

## CHAPTER 7. ADDITIONAL STUDY

This Chapter provides the details about the Risk Assessment, Disaster Management Plan (DMP) and on-site emergency plan as proposed for the proposed expansion project. Brief summary of additional studies carried out by Greenstar

### 7.1. Introduction

GREENSTAR would be handling all materials at the proposed plant. The storage of raw material is planned at the site location itself, so, in an unlikely event of toxic material (Ammonia) release emergencies; there would be a potential risk to life and properties. Hence, the risk assessment study has been conducted for various parameters that include identification of hazards, to calculate consequence distances, to evaluate safety at the plant and to spell out risk mitigation measures to enhance safety at the plant.

### 7.2. Hazard Identification

Hazard is defined as a chemical or physical conditions those have the potential for causing damage to people, property or the environment. In this chapter the hazards associated with only the proposed Phosphoric Acid project have been discussed.

The primary step of the Hazard identification is the risk analysis and entails the process of collecting information on:

- the types and quantities of hazardous substances stored and handled at the plant,
- the location of storage tanks & other facilities, and
- Potential hazards associated with the spillage and release of hazardous chemicals.

### 7.3. Hazardous Materials to be Stored at the Plant

Only major hazardous chemicals to be stored at the project site are, Concentrated and spent sulphuric acid, Phosphoric Acid (intermediate product), rock phosphate and and Hydro fluo silicic acid. Bulk storages details are given in Table 2.2,2.3 and 2.4.

### 7.4. Characteristics of Hazardous Materials

Important characteristics of the hazardous material (i.e. Sulphur, sulphuric acid and Phosphoric Acid) has been presented below:

S. No	Material	S. No & Threshold Quantity (TQ in Kg) as per MSHIC Rules			Chemicals Hazards Potential		Remarks
		Schedule-1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic	
1.	Sulphuric Acid CAS No: 7664-93-9 UN No: 1830	591			Flammability: Will not burn Health Hazard: Extremely hazardous - use full protection; Reactivity: Violent chemical change possible	ERPG-1: 2.0 mg/m <sup>3</sup> ERPG-2: 10 mg/m <sup>3</sup> ERPG-3: 30 mg/m <sup>3</sup> IDLH: 15 mg/m <sup>3</sup>	
2.	Ammonia CAS No:7664-41-7 UN No:1005	31	2 TQ-1: 60 MT TQ-2: 600 MT	105 TQ-1: 50 MT TQ-2: 500 MT	Fire Hazards: Mixing of ammonia with several chemicals can cause severe fire hazards and/or explosions. Ammonia in container may explode in heat of fire. Health Hazards: Vapors cause irritation of eyes and respiratory tract. Liquid will burn skin and eyes. Poisonous; may be fatal if inhaled. Contact may cause burns to skin and eyes. Contact with liquid may cause frostbite.	ERPG-1: 25 ppm ERPG-2: 150 ppm ERPG-3: 750 ppm IDLH: 300 ppm	
3.	Phosphoric Acid CAS No: 7664-38-2 (85%); Colourless Solution with caustic Odour	497	---	---	Inhalation of mists can cause corrosive action on mucous membranes. Symptoms include burning, choking, coughing, . Liquid causes burns/ inflammation etc; Eye burn, watering eyes.	LD50 [oral, rat]; 1530 mg/kg]; LC50 (rabbit)1.689 mg/L (1 hour) LD50 (Dermal /rabbit)- 2740mg/Kg.	Plant uses dilute acid

## 7.5. Hazard Evaluation

The evaluation phase determines the extent and degree of employee's exposure to toxicants and other physical hazards in the work place environment. In the case of major accident/breakdown occurrences, hazards exposure may cross plant boundary limit and persons/properties in the neighbouring areas may be exposed. During the evaluation study, the likelihood of large and small leaks is also considered. Hazardous substances may be released as a result of leaks or catastrophic failures causing possible damage to the surrounding areas. The extent of damage will depend upon the nature of release. The release of flammable and toxic materials and subsequent ignition results in heat radiation, pressure wave or vapour cloud depending upon the flammability, toxicity and its physical state.

Sudden exposure to high concentrations of toxic chemicals via leaks or operational upsets (relief valve pop up) may lead to acute effects, such as, unconsciousness, burning eyes, fits of coughing, etc.

Chronic effect, however, arises by repeated exposure to toxic chemical concentrations mostly by small leak. Many fine toxic dusts or vapors are invisible, colorless and odorless. Small leaks of these substances might not become obvious for months or even years.

