Coromandel
FUTURE POSITIVE

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To,
The Member Secretary,
CRZ & Infrastructure Committee, IA Division,
Ministry of Environment and Forests & Climate Change,
Indira Paryavaran Bhavan,
Jorbagh Road, New Delhi - 110 003,

Sub : Submission of additional details w. r. t. to our Project Proposal –
MoEF file No.: 11-35/2015-IA-III

Dear Sir

During 154th meeting of EAC dated 23rd Dec.'15 we have been advised to submit additional details for further consideration of our proposal.
The following is the document attached:-

1. Disaster & Environmental Management Plan for the proposed Acid Storage Facility at Wharf, Coromandel International, Visakhapatnam

We request you to kindly consider our additional details and include our proposal in the review meeting scheduled during the month of February 2016.

Yours faithfully
For Coromandel International Ltd.,

MKumaresan
Sr. Asso. V.P.-Manufacturing

Encl:
a/a

2016

Disaster Management & Environment Management Plan for the Proposed Acid Storage facility at wharf, Visakhapatnam

For

M/s. Coromandel International Limited
Sriharipuram
Visakhapatnam
Andhra Pradesh

Prepared By

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Chapter -1

Executive Summary

i. Coromandel International Limited, Visakhapatnam Unit is located at Sriharipuram, Visakhapatnam, Andhra Pradesh.

ii. Coromandel, a leading Phosphatic fertilizer unit, proposes to install storage tanks and associated facilities for storage and handling of imported sulphuric acid and phosphoric acid in their own premises at their Wharf which is located 5 kms away from the Plant and is connected through a dedicated road.

iii. Coromandel further proposes to transfer the stored phosphoric acid to the plant by road tankers, while sulphuric acid is transferred by pumping to the storage tanks in the plant.

iv. The estimated cost of the project is Rs.27 crores.

v. Coromandel Visakhapatnam has Sulphuric Acid and Phosphoric Acid manufacturing units and Acid storage facility, in addition to the Granulation Plants.

vi. These facilities are being operated successfully since 1967 and Coromandel gained experience in operation, maintenance and mitigation of emergency situations.

vii. Coromandel has qualified, experienced and competent staff for the operation of Acid storage facility at plant and hence they can mitigate emergency situation more effectively with minimum loss of containment and life, etc.

viii. Coromandel has full-fledged Disaster Management Plan (DMP) approved by factories department, A.P. Government and the same is attached for reference. The existing DMP covers the facilities, which includes Sulphuric Acid plant, Phosphoric Acid plant, Granulation Plant, Ammonia Storage and handling, Acid storage and handling, storage of solid raw materials, and wharf facility etc.

ix. Review of existing DMP (Disaster Management plan) forcurrent manufacturing facility has revealed that adequate facilities and effective organization to handle any emergency and to mitigate the effects of all possible accidents, if they occur in spite of all the care taken to prevent the same have been provided

x. Coromandel has full-fledged Safety Department which monitors the requirement of safety of the plant and staff and takes steps periodically to create awareness of the risks involved, conducts training in safety, fire-fighting and mock drills.

xi. Coromandel is committed and accords top most priority to protect the health and promote safety of its employees, the community, environment, and facility assets. In line with this objective, Coromandel has implemented voluntarily Process Safety Management Systems and Occupation Health & Safety Management System (OHSAS-18001).

xii. The proposed installation of Sulphuric Acid and Phosphoric Acid storage facility are environmentally and inherently safe if the provisions of relevant national and international standards, applicable codes are complied with and the recommendations of quantitative risk assessment are taken into consideration both during construction and regular operation.

xiii. These measures improve safety of the proposed installation and minimize the threat from occurrence of disaster.

xiv. Reviewed the existing DMP including infrastructure for its adequacy to proposed acid storage facility at wharf. As the operations of proposed acid storage facility at wharf except unloading and transfer of acid to plant, are similar to that of acid storage facility in plant premises, existing DMP holds good to a larger extent for the proposed acid storage facility too. However, additional procedures are drawn in respect of acid unloading and transfer to the plant, and will be integrated with existing DMP after implementation of the proposal

xv. Besides above, studied fire safety management system of existing facility at wharf and recommended to extend the current fire hydrant system up to proposed storage facility.

xvi. Risk assessment of the proposed facility has been studied and found that risk levels for the proposed installation are moderate and tolerable as no catastrophic failure of acid storage tanks is envisaged.

xvii. Reviewed likely accidental scenarios with respect to proposed installation and found it may not likely turn into an off-site emergency and will to on- site emergency.

xviii. No significant environmental impact is envisaged from the proposal as no acquisition of additional land and manufacturing process is involved in this proposed activity. It consists of only receipt and storage Sulfuric acid and Phosphoric acid in closed roof tanks and transfer of the same to plant premises. However, developed Standard operating Procedures, spillage control plan and mitigation measures as part Disaster and Environmental Management Plan for the proposed acid storage facility at wharf.

Chapter-2

Introduction

i. Coromandel International Limited, a part of Murugappa Group, is in the business of manufacturing fertilizers and pesticides, has been continuously in the service of the farmers, making quality fertilizers and pesticides available to them and rendering other agronomic services. One of its fertilizers plant is located at Visakhapatnam, Andhra Pradesh.

ii. The manufacturing unit at Visakhapatnam was the first in the country to manufacture Urea Ammonia Phosphate and was commissioned in the year 1967 with a production capacity of 2.5 lakh MT PA. To meet the growing demand of fertilizers, the Unit has enhanced its capacity to 12 lakh MTPA. It produces NP, NPK and Water Soluble Fertilisers. The plant also manufactures Sulphuric Acid and Phosphoric Acid. These are intermediate products for the manufacturing Phosphaticfertilisers. Gypsum is produced as byproduct during the manufacture of Phosphoric Acid. Raw materials like Potash, Urea, Rock Phosphate and Sulphur required for the manufacturing of fertilizers are unloaded at the dedicated Jetty located within the Port premises and transferred to Plant by trucks. Ammonia is another raw material which is imported and transferred to the plant through a dedicated pipeline and stored in the storage plants located in the plant. Wharf is located 5 kms away from the plant premises and is connected through a dedicated road of Coromandel and is built in with adequate infrastructure.

