broadly classified into the following categories:

- Mechanical Risks
- Electrical Risks
- Fire/Explosion Risks
- High /low Temperature Exposure Risks
- Toxic/Carcinogenic Chemicals Exposure Risks
- Corrosive/Reactive/Radioactive Chemicals Exposure Risks

The first two types of risks are of universal nature associated with any industrial activity and not specific to a particular plant or process.

Mechanical Risks

Mechanical risks which are generally encountered are injuries to the head, Limbs, eyes, etc usually as a result of negligence on the part of operating/maintenance personnel in the use of improper tools, bypassing prescribed safety procedures neglect of personal protective wear and risks associated with rotating machinery as well as risks associated with high-energy release from compressed gases. Electrical risks which result in shock and/or burns are most often a consequence of poor maintenance, ingress of dust or moisture, handling by unauthorized personnel and use of improper/substandard hardware.

Electrical Hazards

Electrical hazards leading to fire and explosion in switchgear and other equipment mainly due to failure of circuit breakers, insulators, fuses, bus bars, and poor maintenance. Accidents may also occur in transformer due to open arcing, flashover above oil level, insulator failure, overloading, failure of air cooling system, lighting etc. Nevertheless, all these hazards lead to localized accidents only.

Fire Hazards

There could be other areas in the plant that have a potential for fire hazard and require adequate firefighting equipment for example, the fuel storage. These are considered here since uncontrolled fire may trigger the above emergencies due to domino effect. However for the proposed plant, safety guidelines will be as per Tariff Advisory Committee.

Toxic release

The proposed plant will use Sulphuric acid which is corrosive and toxic. If sulphuric acid will not handled properly it will lead to toxicity and burns. Self contained breathing apparatus will be available in the premises in the event of leakage in case of emergency. Employees will be trained in handling these self contained breathing apparatus. Since the quantity of toxic release will be on lower side, offsite implications of release are not envisaged.

Hazardous Chemicals Release

There are various hazardous chemicals (toxic and flammable), which will be used as raw material for manufacturing of SSP in the plant. Separate storage area will be provided for these chemicals and will be handled with at most care following the safety norms for handling of hazardous chemicals. Bulk storages are provided for those chemicals, which will be required in the large quantity and are flammable/toxic in nature. The storage tanks will be in the isolated zone and will have fire water hydrant system. The details of bulk chemical storage are given in **Table 7-1**.

Table 7-1: Chemical Storage details

Sr. No.	Particulars	Number of tanks	Capacity of Storage	Category
1	Sulphuric Acid	Three	1500 MT	Corrosive

Properties of the chemicals are mentioned in below.

1. Sulphuric Acid:

a. It is highly corrosive in nature.

b. Specific gravity is 1.84 (water = 1).

c. Vapor Density is 3.4 (air = 1).

Preliminary Hazard Analysis for Process and storage areas is mentioned in **Table 7-2**

Table 7-2: Preliminary Hazard Analysis for Process and storage areas

Sr. No.	Blocks/ Area	Capacity / Quantity	Hazard Identification
1	Flammable Chemical Storage (HSD)	200 Ltr	Fire, Spontaneous Combustion
2	Power Transformers	-	Explosion and Fire
3	Switch – yard Control Room	-	Fire in cable galleries and Switchgear / Control Room.
4	Process reaction vessels	-	Fire due to accidental spill, leakages of flammable raw material from the equipment.

Preliminary Hazard analysis for whole plant in general is mentioned in **Table 7-3**.

Table 7-3: Preliminary Hazard analysis for whole plant in general

Sr. No.	PHA Category	Description of Plausible Hazard	Provision
1	Environmental Factors	If there is any leakage and eventuality of source of ignition	All electrical fittings and cables are provided as per the specified standards.
		Highly inflammable nature of the chemicals may cause fire hazard in the plant.	A well designed fire protection including dry powder, CO2 and foam extinguisher should be provided. Fire extinguisher of small size and big size are provided at all potential fire hazard places. In addition to the above, fire hydrant network is also provided to required locations in plant.

7.1.3 Safety Measures

Following safety measures will be provided to ensure safe operations:

- Applicable standards will be followed in the design of equipment.
- Piping for flammable liquid will be provided with continuity jumpers and earthing.
- Safety valve will be provided as per requirement
- Fire protection system will be provided to locations handling flammable liquids and appropriate type of fire extinguishers will be provided.
- Fire alarm system will be provided in plant identified risk areas
- Adequate Process safety interlocks shall be included in the design
- Standard operating procedures (SOP) will be provided for each unit operation
- On site emergency plan have been prepared for the onsite emergencies
- Adequate Personal Protective Equipment (PPE) such as hand gloves, safety goggles, helmets, safety shoes, protective clothing, apron, respirators will be provided
- First aid and fire fighting training will be provided to all the employees
- Work permit system will be applied to the major installations
- Pre employment and periodic medical checkup will be carried out.

Specific Safety Measures Related to Sulphuric Acid Storage & Handling

Sulfuric acid is a corrosive, oily, colorless liquid when pure. Sulfuric acid is most often used as a chemical intermediate to manufacture other chemicals.

Common Routes of Sulfuric Acid Exposure:

- **Inhalation** - The most common way for sulfuric acid to enter the body is through the respiratory system. Serious lung damage may result from inhalation exposure to sulfuric acid.
- **Contact with the Skin** - Sulfuric acid can irritate the skin and cause chemical burns ranging from mild to severe, depending on the concentration of the sulfuric acid solution. Concentrated vapor or solution that contacts the skin may cause the victim to experience severe pain, redness of the skin, blisters and necrosis.

- **Contact with the Eyes** - Sulfuric acid or sulfuric acid vapor, even with short term exposure, can irritate the eyes and cause burning, swelling, tearing of the eyes and/or blurred vision, and may cause blindness.
- **Ingestion** - Immediate burning in the mouth and throat occur when sulfuric acid is swallowed. Ingestion of concentrated solution can cause severe pain in the mouth, chest and abdomen, nausea and vomiting, or perforations in the esophagus.

Acute Health Effects of Sulfuric Acid Exposures:
As the concentration of sulfuric acid increases, the symptoms become more severe. Acute exposures to sulfuric acid can cause immediate burning of the eyes. Itchy, burning eyes can help to warn people of potentially hazardous exposure levels. The very young, the very old, and people with health problems are at an increased risk from the health effects of sulfuric acid exposure.

Chronic Health Effects of Repeated Exposure to Sulfuric Acid:
Erosion of the teeth, gastric strictures, chronic bronchial irritation with cough, and/or chronic shortness of breath may occur with repeated or long-term exposure to sulfuric acid. Skin rashes may also occur with repeated exposures of dilute concentrations of sulfuric acid.