## 7.6. Associated Hazards

Hazards associated with Ammonia: Ammonia visually looks like water – colorless. It has a pungent odor. Ammonia has a low odor threshold. The average person can smell ammonia at 2 to 5 ppm (compare to PEL/REL/STEL of 50/25/35 ppm). Thus, it has good warning properties. Responders most likely will be dealing with the vapor phase, although anhydrous ammonia can form liquid pools. When ammonia boils, it absorbs a tremendous amount of heat, which is why it is used as a refrigerant. Based on its low Boiling Point and this absorption of heat, there is potential for frost or freeze burns if the liquid phase gets on skin. When ammonia boils (or is being released from a liquid phase to vapor phase) it is seen a white cloud.

Even though ammonia vapor density is lighter than air, it can exhibit heavier than air characteristics. Weather will have an impact. Wet weather (such as high humidity, foggy, misty morning, light rain, etc.) as well as cold temperatures can keep an ammonia cloud on the ground.

Even though ammonia's textbook LEL/UEL is relatively high and a narrow range, indoor releases can pose a flammability risk, especially in industrial refrigeration where the ammonia is also contaminated with water and oil. Use ventilation and control ignition sources. Do not enter a visible clouded atmosphere. Ensure ventilation used is not exposed to flammable concentrations or a source of ignition.

Ammonia is not stored at site. It is directly transported from port jetty storage to plant site for consumption.

Hazards associated with the use and storage of sulphuric acid has been presented in the following table:

<b>CAS number</b>	7664-93-9	<b>EC number</b>	231-639-5
<b>ChemSpider</b>	1086	<b>UN number</b>	1830
<b>UNII</b>	O40UQP6WCF	<b>RTECS number</b>	WS5600000
<b>Properties</b>			
<b>Molecular formula</b>	H <sub>2</sub> SO <sub>4</sub>	<b>Melting point</b>	10 °C, 283 K, 50 °F
<b>Molar mass</b>	98.086 g/mol	<b>Boiling point</b>	337 °C, 610 K, 639 °F
<b>Appearance</b>	Clear, colorless, odorless liquid	<b>Solubility in water</b>	miscible
<b>Density</b>	1.84 g/cm <sup>3</sup> , liquid	<b>Acidity (pKa)</b>	-3
<b>Viscosity</b>	26.7 cP (20 °C)		
<b>Hazards</b>			
<b>MSDS</b>	External MSDS	<b>R-phrases</b>	R35
<b>EU Index</b>	016-020-00-8	<b>S-phrases</b>	(S1/2) S26 S30 S45
<b>EU classification</b>	Toxic (T)		
	Corrosive (C)		
	Dangerous for the environment (N)		
<b>NFPA</b>  <b>704</b>	032W		
<b>Flash point</b>	Non-flammable		
<b>Related compounds</b>			
<b>Related strong acids</b>	Selenic acid		
	Hydrochloric acid		
	Nitric acid		
<b>Related compounds</b>	Sulfurous acid		
	Peroxymonosulfuric acid		
	Sulfur trioxide		
	Oleum		

<b>Types of Hazard / Exposure</b>	<b>Acute Hazards / Symptoms</b>	<b>Prevention</b>	<b>First Aid/ Fire Fighting</b>
<b>Fire</b>	Not combustible. Many reactions may cause fire or explosion. Gives off irritating or toxic fumes (or gases) in a fire.	No contact with flammable substances. No contact with combustibles.	No water. In case of fire in the surroundings: powder, foam, carbon dioxide
<b>Explosion</b>	Risk of fire and explosion on contact with base(s), combustible substances, oxidants, reducing agents or water.		In case of fire: keep drums, etc., cool by spraying with water but No direct contact with water.

**Table 7.1 Actions required in case of Exposure**

Exposure	Effect	Prevent generation of mists! Avoid all contact!	In all cases consult a doctor!
<b>Inhalation</b>	Corrosive. Burning sensation. Sore throat. Cough. Laboured breathing. Shortness of breath. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer for medical attention.
<b>Skin</b>	Corrosive. Redness. Pain. Blisters. Serious skin burns.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
<b>Eyes</b>	Corrosive. Redness. Pain. Severe deep burns.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
<b>Ingestion</b>	Corrosive. Abdominal pain. Burning sensation. Shock or collapse.	Do not eat, drink, or smoke during work.	Rinse mouth. Do not induce vomiting. Refer for medical attention.

### 7.7. Effect & Consequence Analysis- Inventory Analysis

Inventory plays an important part in regard to the potential hazard. Larger the inventory of the vessel or a system, the larger the quantity of potential release. A practice commonly used to generate an incident list is to consider the potential leaks and major releases from fractures of pipelines and vessels containing sizable inventories. The potential vapour release (source strength) depends upon the quantity of liquid release, the property of the materials and the operating conditions (pressure). These when combined into matrix and vapour source strength computed for each release case, a ranking should become a credible exercise. Plant inventory can get discharged to environment due to loss of containment.