2.1 Brief Description Of The Proposal

i. Besides the above raw materials, since the last 10 years, Coromandel Visakhapatnam Unit is importing both Sulphuric Acid and Phosphoric Acid for the Plant over and above captive production capacity and storing in leased tanks of private vendors within the Port premises and transporting the same to the plant through road tankers passing through the public road

ii. In order to avoid risks associated with the transportation of these hazardous chemicals through public road and environmental degradation with Acid leakage due to improper maintenance of storage tanks and road tankers by private vendors, Coromandel has proposed to install storage tanks of Sulphuric Acid (2 x 12,500 MTs) and Phosphoric acid (2 x 10,000 MTs P2O5) and associated facilities for storage and handling of Sulphuric Acid and Phosphoric Acid in their premises i.e., at the existing wharf of Coromandel which has been leased by Visakhapatnam Port Trust.

2.1.1 Salient Features Of The Proposal

i. No additional land is envisaged.

ii. No increase in pollution load as there is no increase in fertilizers production and no manufacturing process is involved in the proposal.

iii. Eliminates associated risk of transporting Sulphuric Acid and Phosphoric Acid through public road.

iv. Provides direct access to the proposed storage facility through a dedicated road of Coromandel.

v. Minimizes vehicular emissions and traffic related issues.

vi. It is a cost-effective option as it brings in cost saving to the company due to leasing and transportation.

vii. Coromandel international ltd Visak unit has submitted their proposal to MoEF for CRZ clearance for the proposed acid storage facility at wharf. As part of the process during making presentation by Coromandel to the Expert Appraisal Committee, Ministry has directed us to submit comprehensive Disastrous and Environmental Management plan for the proposed facility. Accordingly. Coromandel retained M/s S.V Enviro, Visakhapatnam to undertake studies and submit a report for the same.

viii. M/s S.V Enviro has visited the plant site, held discussions with concerned technical personnel and collected information & data in this regard.

Chapter -3

About Proposed Facililty

3.1 Description of proposed facility:

The facility broadly consists of:

i. Two nos of Sulfuric acid plants each of 125000 MT capacity and two nos of Phosphoric acid plants each of 10000MT of P2O5 with closed roof and built in with dyke walls around storage tanks at wharf

ii. Two independent lines one for Sulfuric acid and one for Phosphoric acid from jetty to proposed storage tanks at wharf

iii. Flexible hoses connects ship manifold and the unloading lines to the proposed acid storage facility.

iv. Dedicated line for transfer of Sulfuric acid from proposed storage facility to the storage tanks in plant premises.

v. Loading station at wharf to transfer Phosphoric acid into road tankers for onward transfer to plant premises

vi. Loading station at wharf for transfer sulfuric acid from wharf to plant premises

vii. Fire fighting arrangement around proposed storage facility and at unloading loading area.

viii. Blowers at wharf to facilitate emptying of unloading line after ship unloading activity.

3.1.1 Operation Of The Proposed Facility

i. There is no manufacturing process in the proposed industrial activity, but it only involves receipt, storage and transfer of Sulphuric Acid and Phosphoric Acid through road tankers to storage tanks in the plant premises.

ii. Sulphuric Acid is one of the principal raw materials used for the production of complex fertiliser as well as for the production of Phosphoric Acid. Sulphuric Acid is imported either from abroad or locally through bulk shipments. Sulphuric Acid is transferred by ship pumps through above ground pipeline and stored in carbon steel tanks. It is further pumped to the storage tanks of the plant through a dedicated pipeline along the private road of Coromandel.

iii. Phosphoric Acid is another raw material used for manufacturing of complex fertilizers. Being highly corrosive to carbon steel, it is stored in rubber lined carbon steel storage tanks It is handled with the help of stainless steel pumps and rubber lined Carbon Steel pipeline. The Sulphuric Acid/Phosphoric Acid are discharged by the ship pumps at a rate not exceeding 1000 MTs per hour with operating pressure of 5 kg / cm2. The proposed Sulphuric Acid/Phosphoric Acid consignments will be around 20,000 MTs.

iv. The Sulphuric Acid / Phosphoric Acid Storage Tanks are built in with separate dykes provided with sump and pump to recycle back any spill / overflow acid. The dyke is provided with drain valve which will be closed at all times, except for draining in accumulated drain water in the dyke. This would ensure that any accidental acid leaks are held within the dyke area and do not get into the outside environment.

v. The Sulphuric Acid/Phosphoric Acid being highly corrosive requires is tobe handled by trained persons.

vi. Personal protection equipments like acid P.V.C suits, gloves, and gum boots are used while handling Sulfuric acid and Phosphoric acid to avoid any spill over of acid on persons.

vii. Eye wash / Safety Shower are provided at storage facility and unloading area. This will be used for washing purpose if affected with acid spray.