Proper Handling and Storage Procedures:
Before working with sulfuric acid, individuals will be trained in its proper handling and storage and know how to use proper personal protective equipment. Sulfuric acid will be stored in a cool, dry, well ventilated area in tightly sealed containers protected from exposure to weather, extreme temperature changes, and physical damage. Sulfuric acid is incompatible with organic materials and metals.
Contact with either of these materials can cause fire and explosions, or generation of toxic sulfur dioxide fumes and flammable hydrogen gas.
If a fire occurs in the immediate vicinity of sulfuric acid containers, will be removed promptly if it can be done safely. If removal will not be possible, use of dry chemical or carbon dioxide to extinguish the fire for small fires. For large fires, flood the fire area with water from a safe distance. When water is applied directly to sulfuric acid, heat evolves and spattering may occur. When heated, sulfuric acid emits highly toxic fumes, so firefighters would use positive-pressure breathing apparatus.

Personnel Protective Equipment:
Clothing
Skin contact with sulfuric acid will be avoided. Chemical-resistant clothing and protective gloves (Nitrile and natural rubber gloves are best suited for prolonged contact with sulfuric acid, but vinyl gloves are also acceptable) will be provided to the workers.

Eye Protection
Employees will use splash-proof goggles when there will be any possibility of sulfuric acid exposure.
An eye-wash fountain or an eye wash kit for emergency responders will be available if there will be any possibility of the eyes coming in contact with a solution or liquid sulfuric acid with more than 1 %sulfuric acid by weight.

First Aid Management:

Prompt action will be taken if there is a sulfuric acid spill or leak. If a sulfuric acid spill or leak occurs, following actions will be taken:

- **Breathing**
  If sulfuric acid is inhaled, person will be moved to the fresh air at once. If breathing stops, artificial respiration will be performed. Affected person will be kept warm and resting and medical attention will be provided immediately.
- **Eye Exposure**
  Eyes will be washed immediately with large amounts of water for at least 15 minutes, lifting the upper and lower lids. Medical attention will be provided immediately. Contact lenses will not be worn when working with sulfuric acid.
- **Skin Exposure**
  Skin contaminated with sulfuric acid will be flushed with soap and water for at least 15minutes. If strong concentrations of gas or solution penetrate clothing, then cloths will be removed and skin will be flushed with water. Medical attention will be provided immediately.
- **Swallowing**
  If sulfuric acid solution is swallowed, and the person is conscious, large amounts of water or milk will be given to dilute the sulfuric acid solution. Attempt to vomit by exposed person will be allowed. Medical attention will be provided immediately. Material safety data sheet (NISDS) will be referred or a physician will be called.

Spill Management:

If a sulfuric acid spill or leak occurs, following actions will be taken:

- Trained personnel will be called immediately, such as the company fire officer or the local fire department. Untrained persons or those without proper personal protective equipment will not allowed enter in areas with high concentrations of sulfuric acid.
- Evacuation and restriction of people from the hazardous area of a sulfuric acid release.
- Stop or control the source of exposure.
- Ventilation of contaminated atmospheres by opening windows to disperse the fumes.
- If the exposure is from the spill of a solution, collection of the spilled material. Dilution and neutralize of the spill and dispose in a secured landfill.

7.2 Disaster Management Plan

The DMP is supposed to a dynamic, changing, document focusing on continual improvement of emergency response planning and arrangement. A structure working on a Plan, Do, Check and Review (PDCR) cycle has been therefore suggested. A person, head of operations, will be deployed who will be in-charge of overall disaster management system.

7.3 Policy

The Environment, Health and Safety (EHS) policies are to be made accessible to all at site and to other stakeholders. The policies must be framed considering legislative compliance, stakeholder involvement, continual improvement, and management by objectives.

7.4 Planning

7.4.1 Identification and Prevention of Possible Emergency Situations Identification of Emergencies

Possible emergency situation can broadly be classified into toxic release, fire or explosion, while doing so, it is stressed that these results are only for the modeled scenarios and, that the distances as well as damages can change depending upon the actual development of a scenario. Additional emergency situations can be developed on the basis of audit / HAZOP or other procedures prior to commencement of operations.

Emergency Prevention

Some of the ways of preventing emergencies are as follows:

- Preparation of a Preventive Maintenance Category Programme covering maintenance Category for all critical equipments and instruments as per recommendations of the manufacturer's user manuals.
- Establishment of a computerized Failure Modes Effects and Criticality Analysis (FMECA) or similar procedure to generate data on failures of critical equipments and instruments based on mode wise failures and their criticality. This requires codification of equipments, instruments and their modes of failure and their criticality. Consideration may be given to the use of appropriate software for processing FMECA data for review of the Preventive Maintenance Category and for improvement of the same to ensure critical failures,
- Establishment of a Non Destructive Testing (NDT) system as necessary. This may not be feasible in-house but there are specialized organizations who undertake the work, and the same may be used.
- Importantly, it is of great importance to collect and analyze information pertaining to minor incidents and accidents at the site, as well as for recording near-misses or emergencies that were averted. This information gives an indication of how likely or unlikely it is for the site to face actual emergencies and what should be further done to prevent them from occurring. Establishment of an ongoing training and evaluation programme, incorporating the development of capabilities amongst employees about potential emergencies and ways and means of identifying and averting the same. Most emergencies do not occur without some incident or an abnormal situation. So there is always sometime of few seconds to few minutes to arrest an incident of abnormal situation from turning in to an emergency. This is the role of the shift in-charge who is the incident controller(IC) along with his shift team.

7.4.2 Formation of Emergency Plan Objectives

Specific objectives of the Emergency Response Plan are to be clearly listed with regards to the responses desired for successful management of the possible emergency situations. Suggested
Objectives could, initially include:

- Formulation of suitable onsite / offsite fire release response

- Improved awareness of safety issues amongst site personnel
- Training of key persons in cardio-pulmonary resuscitation and other first aid

The objectives suggested currently are generic in nature. However, they will evolve and become more specific as the project develops further. Responsibilities, resources and timeframes require to be allocated for implementing the objectives.

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7.5 Onsite Emergency Plans

7.5.1 Types of Emergencies

In an industry where various types of hazardous chemicals are handled, various processes are carried out the following types of emergencies can occur:

- Fire, explosion or release of toxic gases
- Spillages of chemicals in large quantities resulting into pollution of land
- Collapse of building or structure due to explosion
- Release of hot material due to run away reaction resulting into person injuries to people
- Toppling of road tanker containing flammable or corrosive chemicals resulting in to contamination of land

7.5.2 Statutory Requirement of Onsite Emergency Plan

Section 41B of Factory Act 1948 defines to draw up an Onsite Emergency Plan with mentioned of all control measures for the industry and educate employees accordingly about the plan. Rule 13 of Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 says to prepare an Onsite Emergency Plan.