From the preliminary risk assessment study carried out for each participating unit, some of the possible hazards have been identified. The likely accident scenarios considered are given in **Table 7.2:**

**Table 7.2 Likely Accident Scenarios**

Sl. No.	Scenario	Vulnerability Zone	Remarks
A-1.	Ammonia Leak— 50 mm line	Area close to leak / Downwind direction	Isolate the line / area; Cool / drench / dilute the source point to prevent



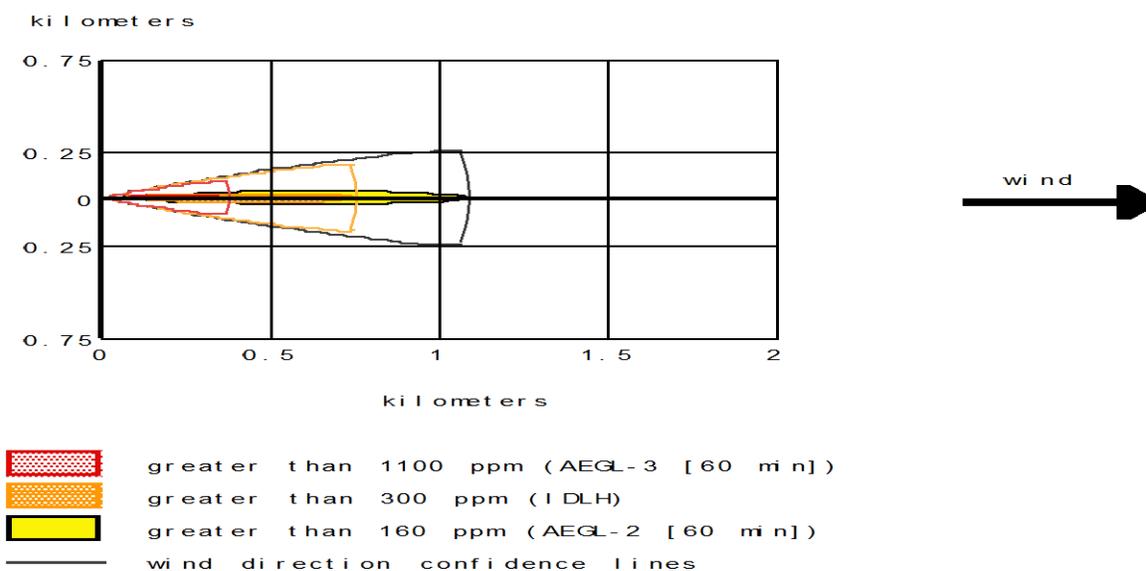
Exposure Duration	Radiation Energy {1% lethality; kW/m <sup>2</sup> }	Radiation Energy for 2 <sup>nd</sup> degree burns; kW/m <sup>2</sup>	Radiation Energy for 1st degree burns; kW/m <sup>2</sup>
10 sec	21.2	16	12.5
30	9.3	7.0	4.0

**7.8.2. Selected Failure Cases**

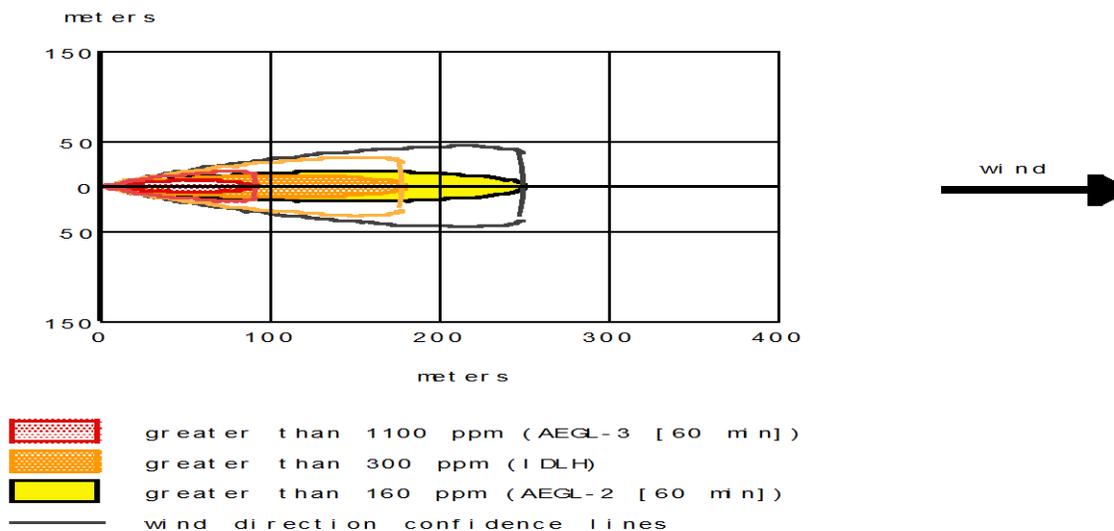
Few accidental scenarios have been considered and subjected to consequence analysis / damage zone. The impact zone of the scenarios is given below in **Table 7.5** and Templates.