Chapter -4

Disaster Management Plan

4.1 Introduction:

i. It is the Company's policy and corporate responsibility to ensure personnel safety, conserve natural resources and the environment and protect property in order to achieve the highest levels of safety. It is the Company's policy to maintain and continuously improve the capability for a rapid and effective response to all emergencies which may affect its operations. In pursuit of this policy, the company recognizes that emergencies can occur in spite of rigorous and ongoing preventive measures. It shall there prepare and revise DMP including procedures, establish an Emergency Response Group to implement them. Train the personnel for an emergency and liaise with external organizations.

ii. Disaster Management plan has two components ieon site preparedness plan and 0ff site preparedness plan. On site plan indicate details of in-built measures, role of key persons during Emergency situation, Disaster combating procedures, evacuation of non-essential persons, rescue of effected persons, Mutual aid and post emergency rehabilitation and recovery procedures etc.

iii. If the effects of a chemical Hazard are not restricted within the plant boundaries and are felt beyond the premises, the situation warrants Offsite Emergency planning. In such scenarios, the action no longer remains in control of the factory management alone, but also becomes a concern for the general public living outside the affected zone. To control such situation, involvement of local and district administration and law & order authorities becomes essential .Therefore district magistrates of each district are given the responsibilities of preparation of Off-site plan for their districts in commander based on the data submitted by the identified hazardous installation in their area in their On-site emergency plan.

4.1.1 Objectives:

- The overall objectives of DMP are to:

i. Localize the emergency and if possible to eliminate it.

ii. Minimize the effects of the accidents on people and property, neighborhood and general environment.

iii. Minimizing the effects may include timely warning within plant and if necessary toneighborhood, evacuation, rescue first aid, transport, rehabilitation and restoration to normalcy.

- This is achieved by:

i. Describing procedures to deal with emergencies affecting personnel, equipment, third party contractors, local communities or the environment.

ii. Defining the roles and responsibilities of supervisory personnel.

iii. Describing the resources available to the ERG for use in an emergency and how these resources should be coordinated.

4.2 Risk Management :

Risk assessment was carried out for the variousscenarios as mentioned below and found risk levels are moderate and tolerable except in the case of rupture of flexible hoses. The catastrophic failure scenarios for storage tanks are not envisaged based on data collected. The nature of certain operations of the proposed activity is similar to our existing operations associated with manufacturing and storage of sulfuric and Phosphoric acid in plant premises. Standard operating procedures, Emergency control

plan and procedures for recovery operation developed as part of existing DMP holdsgood for the proposed storage facility to larger extent.

However, as part of DMP for proposed storage facility,best risk management practices, procedures for eco-friendly handling of Sulfuric acid and Phospshoric acid, standard operating producers for unloading sulfuric acid and Phospshoric acid from ship, loading acids into road tankers, emergence control plan and recovery operation procedures are discussed in detail in this section.

4.2.1 List of Hazardous scenarios identified for the proposed activity:

i. Leak of flexible unloading hose from ship.

ii. Rupture of flexible unloading hose.

iii. Leak of Sulfuric acid line from jetty to storage tank.

iv. Rupture of Sulfuric acid line from jetty to tank.

v. Leak of Sulfuric acid pump suction line from storage tank.

vi. Leak of Sulfuric acid line from pump discharge to plant.

vii. Leak of Phosphoric acid unloading hose from ship.

viii. Leak of Phosphoric acid line from jetty to storage tank.

ix. Leak of Phosphoric acid pump suction line from storage tank.

x. Leak of Phosphoric acid from pump discharge to road tanker.

xi. Leak of Phosphoric acid from road tanker.

4.2.2. Best Risk Management Practices

i. Well designed pipe lines with expansion loops are used for installation of unloading, loading and acid transfer service.

ii. Material of construction of Sulfuric acid and Phosphoric acid storage tanks and associated piping are selected based on the material compatibility.

iii. Storage tanks are designed to withstand worst weather conditions like cyclones, earthquakes etc.

iv. Good Engineering practices, National standards and applicable codes are adopted while designing the layout selection of equipment and construction.

v. Periodical inspection, maintenance and thickness measurement of the pipelines and tank should be carried out once in 2 years.

vi. Hydraulic test of the unloading hoses shall be carried out as per IS 10733 and hoses shall be checked for electrical conductivity after each hydro testing.

vii. Visual inspection and ultrasonic thickness monitoring, di penetration test of weld joints are carried out once in two years.

viii. Hydraulic test of the pipelines once in 5 years at a test pressure not exceeding the rating of the valves and of pressure not less than 1.25 times the operating pressure is carried out.

ix. FFS (Fitness for service) for the proposed storage facility is scheduled once in five years.

x. Sulfuric acid transfer pipe line to the plant is fully welded with no flange joints, thus minimizes the source of acid leakage.

xi. Round the clock monitoring and supervision is ensured during ship unloading and Sulfuric acid transfer to plant in particular.

xii. Continuous surveillance of Sulfuric acid line through CCTV is carried out during transfer of acid from wharf to plant.

xiii. Proposed acid storage facility is equipped with following control systems.

- Level control system.
- Radar gauge with alarm.

- High- High alarm on tanks to trigger the manual control of the feed pump.
- Dyke wall spill control sump.

xiv. Firefighting system is installed at proposed acid storage facility.