7.5.3 Hazard at Out Unit

Following hazards have been identified as emergency situation at out unit:

- Fire
- Explosion
- Release of Toxic Gases

Fire as we all know, sets up with the combination of Air, Fuel and heat sources. In an industry it becomes utmost necessary to eliminate all sources of heat generation. Some of the following aspect scan be ensured to remove any chances of heat / spark generation:

- Provision of Spark arrestor on all incoming vehicles

- Installation of flame proof electric fittings in the areas where flammable chemicals are stored or handled
- Carrying out of hot work activities with an adequate work permit
- Ensure earthing connections to equipment / vehicle wherever is required
- Prohibition of items that has a potential to create a direct spark such as matchboxes, camera, mobile phones etc. beyond specified limit
- Usage of non-sparking tools in flameproof areas Explosion is generally occurring inside a vessel or outside the vessel, which resulted into loss of flammable or toxic chemicals. Release of flammable vapor during an explosion can lead to BLEVE

(Boiling Liquid Expanding Vapor Explosion), which can create havoc inside the factory as well to the neighboring population. Release of toxic gases can occur due to failure of safety system of the equipment or excess pressurization of reactive mass inside a vessel.

There are some other incidents that have potential to convert into a disastrous situation; those incidents are categorized as below:

- Earthquake
- Cyclone
- Manmade War
- Sabotage

7.5.4 General Guidelines

- Site Main Controller or Incident Controller can change the guideline based on prevailing situation.
- Fire Operator / Fireman should be available at fire station till maintenance engineer take charge from him. After that he will follow the instructions of incident controller.
- Follow the instructions of Incident & site main controller.
- Plants and unit may be stopped as per the instructions of site main controller and incident controller.
- Those who are not required for handling emergency or running plants should move to assembly point.
- All employees should guide visitors or contractors to approach assembly point.
- One trained first aider must be available at the occupational health centre and assist / coordinate factory medical officer / male nurse during emergency.
- Emergency vehicle should be available near security main gate with spark arrestor, and rush to the emergency control centre at the blowing of emergency siren. The driver of emergency vehicle will follow the instructions of Incident Controller / Site Main Controller.
- The shift engineer / Electrician to get ready to manage MCC as per the instructions Incident Controller / Site Main Controller.

The Disaster Management Plan (DMP) is a guide, giving general considerations, directions and procedures for handling emergencies likely to arise from planned operations. Site specific documentation contingent to – and demonstrating suitable implementation of the DMP is described in the annexure to the DMP. The Annexure, being site specific, will require to be updated once the actual site operations are underway.

The DMP must also be revaluated prior to start of operations and it is the responsibility of the Plant Manager to do this. The DMP has been prepared for Narmada Bio fuel Pvt. Limited on

the basis of the Risk Assessment and related findings covered in the earlier chapters of this report. The results of consequence assessment for the credible scenarios indicate that the risk contours are confined within the site boundary only.

7.6 Emergency Control

In case of emergencies, actions can broadly be categorized into the following activities:

- Saving of human lives
- Controlling the spread of the emergency and ultimately stopping it from further developing On the basis of the issues covered in this chapter, the following are required to be incorporated in to the CP for implementing this EP's requirements:
- Onsite Emergency Control
- Shut down and Isolation: Raising the alarm, followed by immediate safe shut down of the power supply, and isolation of affected areas.
- Escape, Evacuation and Rescue: Safeguarding human lives at site by commencement of the Emergency Evacuation and Rescue Plan. Ensuring that all personnel are accounted for and carrying out a head count of persons evacuated. Notification and commencement of offsite emergency plan in case offsite impacts are possible.
- Stopping the development of the emergency: Control or response to the emergency depending upon its nature (fire or explosion).
- Treatment of injured: First aid and hospitalization of injured persons.
- Protection of environment and property: During mitigation, efforts should be made to prevent impacts on environment and property to the extent possible.
- Welfare of the personnel managing the emergency: Changeover, first aid and refreshments for the persons managing the emergency.
- Informing and collaborating with statutory, mutual aid and other authorities including those covered in the Local Crisis Group.
- Informing and assisting relatives of the victims.
- Informing the news and electronic media.
- Preserving all evidences and records: This should be done to enable a through investigation of the true causes of the emergency.
- Investigation and follow up: This requires to be carried out to establish preventive measures for the future and a review of the EP and CP to fill up the deficiencies in the emergency planning procedures.
- Ensuring safety of personnel prior to restarting of operations: Efforts require to be made to ensure that work environment is safe prior to restarting the work.

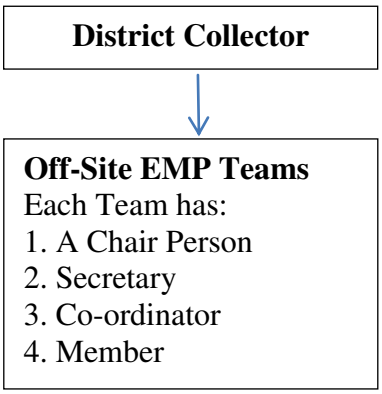
7.7 Off-site Emergency Response Plan

The following are the Expanded Incorporation's responsibilities towards generation of the Offsite Emergency Plan:

- To provide basic information on Risk and Environmental Impact Assessment to the Local/District Authority, Police, Fire Brigade, Doctors, surrounding industries and the public and to appraise them on the consequences and the protection/prevention measures and control plans and seek their help to manage the emergency.
- To assist the District Authorities in preparing the Off-site Emergency Plan.
- An off-site emergency plan organization has essentially two parts:

- Formation of the Local Crisis Group: This Group is headed by the Deputy Collector or the Magistrate of the Industrial area and is responsible for the management of any industrial emergency confined to the local area.
- Formation of the District Crisis Group: This Group is headed by the District Collector of the District and is responsible for any major Industrial emergency affecting Local and beyond any industrial area of the District. The composition of the Off-site crisis is covered in. since, the actual offsite plan requires the participation of outside agencies; this report does not dwell further on the issue. Refer **Figure 7-1**.

Figure 7-1: Composition of Offsite Crisis Group



7.8 Offsite Plan Components

Based on the details of the hazard distances of identified containment loss scenarios, the detailed offsite plan may be drawn up in consultation with the Local Authorities.