**Table 7.5 Impact Zone of selected Scenarios**

Scenario No.	Scenario	Impact Zone (m)	Remarks
A - 1.	❖ Ammonia Leak—50 mm line	❖ IDLH ~ 761 ❖ IDLH ~179	Stability Class- F [Template-1] Stability Class -D [Template-2]
A - 2.	❖ Kerosene Tank Failure—Pool Fire	❖ ~ 20 (from Pool edge)	1 <sup>st</sup> degree burn [Radiation Intensity-4.5 KW/m <sup>2</sup> ]



Template-1. Ammonia Line Leakage (Stability Class- F)



Template-2. Ammonia Line Leakage (Stability Class- D)

## 7.9. Recommendations

Based on the outcome of the risk assessment, following recommendation has been made to avoid any risk associated with the storage and use of sulphuric acid in the plant:

- Double drain valve will be provided to sulphuric and Phosphoric acid storage tanks.
- Full body protection will be provided to operator as and when required.
- Caution note and emergency first aid will be displayed
- All employees will be trained for use of emergency first aid.
- Safety shower and eye wash will be provided in storage tank area and plant area.
- Total close process will be adopted for Sulphuric acid handling.
- Dyke wall will be provided to storage tank
- Tanker unloading procedure will be prepared.
- SOP will be prepared for sulphuric acid handling.
- Training programme will be conducted for safe handling and emergency handling of Sulphuric Acid
- In Storage Tank Area, reaction with water generating fumes should be displayed and avoided
- Suitable extinguishing media-Extinguish with dry powder / sand. Do not use water.
- Fire and explosion hazards-Not flammable. May evolve toxic fumes in fire (sulphur oxides).
- Personal protective equipment-Fire fighter must use fresh-air helmet and chemical protection suit
- Personal protection: complete protective clothing including self-contained breathing apparatus. Do not let this chemical enter the environment.
- Evacuate danger area! Do not absorb in saw-dust or other combustible absorbents.

### **7.9.1. Occupational Exposure Mitigation Planning**

To control any occupational health and safety impact a detailed planning for mitigation measures has been done in the design stage of the project. Apart from the occupational exposure mitigation plans for various activities and work areas of hazards, following administrative control measures will be followed:

- All the employees will be trained for EHS policies.
- Annual Health check-up for Employees.
- All the employees have been trained for Basic life support, first aid, Basic fire safety and emergency preparedness.
- Ambient air quality monitoring in every month at 3 locations
- Monthly monitoring of environmental parameters.
- Safety display boards provided throughout the plant.
- Monthly fire extinguisher audit.
- Work permit system
- PPE adherence
- Waste management and hazardous waste handling
- Safe lifting operation
- Industrial hygiene

### **7.9.2. Other Recommended Measures for Safe Operation of the Plant**

In addition to the specific recommendations made in the above section for storage and handling of sulphuric acid within the plant premises, for safe operation of the plant and risk reduction, following suggestions and recommendations are made:

- Personnel especially contractor workers at the plant should be made aware about the hazardous substance stored at the plant and risk associated with them.
- A written process safety information document may be compiled for general use.
- The document compilation should include an assessment of the hazards presented including (i) toxicity information (ii) permissible exposure limits. (iii) physical data (iv) thermal and chemical stability data (v) reactivity data (vi) corrosivity data (vii) information on process and mechanical design.
- The process design information in the process safety information compilation must include P&IDs/PFDs; process chemistry; maximum intended inventory; acceptable upper and lower limits, pressures, flows and compositions and process design and energy balances.
- The adequate numbers of heat, smoke, detectors may be provided at strategic locations in the plant and indication of detectors/sensors should be provided in main control room.
- Predictive and preventive maintenance schedule should be prepared for equipment, piping, pumps, etc. and thickness survey should be done periodically as per standard practices.
- Safe work practices should be developed to provide for the control of hazards during operation and maintenance.

- Personnel engaged in handling of hazardous chemicals should be trained to respond in an unlikely event of emergencies.
- The plant should check and ensure that all instruments provided in the plant are in good condition and documented.
- Safety measures in the form of DO and Don't Do should be displayed at strategic locations especially in Hindi and English language.

### **7.9.3. Personal Protective Equipment**

Personal protective equipment (PPEs) are devices that are fitted and issued to each worker personally for his or her exclusive use. They are intended for temporary use and emergency response action only. If a worker must enter a contaminated area, he must wear adequate protective equipment. Employees should be taught when and how to use respiratory apparatus (SCBA) provided, and how to recognize defects in the equipment. Without SCBA entry into the contaminated area should not be attempted.