4.2.3 Eco-friendly handling of sulphuric acid and phosphoric acid

i. Sulphuric Acid and Phosphoric Acid used in our fertiliser complex are hazardous chemicals. Phosphoric Acid is mild and less hazardous, while Sulphuric Acid is corrosive and more hazardous and toxic in nature.

ii. Carbon Steel and Rubber lined Carbon Steel Tanks are used for storage of Sulphuric Acid and Phosphoric Acid respectively. PVC carboys are used to handle smaller quantity of hazardous chemicals.

iii. Carbon Steel/SS316 and rubber-lined carbon steel pipes are used for handling Sulphuric Acid and Phosphoric Acid respectively.

iv. Signage Boards along with DANGER signs with safety measures to be followed are displayed at Acid storage and handling facility.

v. Storage Tanks are built-in with Dyke, Sump and Pump for collection of acid leakage and transfer the same to other storage tanks.

vi. Dyke is provided with impervious HDPE liner followed by acid resistant tiles to prevent seepage of the acid into the ground.

vii. Water shall not be sprayed on the spillages or shall be used for neutralization of Sulphuric Acid.

viii. In case of Acid leakage of pipeline:

- Isolate the leak immediately from source to avoid spreading of acid into other areas including marine waters
- Cordon off the area with suitable signage boards.
- Evacuate the people from affected areas.
- Containment is made with sand in HDPE bags.
- Use portable pumps or crates to transfer pool of acid into suitable acid proof container/ carboys .The containers are shifted and placed at designated area in the plant which is an impermeable floor and properly labeled. The containers are shifted to plant using tractor truck. The acid is poured slowly and carefully into a sump of either Phosphoric acid plant/granulation plant after obtaining clearance from the concerned for recycle and reuse.

- Neutralize residual acid with soda ash.

- Collect the contaminants and transfer the same to effluent treatment plant.

ix. In case of major leaks from failure of storage tanks, allow Sulphuric Acid/Phosphoric Acid flow towards sump line with acid resistant tiles and the acid is transferred into other storage tanks.

x. Padding/C clamp and wooden plug are employed for arresting minor acid leaks of pipelines and storage tanks respectively.

xi. Loading stations of Sulphuric Acid and Phosphoric Acid are lined with acid resistant bricks to prevent seepage of acid and land contamination.

xii. Adequate instrumentation is made like pressure indicators, level indicators and level alarm is provided for loading Phosphoric Acid into road tankers and for transporting Sulphuric Acid from wharf to the plant.

xiii. Usage of PPE such as PVC gloves, PVC suit, Face Shield, and Gum boots is ensured while handling Sulphuric Acid and Phosphoric Acid.

xiv. Well laid Standard Operating Procedures (SOP) for unloading both acids from ship, loading of Phosphoric Acid into road tankers, transfer of Sulphuric Acid from Wharf to plant and emergency control procedures are developed.

xv. Training is also imparted to Operating & Maintenance personnel.

xvi. Safety showers and Eye Wash Fountains are provided at easily accessible positions near the proposed Acid storage facility and used if persons are affected with acid spray.

xvii. Attached photographs showing eco friendly handing of sulphuric acid/phosphoric acid being follow in our existing plant premises.

4.2.4. Operating procedure for unloading Sulphuric Acid/Phosphoric Acid to proposed Storage facility at Wharf

i. Check all the relevant instrumentation of the storage tank such as level indicators, high level alarms on tanks, and pressure gauges on the unloading lines, for their effective functioning before the arrival of the ship at the proposed facility.

ii. Check the unloading pipelines and unloading hose for any leaks/damages

iii. Check the support of the line and of the unloading hose for its integrity.

iv. Check all the communication systems like Radio Trunks, Walkie Talkies, for their proper functioning and ensure Dyke area drain Valve on the storage tank is kept closed.

v. After the ship is berthed and obtaining customs clearance, connect the unloading hoses to the pumps discharge manifold and to the unloading pipelines at the jetty.

vi. Open valve on the receiving tank and on the unloading pipeline. Ensure that the inlet valve on the other tank is kept closed.

vii. Unloading operator on the jetty shall establish proper communication contact between storage tank area panel operator and with Unloading Master of the Ship.

viii. After ensuring from the storage tank area operator, that the total system is ready for receiving Phosphoric Acid/Sulphuric Acid from the ships, communicate to the unloading master of the ship for starting the pumps at a pre-determined flow rate.

ix. After ensuring the unloading operation is stabilized, increase the rate of unloading to maximum up to 1000 MTs per hour, maintaining pumping discharge pressure at 5kg/cm2.

x. Shore Operator keeps contact with unloading master of the ship from time to time regarding any eventualities/emergencies that might occur during the course of unloading.

xi. In case of any emergency, such as pipeline/unloading hose rupture, shore operator initiates immediate action informing the same to the ship unloading master and gets the pumps tripped/stopped.

xii. After receipt of ship billed quantity, the unloading hose and the pipelines are air-flushed with the installed compressor at wharf till the acid in the pipeline and the hoses are emptied out.

xiii. After completion of the air-flushing operation, all the valves are kept closed and unloading hose is disconnected from the ship of manifold and necessary blinds are fixed on the pipeline. The unloading hose is moved back to the designated storage area.

xiv. Ensure the unloading hoses are tested and fit to use before commencement of unloading operation.

xv. Ensure the Fire Water System is available at the Jetty and the Storage Tank area.

xvi. Ensure portable water is available to eye-washers.

4.2.5 Operating procedure for loading Phosphoric acid into Road tankers

i. Confirm the road tanker is empty and is carrier of Phosphoric acid service withno other chemical or water present in it.

ii. Ensure loading hoses are in good condition with valid certification from authorized agency.

iii. Ensure tanker unloading drain/unloading valve is closed and dummied with flanges.

iv. Ensure truck vent valve is opened and extend vent valve is free of holding. Vent hose other end is tied closely to tanker bottom.

v. Arrange road tanker top cover opened.

vi. Drop in the loadinghose into road tanker.

vii. Ensure the selected pump inoperating condition.

viii. Open the suction ofselected pump.

ix. Open the bottom of selected storage tank.

x. Open all the valves of standby pump closed.

xi. Open recirculation valve of the pump to the selected storage tank under operation.

xii. Install flow meter at pump discharge end.

xiii. Start selected pump and observe the pressure and if the discharge pressure reaches 2.0kg/cm2, open the discharge valve of loading hose into tanker.

xiv. Open truck loading main isolation valve slowly and adjust flow to the desired level.

xv. Observe flow meter (FM) for its working.

xvi. Continue tank loading till carrying capacity of tanker is reached and periodically check quantity of acid loaded through FM integrator to prevent any possible over flow.

xvii. Stop loading operation if there is any leak in the system and attend the same.

xviii. Stop pump and close discharge valve.

xix. Empty road tanker hose and place it at designated location.

xx. Close road tanker isolation valve.

xxi. Close isolation valve of recirculation line.

xxii. Arrange top cover of road tanker fixed.