7.9 General Safety Practices

7.9.1 Work Permit System

- It is recommended that plot plans of the installation and the operating blocks should be displayed in the fire and concerned unit control rooms respectively and site of hot jobs under progress should be indicated on these plot plans with red pins
- No hot/cold work shall be undertaken without a work permit except in the areas predetermined and designated by the owner-in-charge
- Permit should be issued only for a single shift and its validity should expire at the termination of the shift. However, where the work has to be continued, the same permit may be revalidated in the succeeding shift, by authorized person after satisfying the normal checks
- Equipment or area where work is to be conducted should be inspected to ensure that it is safe to carry out the work and assess other safety requirements / stipulations Unsafe conditions for performance of work may arise from surrounding area. It should be cleaned-up to remove flammable material such as oil, rags, grass etc

- Other activities (routine / non-routine) being carried out near-by which can create conditions unsafe for performance of the permit work, should be taken into consideration and the concerned persons should be alerted accordingly
- Running water hose and portable fire extinguisher are required respectively to flush /dilute in case of release of any hazardous chemical or to quench sparks and to put out small fires immediately
- In order to meet any contingency, it should be ensured that the fire water system including fire water pumps, storage, network etc. is checked and kept ready for immediate use
- Equipment / Vessel, on which the work permit is being issued, should be completely isolated from the rest of the plant with which it is connected during normal operation, in order to ensure that there is no change in the work environment with respect to presence of toxic / flammable gases, liquids, hazardous chemicals etc. in the course of the work
- Equipment under pressure should be depressurized after isolation. This will be followed by draining / purging / water flushing etc. as the case may be
- Proper means of exit is required in case of emergencies developed on account of the work or otherwise. Availability of an alternate route of escape should be considered

7.9.2 Contractor Safety

Duties and responsibilities of the contractor should include the following:

- To implement safe methods and practices, deploy appropriate machinery, tools and tackles, experienced supervisory personnel and skilled work force etc. required for execution
- To prepare a comprehensive and documented plan for implementation, monitoring and reporting of Health, Safety and Environment (HSE) and implement the same after its approval
- To nominate qualified and trained Safety Engineers / Officers reporting to the Site in charge, for supervision, co-ordination and, liaison for the implementation of the safety plan
- To arrange for fire protection equipment as per the advice of owner
- To ensure that its employees have completed appropriate health and safety training as required by the statute / regulation and also as per requirements of the Owner /Consultant
- To comply with all the security arrangements of owner
- To ensure availability of First Aid boxes and First Aid trained attendant
- To ensure that all incidents including near misses are reported to all concerned immediately
- To ensure strict compliance with work permit system by carrying out work only with appropriate work permits and after ensuring that all safety precautions / conditions in the permit are complied with and closing the same after job completion
- To ensure that the workers likely to be exposed to hazardous chemicals/materials have access to appropriate Material Safety Data Sheets (MSDS), wherever applicable, and provide necessary mitigation measures
- To ensure that appropriate warning signboards or tags are displayed
- To ensure that workers have proper training for their job assignments, including use of appropriate PPE and first aid firefighting equipment

- To comply with all applicable safety and health standards, rules, regulations and orders issued by competent authority pertaining to the assigned activities
- To conduct daily inspections to ensure compliance with safety standards, codes, regulations, rules and orders applicable to the work concerned

7.9.3 Static Electricity

- Ensure no metal objects/appurtenances projecting from roof/shell plates, which will attract highly charged spots in fuel for dissipation
- Ensure reduced rate of flow initially into tank/vessel until fill point/nozzle is completely submerged in fluid
- Ensure periodic checking and recording of earthing test for tanks and piping systems are maintained
- Agitation with air, steam gas, jet nozzle or mechanical mixtures should be avoided
- Ensure no personnel is allowed on tank roof for gauging / sampling during product transfer unless dip pipes extend to bottom of tanks. Use only mechanical gauges for ascertaining product transferred during transfer operations otherwise
- Protective bonding is required when fill open containers where the product to be handled has a flash point below 54.5 oC (130 oF) or, in the case of a higher flash point product, when it is heated to within 6.0 oC (15 oF) of its flash point. The purpose is to keep the nozzle and container at the same electrical potential, thus avoiding a possible static spark in the area of a flammable mixture
- Small containers made up of plastic or other non-conductive materials should not be used for filling of fuels
- Water washing is safe from a static electricity stand-point. However, there should be no insulated conductive objects within the tank.

7.9.4 Lightning Protection

- Measures to control fugitive emission from storage tanks should be given special consideration
- Structures of exceptional vulnerability by reason of explosive or highly flammable contents need special consideration and every possible protection need to be provided even against the rare occurrence of a lightning discharge
- A lightning protection system (Conventional Air Terminal System) consists of the following three basic components - Air terminal, Down conductor and Earth connection
- Non-conducting chimneys whose overall width or diameter at top is up to 1.5m shall be provided with one down conductor, and chimneys with overall width or diameter at top more than 1.5m shall be provided with 2 no. down conductors
- Metal stacks shall be properly earthed at the bottom
- Flammable liquids shall be stored in essentially gastight structures
- Openings where flammable concentrations of vapor or gas can escape to the atmosphere shall be closed or otherwise protected against the entrance of flame
- Structures and all accessories e.g. dip-gauge hatches, vent valves shall be maintained in good and sound operating conditions

- Flammable air-vapors mixtures shall be prevented to the greatest possible extent from accumulating outside storage tanks
- Potential spark-gaps between metallic conductors shall be avoided at points where flammable vapors may escape or accumulate
- A properly designed / constructed gas tight storage tanks considered to be self-protected against lightning provided it is properly earthed and bonded. Such a structure may not require any additional means of lightning protection

7.10 Recommendations

Recommendations are made for different aspects of the project and are given in subsequent paragraphs.

7.10.1 Storage of Hazardous Chemicals in Bulk

- Attempt should be made to find suitable less hazardous alternate chemicals, to replace the hazardous chemical. The inventory of all hazardous chemicals for that matter must be kept as minimum as possible
- The tanks should be located so as not to pose safety problems due to leakage and reaction with other chemicals stored nearby
- The storage area should be declared as a prohibited area and should be provided with fencing having at least two exits / "No Smoking" and/or "Prohibited Area" display boards, as applicable should be provided at site
- The storage tank and foundation should be of suitable material of construction to prevent corrosion
- The connections and openings to the tank should be as less as possible so that the possibility of leakage and maintenance hazards is minimized
- Each storage tank should have necessary instruments to monitor its level, pressure and temperature
- The storage tanks / area should have suitable fire protection and fire fighting facility
- The name of chemical, type of hazard, emergency operational instructions, antidote first aid etc. should be displayed near each tank
- All cables and electric fittings shall be constructed, installed, protected, operated and maintained in such a manner so as to prevent risk of open sparking

7.10.2 Storage of Hazardous Chemicals in Drums and other Containers

- The drums should never be filled full with the liquid chemical. There should be sufficient space to take care of thermal Greenfield
- The drums should preferably be stored in a well ventilated shed (preferably away from process units) with impermeable floor sloping away from drums
- Periodic site inspection should be carried out to ensure that there is no leakage from any of the drums