- Keep personal protective equipment where it can be accessed quickly, outside the hazardous material storage area and away from areas of likely contamination.
- Each employee should maintain his personal protective equipment in clean, working condition at all times.
- All equipment should be used and maintained in accordance with the manufacturer's instructions.
- Equipment installed for body and eye wash should be checked properly for round the clock operation.

### **7.9.4. Handling of Hazards**

Some of the measures employed in handling of hazards:

- Personal protective equipment used by the workers during handling of hazardous chemicals, should be replaced after certain time.
- If any spillage of hazardous chemicals, it should be cleaned and disposed as per standard practiced.
- Empty drums of hazardous chemicals should neutralize immediate.
- Workers engaged in handling of hazardous chemicals should be made aware of properties of hazardous chemicals.

### **7.9.5. Hazardous Cargo Transportation**

Greenstar will be transporting major portion of the material (both raw material as well as products) to distance places. It will increase load on road and rail infrastructure. However being proximity to National highway and also railway network it can be well managed. Some of the hazardous cargo- Liquid Ammonia will transported to site through dedicated pipe line. Special care is to be taken for this cargo as any adverse incident happening will have impact on large area and may affect large number of people if it occurs in inhabited areas.

The hauler is responsible for the safe transport of raw materials by road from the loading point to the discharge point. Special consideration should be given to the following:

## Routing

The transport of all toxic and flammable raw materials follows the regulations. According to this, the route must be selected carefully.

Before starting the Ammonia transportation through road Greenstar / transporter should inform As far as possible, the route should:

- Utilize motorways,
- Avoid inhabited areas
- Safe parking

Drivers must ensure that the vehicle either is supervised or is parked in a secure place. No potential source of heat or fire must exist in the vicinity, and the vehicle must be capable of being easily removed in an emergency. Drivers must inform the hauler of their overnight parking location. The overnight parking locations must be selected in accordance with regulations.

When severe weather conditions are experienced during transport, for example rainy roads or poor visibility, the delivery should be stopped at the next suitable parking place

## Delays or accidents

All delays during transport, whether due to severe weather conditions, breakdown or other reasons must be reported to the consignor as soon as possible. Transport accidents must also be reported to the consignor as soon as possible.

Pressure and temperature checks

For road transport the pressure and/or temperature of the tank contents should be checked regularly and recorded on a checklist or in a logbook

Emergency procedure

Drivers should be given precise instructions as to the acceptable pressure and temperature rise during the journey, and the emergency action to be taken in the event that readings in excess of acceptable levels are observed.

Recommended instructions are given below:

Increase or decrease of temperature or pressure in the tanker

It is essential that drivers should be aware of the appropriate action to be taken should an emergency occur.

Do everything possible to drive the vehicle to an open space away from buildings and populated areas. Park and leave the vehicle, taking with you:

Any temperature/pressure records, wherever applicable

- The transport emergency card,
- The transport documents
- Alert everybody in the surroundings and keep people away.

- Contact immediately the local Police and the Fire Brigade.

Ensure that the consignor is notified as soon as possible and provide detailed information - when the increase started, how long has the temperature/ pressure been increasing, what is the present temperature/pressure.

Assist the local authorities and hand over the transport emergency card.

Check whether the temperature and/or pressure are still increasing, then immediate evacuation of the surrounding area is required. Urgently request the local Police to evacuate the surrounding area immediately and move people as far as possible away from the tank.

In case of Vapour/liquid leakages and/or fire

- Abandon the vehicle immediately.
- Alert everybody in the surroundings and keep people as far away from the vehicle as possible.
- Contact immediately the local Police and the Fire Brigade.
- Ensure that the consignor is notified as soon as possible.
- In the case of accident involving injury or immobilization of the vehicle, but no leakage or fire
- Contact immediately the local Police.
- Ensure that the consignor is notified as soon as possible.

If the vehicle cannot be moved, the emergency flashing lights should be positioned to protect the front and rear of the vehicle. Checks of the temperature and pressure of the tank should continue to be made and recorded.

Routine inspection of road tankers and tank containers at loading terminals

If any of the following conditions are not met, the loading operation must be stopped and the situation rectified before loading is allowed to continue.

Before loading

- Are there any visual observations on the truck against safe driving? (e.g. lights and tyres in good condition)
- Is there a valid certificate for the vehicle?
- Has the driver a valid license for the transport of dangerous substances. And a valid EO specific training certificate?
- For tank containers, is the tank container plate valid?
- Are all 'dangerous goods' labels fitted, are the identification numbers attached. For road transport: is the Tremcard in all required languages on board?
- Does the driver possess all the items of protective clothing and safety equipment? (as specified by the Tremcard)

Determine the maximum payload based on:

- Tare weight
- Transport mode

- Maximum filling degree
- Are all the valves closed upon arrival?
- Is the tank placed at the correct loading position?
- Are the wheels of the tank blocked by wheel blocks or other tools?
- Do all valves function correctly?
- Whilst loading
- Is the maximum degree of filling not exceeded?