4.2.6 Emergency Control Plan:

i. Unloading hoses are periodically inspected and ensured they are fit to use.

ii. Pipe lines and storage tanks are periodically inspected and tested. Any abnormality detected is immediately attended

iii. Provided pressure gages on sulphuric acid transfer line from wharf to plant at strategic locations . Control system is provided in the control room to monitor the pipe line pressure on continuous basis.

iv. Incase of significant drop in pressure on the sulphuric acid pipeline, auto stoppage of the pump or auto closure of on / off valve Is provided.

v. Provided audabe alarm facility in the control room with gives alarm in case of abnormal pressure variation in the pipe line.

vi. Storage tanks are provided with level indicators, overflow pipes, and vents etc to avoid possible failure of storage tanks/ road tankers from excess inflow of acid during unloading /loading operation.

vii. The tanks are provided with containment dyke lined with proper acid resistant flooring

viii. Safety showers and eye wash fountains are provided at easily accessible positions near the storage and handling area

ix. Pipe line from jetty to proposed storage facility at wharf and from wharf to plant is patrolled at regular intervals.

x. Proper flexibility is maintained so that the unloading hose connection can take care of minor movement of ship due to tidal effects or change in draught.

xi. Continuous communication is maintained between jetty, ship and plant control room during ship unloading / loading acid into road tankers.

xii. Continuous patrolling of the ship unloading activity and the sulphuric acid from wharf to plant is carried out to detect any possible leackage in the pipe line and address the same immediately.

xiii. Trained and competent man power is deployed for unloading acid from ship, loading acid into road tankers and transfer of Sulfuric acid from wharf to plant.

4.2.7 Recovery operation procedure after the leakage/spill

i. Isolate the system as early as possible to avoid further leakage

ii. Cordon off the area and inform maintenance to attend the leak

iii. Contain the Sulfuric acid/ Phosphoric acid in the system and if required create a small bund with sand in HDPE bags to avoid spreading of acid into other area/ storm water drain

iv. Use PVC suit, PVC gloves, and gum boots to handle the Sulfuric / Phosphoric acid and Air line respirator and PVC hood if acid fumes are pungent.

v. Use portable SS pump to transfer the pool of acid into a suitable container

vi. Send collected drums / acid containers to the designated area for further action

vii. Neutralize the spill on the floor with soda ash and wash the area and remove it to Effluent Treatment Plant

viii. In case of major spill inside storage tank, allow Sulfuric /Phosphoric acid to flow towards sump and transfer the acid into other storage tank

ix. Check whether the dyke area drain valve is closed or not

x. Do not spray water directly on to the Sulfuric acid pool. Allow Sulfuric acid flow slowly into large volume of water for dilution and neutralization

xi. Check the nearby soil and the storm water drain for any possible contamination, if storm water drain is contaminated, isolate it and arrange for separating the contaminated portion for further disposal through approved system.

Chapter -5

Environmental Management Plan

i. The objective of the Environmental Management Plan is to identify specific project actions that will be undertaken by project proponent (Coromandel international Ltd) for mitigation of specific impacts if any, due to proposed acid storage facility.The action will be incorporated into Coromandel safety management system and integrated into the implementation of project development at various stages of project development. The EMP defined here is concerned with the impacts identified during construction and operation due to proposed acid storage handling facility.

ii. The Environmental Management Plan can be effectively be implemented to mitigate pollution levels by observing the following.

- Polution will be prevented or reduced at the source.
- Polution that can not be prevented will be recycle in Envrionmentally safer manner.
- Polution that can not be prevented or recycled will be treated in Environmentally safe manner.
- Disposal or other releases into the Environment will be used only as last resort and will be carried out in an Environmentally safe manner.

5.1 Construction phase

i. Environmental pollution during construction phase due to the activities involving site preparation and construction. However, the proposed acid storage facility will be built in the premises of Coromandel which is leveled and compacted

ii. Impact during construction phase of the development on air quality shall be limited to marginal dust emission ie 5-10 ug/m3 at Coromandel site. Dust emissions due to construction activity will be prevented by water sprinkling

iii. It would be ensured that construction vehicles are properly maintained to minimize smoke in their exhaust emissions. The vehicle maintenance area would be located in such a way that contamination of surface soil/water by accidental spillage of oil will not take place and dumping of waste oil will be strictly prohibited

iv. Construction workers are given adequate personnel protective equipment like helmets, safety shoes, goggles etc while working in the site to protect themselves from occupational hazards

v. No trash or debris from construction activities would be left at project site. All the waste is handled as per standard industry practices

5.1.1 Operation phase

i. **Air environment:**

- As the proposal of acid storage facility at wharf does not involve any manufacturing process, no fugitive emissions or point source emissions are envisaged

ii. **Water environment:**

- As no manufacturing process and no chemical reactions are involved in the said proposal, no additional consumption of fresh water and hence no generations of effluents is envisaged.

iii. Land environment:

- The proposed facility will be set up in the existing premises without any additional requirement fresh land. Besides the propose storage tanks will be constructed with leack proof system and hence no impact is envisaged on the land Environment and topography.

iv. Noise environment:

- Porposedstorge tanks shall be operated in a closed system with minimum number of rotary equipments and it is envisaged that noice environment would be remain uneffected during operation of proposed storage facility.

v. Solid and Hazardous waste:

- No solid waste generation is envisaged from the storage tanks. However used oils and used cloth if any are generated during operation are disposed to authorized TSDF.

vi. Marine environment:

- The potential impact on marine waters due to any possible acid leakage/ spill from ship unloading system is addressed through

effective spill control plan developed as part of Environment Management Plan.