7.10.3 Unloading of Tank Trucks

- Before the tanker enters the industry premises, the tanker is to be inspected for authorized entry and safe and sound condition of the tanker, its contents and that of the prime mover. Tankers entering plant are to be fitted with flare arresters on their exhaust

- Static charge neutralizing at gate entry only
- The quality of the chemical in the tanker should be ascertained before unloading to avoid contamination of chemical already at storage
- Coupling used for connecting hose to tanker must be leak proof
- For flammable chemicals, the tanker and the hose are to be properly earthed before starting unloading operation
- Unloading should be done under personal supervision of responsible staff authorized by the management
- Provision of sample quantity of water / neutralizing medium to take care of leakage /spillage must be made. Also steam and inert gas hose stations must be available at unloading point
- Fire alarm and fire fighting facility commensurate with the chemical should be provided at the unloading point

7.10.4 Hazardous Waste Transport

The occupier of hazardous substance shall prepare six copies of the manifest (transporting documents) in Form 9 comprising of colour code indicated below (all six copies to be signed by the transporter):

- Copy 1 (White): to be forwarded by the occupier to the State Pollution Control Board or Committee
- Copy 2 (Yellow): to be retained by the occupier after taking signature on it from the transporter and rest of the four copies to be carried by the transporter
- Copy 3 (Pink): to be retained by the operator of the facility after signature
- Copy 4 (orange): to be returned to the transporter by the operator of facility after accepting waste
- Copy 5 (Green): to be returned by the operator of the facility to State Pollution Control
- Board / Committee after treatment and disposal of wastes.
- Copy 6 (Blue): to be returned by the operator of the facility to the occupier after treatment and disposal of wastes

The occupier shall forward copy number 1 (white) to the State Pollution Control Board or Committee and in case the hazardous waste is likely to be transported through any transit State, the occupier shall prepare an additional copy each for such State and forward the same to the concerned State Pollution Control Board or Committee before he hands over the hazardous waste to the transporter. No transporter shall accept hazardous wastes from an occupier for transport unless it is accompanied by copy numbers 2 to 5 of the manifest. The transporter shall return copy number 2 (yellow) of the manifest signed with date to the occupier as token of receipt of the other four copies of the manifest and retain the remaining four copies to be carried and handed over to respective agencies as specified in sub-rule (4).

7.11 Public Consultation

Public consultation

During Public hearing the following point discussed

Sr.	**Issue Raised**	**Response**

No		
1.	When this air pollution industry what measures will be taken for control of noise during crushing operations.	Care to be taken for controls of noise level are included in EIA report, PPEs will be provided to the workers.
2.	As per the Executive summary of the project, the water requirement will be 200 CMD but considering the drought prone area.	Figure showing in executive summary for the water requirement is a typographical mistake; the actual requirement of water is 97 CMD. The proposed project is sister concerned of M/s Nath Pulp and paper mills ltd to which water has been already been sanctioned by the irrigation department and mostly the water from Jaikwadi Dam will be used with agreement between both the companies and priority will not be given for the ground water.
3.	About noise monitoring pointed out that noise level is more than the prescribed limit at some places	Noise monitoring is carried out 6 different places as per TOR and the control measures are included in the report for reducing the noise level. After Public hearing noise level monitored 6 different places as per TOR, and we found noise level was within the prescribed limit. Incorporate the noise monitoring report in Chapter 3.

Total number of public participants present for public hearing	46

In order to ascertain the concern of the local persons who have plausible stake in the environmental impact of this project, the proponents though it fit to interview some people as sample survey basis. These interviews were oral and informal. This was not meeting any statutory requirement or a mechanical formality. Proponent really wanted to know as to whether this project is a welcome addition in the minds of surrounding people.

- There is a constant rapport, open corridors for discussion and transparency in working.
- No odor or noise nuisance is felt.
- It is however, necessary to see that no water pollution is created by this industry, for which the proposed arrangement appears to be satisfactory.
- Sons of the soil should get preference in employment.

The local people and proponents are comfortable with each other

7.12 Project Specific Study

Risk Analysis report on Rama Paper Group's Linear Alkyl Benzene Sulphonic Acid (LABSA) 50MT/Day and Single Super Phosphate (SSP) 400MT/Day

Rama Paper group is proposing to set up a manufacturing unit, with two plants. One for manufacturing 50 MT per month of Linear Alky Benzene Sulphonic Acid (LBSA) and another plant for manufacturing Single Super Phosphate 400 MT per month. 80% diluted Sulphuric Acid is by product from LBSA plant.

Sr. No.	Product	Quantity MT/month	Quantity MT/year
1	Linear Alkyl Benzene Sulphonic Acid (LABSA)	1500	18000
2	Diluted Sulphuric Acid 80%	1327.50	15930
3	Single Super Phosphate (SSP)	12000	144,000

Raw Material requirements are Linear Alkyl Benzene and 98% Sulphuric Acid for LBSA production and Indian Rock Phosphate (33% P2O5) and Sulphuric Acid for SSP production

Brief Process Description for LABSA:

Linear Alkyl Benzene (LAB) is stored in 2 vertical storage tanks of capacity 200m3 capacities. Each tank is provided with Level indicator with low level alarm. LAB is pumped to the Sulphonator through a measuring overhead vessel. This is provided with overflow line to ensure exact required quantity is charged to the sulphonator.

Sulphuric acid is stored in underground tank of 200 MT capacities. Sulphuric acid is pumped to three overhead batch tanks and added sequentially.

Agitation/ mixing is started by starting an external circulation pump. Then 98% Sulphuric acid added slowly over a period of 6 to7 hours controlling the temperature between 55 to 60 deg C by both cooling water circulation through reactor jacket and by controlling rate of Sulphuric acid addition.

There is TI and TIA alarm provided at the circulation pump suction. There is a provision of pump running and for stopping/starting the pump from the control room.

After complete addition and ensuring the reaction is complete the reaction mass is diluted by controlled addition of water, under agitation to control reactor temperature within 55 to 60 deg C.

Then Reactor mass is transferred to settling tank for separation of LBSA and 80 % spent acid layers.

LABSA is transferred to LABSA product tank and spent acid layer to spent acid storage tanks.

Storage Details for Raw Materials and Finished Products.

Sr No	Material	Capacity MT	Number	MOC
1	LAB	200	2	MS
2	LABS	50	2	MS
3	H_2SO_4 (98%)	200	1	MS
4	H_2SO_4 (80%)	50	1	MS
5	H_2SO_4 (70%)	100	1	MS (Rubber lined)

Areas of Concern and Mitigation measures:

In this plant, Sulphonation reaction section is the only area of serious area of concern from the Risk assessment and Hazard control point of view.