After loading

- Is the maximum gross weight not exceeded? (check by weighbridge)
- Is a leakage test performed (bottom valve and end valve)?
- Are all valves closed and blinded, with all bolts in place or are all dry disconnect couplings / metal caps in place?
- Are all seals or locks in place?

#### **7.9.6. Hazardous Materials Transportation Safety Guidelines**

Transportation typically involves carrying of small amounts of materials over short distances. Transportation does, however, pose significant risks from the frequency of the activity and the lack of observance of prescribed regulations.

The hazardous materials should be packaged, based on the composition in a manner suitable for handling, storage and transport. Labelling and packaging is required to be easily visible and be able to withstand physical conditions and climatic factors. These guidelines are issued to facilitate safe transportation of the hazardous material in compliance of the regulations. In view of the stringent product quality requirement, various complex processes are introduced involving the handling of hazardous chemicals. These chemicals pose various types of hazards like flammability, toxicity, explosives, corrosives etc. Inadequate awareness about the hazardous properties of these chemicals may lead to serious accidents which will affect the men at work and the environment.

#### **Scope**

This document applies to the vehicular transportation, of hazardous materials, substances, and wastes. Hazardous materials include chemical materials, substances or wastes. Transportation shall be performed in a manner which minimizes risk to the health and safety of employees, the public and the environment.

#### **Guidelines for Transportation**

##### **General**

It will be ensure that during the transportation contents are not spilled, packaging is not damaged and personnel are properly trained to generate, transport and receive such materials.

In general, the traffic control program at Greenstar requires that an onsite driver possess a valid driver's license. The maximum speed limit is 10 KMPH. TREM cards are to be provided to the drivers.

### ***Incoming Hazardous Materials***

Products delivered to Greenstar are expected to arrive in full compliance with DOT and Hazmat requirements. These items are delivered directly to the point of use in their original packaging as required by contract with Greenstar.

### ***Packing***

The containers must be able to withstand normal handling and retain integrity for a minimum period of six months. In general, packaging for hazardous substances must meet the following requirements:

- All packaging materials including containers shall be of such strength, construction and type as not to break open or become defective during transportation.
- All packaging materials including containers shall be so packaged and sealed those spillages of hazardous materials / substances are prevented during transportation due to jerks and vibrations caused by uneven road surface.
- Re-packaging materials including that used for fastening must not be affected by the contents or form a dangerous combination with them.
- Packaging material should be such that there will be no significant chemical or galvanic action among any of the material in the package.
- Ensure that any cushioning or absorbent material used for packaging is also compatible with the hazardous material
- The containers when used for packaging of the hazardous Material shall meet the following requirements:
  - Modes of packaging, like collection in 200-litre plastic drums, cardboard cartons, PP and HDPE/LDPE containers etc., also work for variety of materials. However, all such container should be amenable to mechanical handling.
  - It should be leak proof.
  - Use drums that are in good condition and free of rust and major dents.
  - Ensure that drums are not leaking or overfilled before transporting them.
  - Ensure that drum bungs are tight.
  - Carefully inspect pallets before they are loaded.
  - Do not use pallets with cracked or broken slats.
  - Use a drum dolly to place drums on pallets.
  - Secure all drums to the pallet with appropriate strapping material.
  - In general, the containers for liquid HM should be completely closed, in fact sealed. There should be no gas generation due to any chemical reaction within the container, and, hence, there should not be any need for air vents; expansion due to increase /decrease in temperature normally does not need air vents.

- Container should be covered with a solid lid or a canvas to avoid emissions of any sort including spillage, dust etc. and to minimize odour generation both at the point of loading as well as during transportation.
- Container used for transportation of Material should be able to withstand the shock loads due to vibration effect/undulations of pavements etc.,
- Container should be easy to handle during transportation and emptying.
- As far as possible, manual handling of containers should be minimized. Appropriate material handling equipment is to be used to load, transport and unload containers. This equipment includes drum, dollies, and forklifts, drum handling equipment, lift gates and pallets. Drums should not be rolled on or off vehicles.
- Where two-tier or three-tier storage is envisaged, the frame should have adequate strength to hold the containers.
- One-way containers are also allowed. The multi-use containers should be reusable provided it should be cleaned and free from deterioration or defects.
- Loads are to be properly placed on vehicles. HM containers are not to overhang, perch, lean or be placed in other unstable base. Load should be secured with straps, clamps, braces or other measures to prevent movement and loss. Design of the container should be such that it can be safely accommodated on the transport vehicle.
- Dissimilar materials shall not be transported in the same container.