5.2 Spillage control plan

i. Automatic isolation system is provided to prevent further leakage and contamination of soil including marine waters.

ii. Adequate instrumentation like pressure indication on the pipe line, level indicators to the storage tankers and for loading Phosphoric acid into road tankers is providedto prevent any spillage from over flow due to inadvertent operation.

iii. Standard operating procedures are developed for unloading acids from ship to storage tank, loading Phosphoric acid into road tankers and transfer of Sulfuric acid from proposed storage facility to plant premises to ensure spill /leak free acid transfer operation

iv. Padding/C clamps and wooden plugs are used for arresting temporarily minor acid leaks of the pipe lines and from storage tanks respectively.

v. Splash guards are provided to all pipe line flanges to prevent any possible leakage and land contamination.

vi. Acid pumping station is built in with recirculation system for loading acid into road tankers and transferring Sulfuric acid from wharf to plant. This provides fine control on acid transfer and loading and prevents inadvertent overflow/spillage of acid on the ground.

vii. Preventive and predictive inspection and maintenance of storage tanks, pipe lines and other equipment are followed meticulously to avoid any possible acid leakage from pump valves, gland and casing.

viii. Closed supervision during acid unloading, loading and transfer operation is to be ensured

ix. Acid loading and unloading hoses are to be tested and inspected for any leaks before their usage during each time in particular during ship unloading operation.

x. Road carriers for phophosric acid service are periodically inspected for its integraty.

xi. Isolation valves on the sulfuric acid pipe line, Sumps with pumping facility are provided at strategic locations in between the wharf and plant to drain the Sulfuric acid in the pipe line into pits in case of leak/maintenance and transfer the same to storage tanks.

xii. Suitable spill collection system is made available at the jetty area to avoid any accidental spill/leakage into marine environment.

xiii. Flooring and the walls inside acid storage tank dyke is provided with acid resistant tiles

Chapter -6

Annexures

i. Material safety Data sheet for sulfuric acid.

ii. Material safety Data sheet for Phosphoric acid.

iii. Process flow diagram for transfer of sulfuric acid to plant.

iv. Process flow diagrm for loading phosphoric acid into road tankers.

v. Photographs showing the eco friendly handing of sulfuric acid and phosphoric acid at Visakha plant.

Annexure-I

Material safety Data sheet for sulfuric acid

ScienceLab.com
Chemicals & Laboratory Equipment

Material Safety Data Sheet
Sulfuric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sulfuric acid

Catalog Codes: SLS2539, SLS1741, SLS3166, SLS2371, SLS3793

CAS#: 7664-93-9

RTECS: WS5600000

TSCA: TSCA 8(b) inventory: Sulfuric acid

CI#: Not applicable.

Synonym: Oil of Vitriol; Sulfuric Acid

Chemical Name: Hydrogen sulfate

Chemical Formula: H2-SO4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sulfuric acid	7664-93-9	95 - 98

Toxicological Data on Ingredients: Sulfuric acid: ORAL (LD50): Acute: 2140 mg/kg [Rat.]. VAPOR (LC50): Acute: 510 mg/m 2 hours [Rat]. 320 mg/m 2 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA. Classified A2 (Suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged

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contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion:
Products of combustion are not available since material is non-flammable. However, products of decompostion include fumes of oxides of sulfur. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas. Reacts with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Fire Hazards in Presence of Various Substances: Combustible materials

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Metal acetylides (Monocesium and Monorubidium), and carbides ignite with concentrated sulfuric acid. White Phosphorous + boiling Sulfuric acid or its vapor ignites on contact. May ignite other combustible materials. May cause fire when sulfuric acid is mixed with Cyclopentadiene, cyclopentanone oxime, nitroaryl amines, hexalithium disilicide, phorphorous (III) oxide, and oxidizing agents such as chlorates, halogens, permanganates.

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Special Remarks on Explosion Hazards:
Mixtures of sulfuric acid and any of the following can explode: p-nitrotoluene, pentasilver trihydroxydiaminophosphate, perchlorates, alcohols with strong hydrogen peroxide, ammonium tetraperoxychromate, mercuric nitrite, potassium chlorate, potassium permanganate with potassium chloride, carbides, nitro compounds, nitrates, carbides, phosphorous, iodides, picratres, fulminats, dienes, alcohols (when heated) Nitramide decomposes explosively on contact with concentrated sulfuric acid. 1,3,5-Trinitrosohexahydro-1,3,5-triazine + sulfuric acid causes explosive decompositon.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:
Hygroscopic. Reacts. violently with water. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 STEL: 3 (mg/m3) [Australia] Inhalation TWA: 1 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 1 STEL: 3 (mg/m3) from ACGIH (TLV) [United States] [1999] Inhalation TWA: 1 (mg/m3) from NIOSH [United States] Inhalation TWA: 1 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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Physical state and appearance: Liquid. (Thick oily liquid.)

Odor: Odorless, but has a choking odor when hot.

Taste: Marked acid taste. (Strong.)

Molecular Weight: 98.08 g/mole

Color: Colorless.

pH (1% soln/water): Acidic.

Boiling Point:
270°C (518°F) - 340 deg. C Decomposes at 340 deg. C

Melting Point: -35°C (-31°F) to 10.36 deg. C (93% to 100% purity)

Critical Temperature: Not available.