As this Sulphonation reaction is inherently a dangerous process. The reaction is exothermic and rate of reaction increase with temperature. There is possibility of runaway reaction leading to explosion under any of the following conditions

1. Uncontrolled reactant addition,
2. Accumulation of un reacted Sulphuric Acid,
3. Failure of agitation and
4. failure of Cooling medium

Sulphonator, in particular needs to have all the instrumentation, interlocks and safety devices installed to minimize and desirably totally eliminate occurrence of abnormal conditions.

One of the recommended tools to identify risks, potentially hazardous situations is by systematic HAZOP studies.

And it is necessary to do this, in the early design stage to avoid modifications and additional expenditure. One of the recommended tools to identify risks, potentially hazardous situations is by systematic HAZOP studies.

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HAZOP study will reveal

1. Violations of operating conditions (from the normal operating procedures and conditions) which can lead to hazardous situation.

2. HAZOP study will recommend modification of process, installing proper instrumentation, alarms and interlocks to minimize the risk.
3. It will examine whether the built in instrumentation, alarms, interlocks and Safety devices are adequate or not.

Mitigation Measures:

1. It is strongly recommended that formal HAZOP study should be carried out for the entire process. And it should be ensured that all the recommendations of the study with respect to installation of instrumentation controls, alarms and interlocks are installed.
2. As it may come out of HAZOP study, interlock to stop addition in case of temp. rise, Cooling water failure, and agitation pump tripping will have to be provided.
3. Operating Manual prepared should specifically include range of critical parameters, like rate of addition of Sulphuric Acid, operating temperature range, actions to be taken in case of agitation failure and cooling medium failure etc.
4. Emergency shutdown procedure should be displayed prominently in the language understood by the operators.
5. It must be ensured that standard Operating procedure laid down in the manual is strictly adhered to. No variation in this should be permitted.
6. Operators should be trained and be made aware of hazard and eminent danger in case violation of standard operating procedures.

Storage tank area is not area of concern as both LAB (Flash point 140 deg C) and LBSA are not flammable and Sulphuric acid storage is under ground and only hazard involved of leakage through flange or gland leaks can be dealt with standard maintenance and operation precautions.

It was confirmed by the consultants that necessary safety measures will be incorporated during detail designing with respect to plant layout and storage tank layout for Sulphuric acid, LAB, LABS and 70 and 80 % sulphuric acid, with properly designed dyke walls for over ground storage tanks.

Other Mitigation Measures

1. The project is in the design and detailing stage.
2. Adequate Fire fighting system will be designed.
3. This unit is registered under Factories Act and is bounded by State Factory Rules and accordingly all statutory requirements will be fulfilled. Moreover, disciplined approach is natural to this industry.

Consultant and Director of the company have committed the following

1. Safety and Occupational Health will be dealt carefully.
2. Safety policy will be in place.

3. Consulting physician shall be retained to attend the factory.
4. Personal protection equipments will be provided and use will be insisted.
5. First aid trained and Fire fighting trained person will be available in every shift.
6. Safety Officer shall be appointed and will be competent person.
7. Fire fighting system is kept as per norms of Insurance Company and CIF.
8. DMP (Disaster Management Plan) and off-site emergency plan shall be in place. Accordingly.

7.12 Material Safety Data Sheet of Sulphuric acid

7.12.1General description

- Sulfuric acid is a colorless oily liquid
- It is soluble in water with release of heat.
- It is corrosive to metals and tissue.
- It is corrosive to metals and tissue.
- It will char wood and most other organic matter on contact, but is unlikely to cause a fire.
- Density 15 lb/gal
- Long term exposure to low concentrations or short term exposure to high concentrations can result in adverse health effect from inhalation.
- It is used to make fertilizers and other chemicals, in petroleum refining, in iron and steel production, and for many other uses.
- Rate of onset: Immediate
- Persistence: Hours, days
- Odor threshold
- Source/use/other hazard: Battery/dyes/paper/glue/metals industries; volcanic gas; toxic fumes when heated.

NFPA Diamond

Red 0- will not burn under typical fire conditions

Blue 3 – can cause serious or permanent injury

Yellow 2 – Readily undergoes violent chemical changes at elevated temperature and pressures.

Special ~~W~~- reacts violently or explosively with water

7.12.2Physical properties

- Chemical Formula: H_2SO_4
- Flash Point: data unavailable
- Lower explosive limit(LEL):data unavailable
- Upper explosive Limit(UEL): data unavailable
- Auto ignition Temperature: Not flammable (USCG, 1999)
- Melting Point: 50.65^0F (EPA, 1998)
- Vapor Pressure: 1 mm Hg at 294.8^0F (EPA, 1998)
- Vapor Density (Relative to Air): 3.4 (EPA, 1998)
- Specific Gravity: 1.841 (EPA, 1998)
- Boiling Point: 554^0F at 760.0mm Hg (EPA, 1998)
- Molecular Weight: 98.08 (EPA, 1998)
- Water solubility: Miscible (NIOSH,2003)
- IDLH: 15mg/m^3 (NIOSH, **2003)**

Reactivity Alerts

- Strong oxidizing agent
- Known catalytic activity
- Water-reactive

Air & Water Reactions

- Reaction with water is negligible unless acid strength is above 80-90% then heat from hydrolysis is extreme, may cause severe burns (Merck, 11^{th} ed.1989).
- During sulfonation of mononitrobenzene by fuming sulfuric acid, a leak from an internal cooling coil permitted water to enter the reaction tank and a violent eruption occurred due to the heat of solution (MCA Case History 944 1963).

Fire Hazard

- It is highly reactive and capable of igniting finely-divided combustible materials on contact.
- When heated, it emits highly toxic fumes.

- Avoid heat; water and organic materials
- Sulfuric acid is explosive or incompatible with an enormous array of substances.
- Can undergo violent chemical change at elevated temperatures and pressure.
- May react violently with water.
- When heated, it emits highly toxic fumes.
- Hazardous polymerization may not occur. (EPA 1998)

Health Hazard

- Corrosive to all body tissues.
- Inhalation of vapor may cause serious lung damage.
- Contact with eyes may result in total loss of vision
- Skin contact may produce severe necrosis
- Fatal amount for adult: between 1 teaspoonful and one-half ounce of the concentrated chemical
- Even a few drops may be fetal if the acid gains access to the trachea.
- Chronic exposure may cause tracheobronchitis, stomatitis, conjunctivitis, and gastritis.
- Gastric perforation and peritonitis may occur and may be followed by circulatory collapse.
- Circulatory shock is often the immediate cause of death.
- Those with chronic respiratory, gastrointestinal, or nervous diseases and any eye and skin diseases are at greater risk (EPA,1998)