### ***Labeling***

There are two types of labeling requirements:

- Labeling of individual transport containers (ranging from a pint-size to a tank), and
- Labeling of transport vehicles
- All hazardous Material containers must be clearly marked with current contents. The markings must be waterproof and firmly attached so that they cannot be removed. Previous content labels shall be obliterated when the contents are different. Proper marking of containers is essential. Colour code is to be provided to the tanker to indicate the type of material present in that.
- Containers that contain HM shall be labelled with the words "HAZARDOUS MATERIAL" in Vernacular language, Hindi / English. The information on the label must include the code number of the Material, the Material type, the origin (name, address, telephone number of the supplier and receiver), hazardous property (e.g. flammable, corrosive), and the symbol for the hazardous property.
- The label must withstand the effects of rain and sun. Labelling of containers is important. The following are the requirements for labelling:
- Emergency contact phone numbers shall be prominently displayed viz. the phone number of concerned Regional Officer of the SPCB, Fire Station, Police Station and other agencies concerned.

### ***Unloading of Tank Trucks / Tank Wagons***

- Before the tanker enters the industry premises, the tanker is to be inspected for authorized entry and safe & sound condition of the tanker, its contents and that of the prime mover. Tankers entering plant are to be fitted with spark arresters on their exhaust.
- The quality of the chemical in the tanker should be ascertained before unloading to avoid contamination of chemical already at storage.
- In case of flammable chemicals, the prime mover (engine) should be kept off. The tanker should be properly blocked from movement before connections are made for unloading hazardous chemicals.
- In case of flammable chemicals, the unloading point should be located at a safe distance outside the storage dyke.
- Pressurizing with air / inert gas for unloading should be avoided. It is recommended to use pumps / vacuum systems for unloading. Pumps should preferably be of seal less type and valves should be of glandless types. Solid chemicals in bulk should be handled with lifting machines and conveyors.
- Coupling used for connecting hose to tanker must be leak proof. Flange connections are preferred. Where threaded connections are used, the threaded portion should be properly preserved against corrosion / wearing of threads and thoroughly inspected before connections are made.
- The unloading hose should be devoid of cracks & blisters and should be capable of withstanding whatever pressure developed during unloading operation. The hose should be hydro-tested at a frequency guided by experience. Proper records of hydro-test should be maintained.
- Same hose should not be used for unloading different chemicals. Hoses for different chemicals should be marked with different colour stripes for easy identification.
- For flammable chemicals, the tanker and the hose are to be properly earthed before starting unloading operation.
- Unloading should preferably be done in day time.
- Unloading should be done under personal supervision of responsible staff authorized by the management.
- The operating staff must use suitable personal protective clothing /equipment. Suitable breathing canisters and first aid box must be available at site for use in case of emergency.
- 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.
- There must be adequate illumination at site. Flame proof fittings should be used wherever necessary.
- The unloading systems should have facility to vent / drain the remaining chemical in the hose to a suitable safe point. The hose should be kept blinded when not in use. Thermal safety valve discharging to safe disposal or handling facility should be provided.

- Before starting unloading, the silage of the receiving tank should be checked. Care should be taken to avoid overflow of tanks. Gas / chemical leak detection system to sound an alarm at the control room/site may be provided wherever possible, so that quick remedial measures can be taken. Wherever necessary, quick/remote isolation valves should be provided.
- Fire fighting facility commensurate with the chemical – as mentioned in the data sheet should be provided at the unloading point.
- Effective communication system like telephone must be available for communicating with the control room / fire station / health unit.

### ***Unloading of Drums / Containers***

- Manual handling of drums / containers should be minimized. It is preferable forklifters and suitable cradles are used to handle drums.
- Carboys containing hazardous chemicals should not be subjected to impact.
- Suitable protective clothing should be used while handling drums / containers and the operators should position him such that he is in the upwind direction so that even in case of accidental release of chemical, he is safe.

### **Transportation Requirement**

The following are the requirements pertaining to the transportation of hazardous Material:

- Vehicle used for transportation shall be in accordance with the provisions under the Motor Vehicles Act, 1988, and rules made there under.
- Transporter should have valid "Pollution Under Control Certificate" (PUCC) during the transportation of HM and shall be properly displayed.
- Vehicles shall be painted preferably in allotted colour code with running centrally all over the body. This is to facilitate easy identification.
- Vehicle should be fitted with mechanical handling equipment as may be required for safe handling and transportation.
- "HAZARDOUS SYMBOL / MATERIAL" shall be displayed on all sides of the vehicle in Vernacular Language, Hindi, and English.
- Name of the facility supplier or operator or the transporter, as the case may be, shall be displayed.
- Carrying of passengers is strictly prohibited and those associated with the haulers shall be permitted only in the cabin.
- Transporter shall carry documents of manifest for the material during transportation
- The trucks shall be dedicated for transportation of concerned hazardous material and they shall not be used for any other purpose.
- Each vehicle shall carry first-aid kit, spill control equipment and fire extinguisher.
- HM transport vehicle shall run only at a speed specified under Motor Vehicles `Act in order to avoid any eventuality during the transportation of HM.
- Educational qualification for the driver shall be minimum of 10th pass (SSC). The driver of the transport vehicle shall have valid driving license for heavy vehicles from the State Road Transport Authority and shall have experience in transporting

the chemicals. Driver(s) shall be properly trained for handling the emergency situations and safety aspects involved in the transportation of hazardous chemicals.