Specific Gravity: 1.84 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 3.4 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Easily soluble in cold water. Sulfuric is soluble in water with liberation of much heat. Soluble in ethyl alcohol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability:
Conditions to Avoid: Incompatible materials, excess heat, combustible material materials, organic materials, exposure to moist air or water, oxidizers, amines, bases. Always add the acid to water, never the reverse.

Incompatibility with various substances:
Reactive with oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(316). Highly corrosive in presence of stainless steel(304). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Strong oxidizer. Reacts violently with water and alcohol especially when water is added to the product. Incompatible (can react explosively or dangerously) with the following: ACETIC ACID, ACRYLIC ACID, AMMONIUM HYDROXIDE, CRESOL, CUMENE, DICHLOROETHYL ETHER, ETHYLENE CYANOHYDRIN, ETHYLENEIMINE, NITRIC ACID, 2-NITROPROPANE, PROPYLENE OXIDE, SULFOLANE, VINYLIDENE CHLORIDE, DIETHYLENE GLYCOL MONOMETHYL ETHER, ETHYL ACETATE, ETHYLENE CYANOHYDRIN, ETHYLENE GLYCOL MONOETHYL ETHER ACETATE, GLYOXAL, METHYL ETHYL KETONE, dehydrating agents, organic materials, moisture (water), Acetic anhydride, Acetone, cyanohydrin, Acetone+nitric acid, Acetone + potassium dichromate, Acetonitrile, Acrolein, Acrylonitrile, Acrylonitrile +water, Alcohols + hydrogen peroxide, allyl compounds such as Allyl alcohol, and Allyl Chloride, 2-Aminoethanol, Ammonium hydroxide, Ammonium triperchromate, Aniline, Bromate + metals, Bromine pentafluoride, n-Butyraldehyde, Carbides, Cesium acetylene carbide, Chlorates, Cyclopentanone oxime, chlorinates, Chlorates + metals, Chlorine trifluoride, Chlorosulfonic acid, 2-cyano-4-nitrobenzenediazonium hydrogen sulfate, Cuprous nitride, p-chloronitrobenzene, 1,5-Dinitronaphthlene +

sulfur, Diisobutylene, p-dimethylaminobenzaldehyde, 1,3-Diazidobenzene, Dimethylbenzylcarbinol + hydrogen peroxide, Epichlorohydrin, Ethyl alcohol + hydrogen peroxide, Ethylene diamine, Ethylene glycol and other glycols, , Ethylenimine, Fulminates, hydrogen peroxide, Hydrochloric acid, Hydrofluoric acid, Iodine heptafluoride, Indane + nitric acid, Iron, Isoprene, Lithium silicide, Mercuric nitride, Mesityl oxide, Mercury nitride, Metals (powdered), Nitromethane, Nitric acid + glycerides, p-Nitrotoluene, Pentasilver trihydroxydiaminophosphate, Perchlorates, Perchloric acid, Permanganates + benzene, 1-Phenyl-2-methylpropyl alcohol + hydrogen peroxide, Phosphorus, Phosphorus isocyanate, Picrates, Potassium tert-butoxide, Potassium chlorate, Potassium Permanganate and other permanganates, halogens, amines, Potassium Permanganate + Potassium chloride, Potassium Permanganate + water, Propiolactone (beta)-, Pyridine, Rubidium aceteylene carbide, Silver permanganate, Sodium, Sodium carbonate, sodium hydroxide, Steel, styrene monomer, toluene + nitric acid, Vinyl acetate, Thalium (I) azidodithiocarbonate, Zinc chlorate, Zinc Iodide, azides, carbonates, cyanides, sulfides, sulfites, alkali hydrides, carboxylic acid anhydrides, nitriles, olefinic organics, aqueous acids, cyclopentadiene, cyano-alcohols, metal acetylides, Hydrogen gas is generated by the action of the acid on most metals (i.e. lead, copper, tin, zinc, aluminum, etc.). Concentrated sulfuric acid oxidizes, dehydrates, or sulfonates most organic compounds.

Special Remarks on Corrosivity:
Non-corrosive to lead and mild steel, but dillute acid attacks most metals. Attacks many metals releasing hydrogen. Minor corrosive effect on bronze. No corrosion data on brass or zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2140 mg/kg [Rat.]. Acute toxicity of the vapor (LC50): 320 mg/m3 2 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA. Classified A2 (Suspected for human.) by ACGIH. May cause damage to the following organs: kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
Mutagenicity: Cytogenetic Analysis: Hamster, ovary = 4mmol/L Reproductive effects: May cause adverse reproductive effects based on animal data. Developmental abnormalities (musculoskeletal) in rabbits at a dose of 20 mg/m3 for 7 hrs.(RTECS) Teratogenecity: neither embryotoxic, fetoxic, nor teratogenetic in mice or rabbits at inhaled doses producing some maternal toxicity

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes severe skin irritation and burns. Continued contact can cause tissue necrosis. Eye: Causes severe eye irritation and burns. May cause irreversible eye injury. Ingestion: Harmful if swallowed. May cause permanent damage to the digestive tract. Causes gastrointestial tract burns. May cause perforation of the stomach, GI bleeding, edema of the glottis, necrosis and scarring, and sudden circulatory collapse(similar to acute inhalation). It may also cause systemic toxicity with acidosis. Inhalation: May cause severe irritation of the respiratory tract and mucous membranes with sore throat, coughing, shortness of breath, and delayed lung edema. Causes chemical burns to the repiratory tract. Inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Cause corrosive action on mucous membranes. May affect cardiovascular system (hypotension, depressed cardiac output, bradycardia). Circulatory collapse with clammy skin, weak and rapid pulse, shallow respiration, and scanty urine may follow. Circulatory shock is often the immediate cause of death. May also affect teeth(changes in teeth and supporting structures - erosion, discoloration). Chronic Potential Health Effects: Inhalation: Prolonged or repeated inhalation may affect behavior (muscle contraction or spasticity), urinary system (kidney damage), and cardiovascular system, heart (ischemic heart leisons), and respiratory system/lungs(pulmonary edema, lung damage), teeth (dental discoloration, erosion). Skin: Prolonged or repeated skin contact may cause dermatitis, an allergic skin reaction.