Reactivity Profile

- Sulfuric acid is a strong acid.
- Reacts violently with bromine pentafluoride (Mellor 2 Supp. 1:172 1956)
- Exploded with para-nitrotoluene at 80^0c (Chem.Eng.News 27:2504)
- An explosion occurred when concentrated sulfuric acid was mixed with crystalline potassium permanganate in a vessel containing moisture and Manganese heptoxide was formed, which explodes at 700C (Delhez 1967).
- A mixture of acrylonitrile with concentrated sulfuric acid must be kept well chilled otherwise a vigorous exothermic reaction occurs. (Chem. Safety Data Sheet SD-31:8.1949).
- Mixing sulfuric acid (96%) in equal portions with any of the following substances in a closed container caused the temperature and pressure to increase: acetonitrile, acrolein, 2-aminoethanol, ammonium hydroxide (28%), aniline, n-butyraldehyde, chlorosulfonic acid, ethylene diamine, epichlorohydrin, ethylene cyanohydrin, hydrochloric acid (36%), hydrofluoric acid (48.7%), propiolactone, propylene oxide, sodium hydroxide, styrene monomer (NFPA 1991)

- Sulfuric acid (concentrated) is extremely hazardous in contact with carbides, bromates, chlorates, fulminates, picrates and powdered metals (Haz.Chem. Data 1966)
- Allyl chloride may polymerize violently under conditions involving an acid catalyst, such as sulfuric acid (Ventrone 1971).
- React exothermally with sodium hypochlorite to produce chlorine gas.
- Mixing chlorosulfuric acid and 98% sulfuric acid may evolve HCl (Subref: Anon. Loss Prev. Bull. 1977, (013), 2-3)
- Zinc iodide reacts violently with H_2SO_4 (Pascal, 1962, Vol.5,168)

Belongs to the following reactive groups

- Acids, Strong Oxidizing

Potentially incomplete absorbents

- Cellulose-Based Absorbents
- Expanded Polymeric Absorbents

Isolation & Evacuation

- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids
- In case of spill, increase, in the downwind direction, as necessary, the isolation distance shown above.
- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG**,2012)**

Firefighting

- Fight fire from safe distance or from protected location
- Use care as water applied directly to this acid result in evolution of heat and causes spattering.
- Cool containers that are exposed to flames with streams of water until fire is out.
- Wear positive pressure breathing apparatus and special protective clothing.
- Not flammable.
- For small fires use dry chemical or carbon dioxide.
- Use water on combustibles burning in vicinity of this material.
- For large fires flood fire area with water from a distance.
- Do not get solid streams of water on material.

- Move container from area if you can do so without risk.(EPA, 1998)

Non-Fire Response

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
- Keep combustible (wood, paper, oil etc.) away from spilled material.
- Increase of small spill, cover with dry earth, dry sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
- Prevent entry into waterways, sewers, basements or confined areas (ERG, 2012)

Protective Clothing

- Skin: wear appropriate personal protective clothing to prevent skin contact.
- Eyes: wear appropriate eye protection to prevent eye contact.
- Wash skin: the worker should immediately wash the skin when it becomes contaminated.
- Remove: work clothing that becomes wet or significantly contaminated should be removed and replaced.
- Change: no recommendation is made specifying the need for the worker to change clothing after the work shift.
- Provide: eyewash fountains should be provided (when concentration is > 1%) in areas where there is any possibility that workers could be exposed to the substance' this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided (when concentration is > 1%) within the immediate work area for emergency use where there is a possibility of Exposure.

First Aid

- Caution: Sulfuric acid is extremely corrosive. Caution is advised.
- Signs and symptoms of Acute Sulfuric acid Exposure; Sign and symptoms of acute ingestion of sulfuric acid may be severe and include salivation, intense thirst, difficulty in swallowing, pain and shock. Oral, esophageal and stomach burns are common. Vomits generally has a coffee-ground appearance. The

potential for circulatory collapse is high following ingestion of sulfuric acid. Acute inhalation exposure may result in sneezing, hoarseness, chocking, laryngitis, dyspnea (shortness of breath), respiratory tract irritation, and chest pain. Bleeding of nose and gums, ulceration of the nasal and oral mucosa, pulmonary edema, chronic bronchitis and pneumonia may also occur. If the eyes have come in contact with sulfuric acid, irritation, pain swelling, corneal erosion and blindness may result. Dermal exposure may result in severe burns, pain and dermatitis (red, inflamed skin).

- Emergency Life-Support Procedures: Acute exposure to sulfuric acid may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air purifying or supplied- air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination.
- Inhalation Exposure

  1. Move victims to fresh air. Emergency personnel should avoid self-exposure to sulfuric acid.

  2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.

  3. Obtain authorization and /or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.

  4. Rush to a health care facility.
- Dermal/Eye Exposure

  1. Remove victims from exposure. Emergency personnel should avoid self-exposure to sulfuric acid.

  2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provided CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.

  3. Remove contaminated clothing as soon as possible.

  4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes.

  5. Wash exposed skin areas thoroughly with soap and water.

  6. Obtain authorization or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.

  7. Rush to a health care facility.
- Ingestion Exposure

  1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.

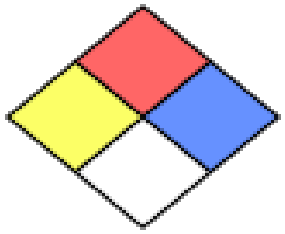
2. Rinse mouth with large amounts of water. Instruct victims not to swallow the water.
3. Do not induce vomiting or attempt to neutralize
4. Obtains authorization or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
5. Activated charcoal is of no value.
6. Give the victims water or milk: children up to 1 year old, 125 mL (4 oz or ½ cup); children 1 to 12 years old, 200 mL (6 oz or ¾ cup); adults, 250 Ml (8 oz or 1 cup). Water or milk should be given only if victims are conscious and alert.
7. Rush to a health care facility.(EPA, 1998)

7.13. Material Safety Data Sheet of Linear Alkyl Benzene

7.13.1General description

- Linear alkyl benzene is a family of organic compounds with the formula $C_6H_5C_nH_{2n+1}$
- Typically lies between 10 and 16, although generally supplied as a tighter cut, such as C12-C15, C12-C13 and C1**0-C13 for detergent use.**
- The C_nH_{2n+1} chain are unbranched. They are sometimes called LABs
- They are mainly produced as intermediate in the production of surfactants, for use in detergents.
- Since the 1960s, LAB has emerged as the dominant precursor of biodegradable detergents.