- The design of the trucks shall be such that there is no spillage during transportation.

#### **7.9.7. Treatment and Control Actions**

##### **Treatment and Controls**

After examining the high priority risks, a prime consideration is given to the potential to reduce or eliminate the risk by using the hierarchy of controls. This assists in establishing methods to reduce risk. From experience, the effectiveness of each method is given as a percentage after each of the control descriptions. The desirability of control plans (with reducing effectiveness) is as follows:

- Elimination: Remove step to eliminate the hazard completely.
- Substitution: Replace with less hazardous material, substance or process.
- Separation: Isolate hazard from person by guarding, space or time separation.
- Administration: Adjusting the time or conditions of risk exposures.
- Training: Increasing awareness, improving skills and making tasks less hazardous to persons involved.
- Personnel protective equipment: Used as the last resort, appropriately designed and properly fitted equipment, where other controls are not practicable.

Control measures can reduce either the likelihood or consequence of the event or both. Depending on the level of reduction of the hazard, there could still be a residual risk that needs to be monitored so that a secondary prevention process can be initiated when trigger points are reached.

#### **7.9.8. General Working Conditions at the Proposed Plant**

##### *House Keeping*

The House Keeping practices employed would be:

- All the passages, floors and stairways should be maintained in good conditions.
- The system should be available to deal with any spillage of dry or liquid chemical at the plant.
- Walkways should be always kept free from obstructions.
- In the plant, precaution and instructions should be displayed at strategic locations in Tamil and English Languages.
- All pits, sumps should be properly covered or securely fenced.

##### *Ventilation*

The Ventilation measures that would be employed:

- Adequate ventilation would be provided in the work floor environment.
- The work environment would be assessed and monitored regularly as local ventilation is most effective method for controlling dust and gaseous emissions at work floor.

### *Safe Operating Procedures*

Other operation procedures followed would be:

- Safe operating procedures will be available for mostly all materials, operations and equipment.
- The workers will be informed of consequences of failure to observe the safe operating procedures.

### *Work Permit System*

Work permit system will be followed at the plant during maintenance.

### *Fire Protection*

For fire protection the measures taken are:

- The fire fighting system and equipment will be tested and maintained as per relevant standards.
- Smoke detectors will be provided at the plant and shall be calibrated and maintained properly.

### *Static Electricity*

The general instructions for working with static electric are:

- All equipment and storage tanks/containers of flammable chemicals shall be banded and earthed properly.
- Electrical pits shall be maintained clean and covered.
- Electrical continuity for earthing circuits shall be maintained.
- Periodic inspections shall be done for earth pits and record shall be maintained.

### *Material Handling*

For material handling the regulatory measures that are taken for workers handling various materials would include:

- The workers shall be made aware about the hazards associated with manual material handling.
- The workers shall be made aware and trained about the use of personal protective equipment (PPE) while handling hazardous chemicals.

### *Communication System*

Communication facilities shall be checked periodically for its proper functioning.

### *Safety Inspections*

The system shall be initiated for checklist based routine safety inspection and internal audit of the plant. Safety inspection team shall be formed from various disciplines and departments.

### *Safe Operating Procedures*

Safe operating procedures should be formulated and updated, specific to process & equipment and distributed to concerned plant personnel.

### *Predictive and Preventive Maintenance*

Predictive and preventive maintenance schedule shall be followed in religious manner.

### *Electrical Safety*

For electric safety provisions to be taken care of are:

- Insulation pad at HT panels shall be replaced at regular interval.
- House keeping in MCC room shall be kept proper for safe working conditions.

### *Colour Coding System*

Colour coding for piping and utility lines shall be followed in accordance with IS: 2379:1990.

#### **7.9.9. Disaster Management Plan**

GREENSTAR is also carrying out mock drill practices on various hazardous scenarios for existing plant.

GREENSTAR has to prepare an Emergency Management Plan (EMP) based on various possible adverse incidents based on proposed project to meet the emergencies. The copy of the draft EMP is to be submitted to Factory Inspector for approval. Mock drills are to be conducted based on various scenarios. GREENSTAR should also take part in DMP – mock drills conducted by district authorities. The report of these Mock drills will bring out weak links which are to be attended and strengthened.