NFPA Diamond



Red 1- Flammable

Blue1-Harmful on contact with skin or ingestion

Yellow 0- Stable

7.13.2 Physical properties

- Chemical Formula: $C_6H_5CHR^1R^2$ where $R^1=C_nH_{2n+1}$ and $R_2 = C_mH_{2m+1}$ .m,n are integers m≥ 1 (typically 10-16)
- Flash Point: 284^0F
- Lower Explosive Limit (LEL): data unavailable
- Upper Explosive Limit (UEL):data unavailable
- Auto ignition Temperature: data unavailable
- Melting Point< -94^0F
- Vapor Pressure: 0.013h Pa at 77^0F
- Vapor Density (Relative to Air): 8.4
- Specific Gravity: 0.858-0.868
- Boiling Point: 532.4-597.2^0F
- Molecular Weight: 239-245
- Water Solubility: Slightly Soluble\
- IDLH: data unavailable

Reactivity Alerts

- Stable
- Incompatible with strong oxidizers and no dangerous polymerization**.**

Fire Hazard

- Combustible products – CO & co2

Health Hazard

- Product irritates eyes and skin
- Acute toxicity data
- Chronic effects cause mil irritation
- May cause mild skin irritation.
- Not a carcinogen, mutagenic
- Not applicable for toxicokinetics, metabolism, distribution.

Reactivity Profile

- Prolonged exposure of containers or tank cars to heat or fire may cause the material to expand with possible container rupture.
- Very dangerous fire hazard when exposed to oxidizers
- Thermal decomposition generates carbon monoxide and carbon dioxide.
- No dangerous polymerization.

Firefighting

- Suitable extinguishers media: Foam, Dry Chemical powder, co2
- Cool containers with water spray.
- Extinguishing media to be avoided: water
- Do not empty into drains
- When burning, it emits carbon monoxide, carbon dioxide and irritant fumes.
- Containers with the substance exposed to excessive heat may explode.
- Wear full protective fire- resistant clothing and self contained breathing apparatus.

Accident Release Measures

- Wear protective clothing and equipment.
- Isolate hazard area.
- Evacuate all unauthorized personnel not participating in rescue operations from the area.
- Avoid entry into danger area.
- Remove all possible sources of ignition.
- Stop traffic and switch off the motors of the engines.
- Do not smoke and do not handle with naked flame.
- Use explosion-proof lamps and non-sparking flame.
- Use explosion-proof lamps and non-sparking tools.
- Avoid contact with the substances.
- Dike flow of spilled material using soil of sandbags to minimize contamination of drain surface and ground waters.

Handling and Storage

- Information for safe handling-observe all fire-fighting measures (no smoking, do not handle with naked flame and remove all possible sources of ignition). Take precautionary measures against static discharges. Wear recommended personal protective equipment and observe instructions to prevent possible contact of substance with skin and eyes and inhalation.
- Information for storage-store rooms should meet the requirements for the fire safety of constructions and electrical facilities and should be in conformity with valid regulations. Store in cool, well-ventilated place with effective exhaust, away from heat and all sources of ignition. Take precautionary measures against static discharges.
- Information for specific use- Detergent intermediate-follow bulk handling and storage procedures as noted above.

First Aid

- Immediate medical attention is required after inhalation or after swallowing
- In case of health troubles or doubts, seek medical advice immediately
- Inhalation- Remove to fresh air, if not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately
- Skin contact: wash skin with water upon contact. Remove contaminated clothing. If irritation persists, get medical attention. Wash clothing before reuse.
- Eye contact –In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.
- Swallowing- if swallowed, do not induce vomiting, get medical attention. Never give anything by mouth to an unconscious person

Occupational Health: in process there is high noise, high heat stress and low level illumination exposure to workers.

Manual material handling only the causes of musculo-sketal disorders (MSD) backache, pain in minor and major joints, fatigue etc. following measures have been taken to avoid above mentioned ill health effect to workers.

- Below 25 kgs weight will be handled by a worker if required to do so.
- Material handling lorry-cart, drum handling trolly, fork lift, stacker, etc. will be used for material handling.
- Training will be carried out for manual material handling**.**
- Ergonomics study will be carried out before commissioning of the plant and correct material flow, process flow of work place will be designed.

Following activities will be carried out for occupational health of the workers.

- Treatment part (OPD) for both company and contractor employees
- Occupational related problems will be studded like ergonomic issues and control measures prevention part-pre medical examination and periodical medical examination for operators, helpers, chemists.
- Profile active (Health Awareness programme)

Table 7.3: Occupational health impact on employees, control measures, action plan if accident occurs

Sr. No.	Chemical	Occupational health impact on employees	Measures to keep exposure below TLV/PEL	EMP for STEL & IDLH
1	Sulfuric Acid	Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated inhalation may cause nosebleeds, nasal congestion, erosion of the teeth, perforation of the nasal septum, chest pain and bronchitis	Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use a corrosion resistant ventilation system.	Clean up spills immediately, observing precautions in the Protective Equipment section. Carefully scoop up and place into appropriate disposal container. Provide ventilation. Do not get water inside containers. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water.
2.	LAB/ LABSA	Route of entry: Those with history of lung diseases, or skin problems may be more susceptible to the effect of this material.	Provide adequate ventilation when using the material and follow the principals of good hygiene to control personal exposure.	Person-related safety precautions Wear protective clothing and equipment. Isolate hazard area. Evacuate all unauthorized personnel not participating in rescue operations form the area. Avoid entry into danger area. Remove all possible sources of ignition. Stop traffic and switch off the motors of the engines. Do not smoke and do not handle with naked flame. Use explosion-proof lamps and non-sparking tools. Avoid contact with the substance. Precautions for protection of the environment Prevent from further leaks of substance. Dike flow of spilled material using soil or sandbags to minimize contamination of drains, surface and ground waters. Recommended methods for cleaning and disposal Soak up residues with compatible porous material and forward for disposal in closed containers. Dispose off under valid legal waste regulations

7.14 EHS POLICY

OCCUPATIONAL SAFETY, HEALTH & ENVIRONMENT PROTECTION POLICY

Factory proposed to be declare their Safety, Health Environment policy. The declaration is as under:

We at M/s Rama Pulp and Paper Ltd. are committed to create and maintaining Safe and Healthy work place with environment friendly operations in our organization. We will develop and implement our occupational Health, Safety and Environment. Management system confirming to National and Environment Management System will be integral part of our work culture.

Occupational health, Safety and Environment will be integrated part of our decision and activities. Will continually review and update performance on this front:

Factory shall strive to achieve objectives by:

- Well-defined organization set up for implementation of the Health, Safety and Environment Policy implementation.
- Encouraging participation of all employees, contractor employees in Health, Safety and Environment activities.
- Ensuring competence by imparting adequate effective Training and Education to all employees.
- Evaluation of Health, Safety and Environment performance and communicate to all.
- Health, Safety and Environment performance will form as an integral part of Personal Assessment Pro-forma for all employees.
- Compliance of all statutory requirements.
- Periodic Risk Assessment and Safety Audits will be carried out to ensure effectiveness of Health, Safety and Environment systems and up-gradation.
- Work zone monitoring will be carried out periodically to ensure safe work environment and conservation of Natural Resources.
- Short resume will be mentioned about Health, Safety and Environment activities in the company's Annual Report.

Declared on: Occupier

Review on