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Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 49 mg/l 48 hours [bluegill/sunfish].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Sulfuric acid may be placed in sealed container or absorbed in vermiculite, dry sand, earth, or a similar material. It may also be diluted and neutralized. Be sure to consult with local or regional authorities (waste regulators) prior to any disposal. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sulfuric acid UNNA: 1830 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sulfuric acid New York release reporting list: Sulfuric acid Rhode Island RTK hazardous substances: Sulfuric acid Pennsylvania RTK: Sulfuric acid Minnesota: Sulfuric acid Massachusetts RTK: Sulfuric acid New Jersey: Sulfuric acid California Director's List of Hazardous Substances (8 CCR 339): Sulfuric acid Tennessee RTK: Sulfuric acid TSCA 8(b) inventory: Sulfuric acid SARA 302/304/311/312 extremely hazardous substances: Sulfuric acid SARA 313 toxic chemical notification and release reporting: Sulfuric acid CERCLA: Hazardous substances.: Sulfuric acid: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R35- Causes severe burns. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S30- Never add water to this product. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

Other Special Considerations: Not available.

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Annexure-II

Material safety Data sheet for Phosphoric acid

ScienceLab.com
Chemicals & Laboratory Equipment

Material Safety Data Sheet
Phosphoric acid, 85% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Phosphoric acid, 85%

Catalog Codes: SLP5569, SLP4555, SLP1732

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Phosphoric Acid; Water

CI#: Not available.

Synonym: Phosphoric Acid 85%; Phosphoric Acid; Orthophosphoric acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Phosphoric Acid	7664-38-2	85-88
Water	7732-18-5	12-15

Toxicological Data on Ingredients: Phosphoric Acid: ORAL (LD50): Acute: 1530 mg/kg [Rat]. DERMAL (LD50): Acute: 2740 mg/kg [Rabbit]. DUST (LC50): Acute: >850 mg/m 1 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive, permeator), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, liver, skin, eyes, bone marrow. Repeated

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or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Reacts with metals to liberate flammable hydrogen gas. Formation of flammable gases with aldehydes, cyanides, mercaptins, and sulfides.

Special Remarks on Explosion Hazards: Mixtures with nitromethane are explosive. (Phosphoric Acid)

Section 6: Accidental Release Measures

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Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, alkalis. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Phosphoric Acid TWA: 1 STEL: 3 (mg/m3) from ACGIH (TLV) [United States] TWA: 1 STEL: 3 (mg/m3) from OSHA (PEL) [United States] TWA: 1 STEL: 3 (mg/m3) from NIOSH TWA: 1 STEL: 3 (mg/m3) [Mexico]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Syrupy liquid Viscous liquid.)

Odor: Odorless.

Taste: Acid.

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Acidic.

Boiling Point: 158°C (316.4°F)

Melting Point: 21°C (69.8°F)

Critical Temperature: Not available.

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Specific Gravity: 1.685 @ 25 C (Water = 1)

Vapor Pressure: 0.3 kPa (@ 20°C)

Vapor Density: 3.4 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Easily soluble in hot water. Soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, alkalis.

Corrosivity:
Extremely corrosive in presence of copper, of stainless steel(304), of stainless steel(316). Highly corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with metals to liberate flammable hydrogen gas. Incompatible with sodium tetrahydroborate producing a violent exothermic reaction. Heat generated with: alcohols, glycols, aldehydes, amides, amines, azo-compounds, carbamates, caustics, esters, ketones, phenols and cresols, organophosphates, epoxides, combustible materials, unsaturated halides, organic peroxides. Formation of flammable gases, with aldehydes, cyanides, mercaptins, and sulfides. Formation of toxic fumes with cyanides, fluorides, halogenated organics, sulfides, and organic peroxides. Do not mix with solutions containing bleach or ammonia. Incompatible with nitromethane, chlorides + staiinless steel. (Phosphoric Acid)

Special Remarks on Corrosivity:
Minor corrosive effect on bronze. Severe corrosive effect on brass. Corrosive to ferrous metals and alloys.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 1530 mg/kg [Rat]. Acute dermal toxicity (LD50): 2740 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: blood, liver, skin, eyes, bone marrow.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive, permeator), of eye contact (corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Corrosive and causes severe skin irritation and can cause severe skin burns. May affect behavior (somnolence or excitement) if absorbed through skin. Eyes: Corrosive. Liquid or vapor causes severe eye irritation and can cause severe eye burns leading to permanent corneal damage or chemical conjunctivitis. Ingestion: May be harmful if swallowed. Causes irritation and burns of the gastrointestinal (digestive) tract. Causes severe pain, nausea, vomiting, diarrhea hematemesis, gastrointestinal hemmorrhaging, and shock. May cause corrosion and permanent tissue destruction of the esophagus and digestive tract. May affect behavior and urinary system, liver (hepatocellular damage, hepatic enzymes increased), blood (blood dyscrasia). May also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Phosphoric acid (Phosphoric Acid) UNNA: 1805 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Phosphoric Acid Illinois toxic substances disclosure to employee act: Phosphoric acid Illinois chemical safety act: Phosphoric acid New York release reporting list: Phosphoric acid Rhode Island RTK hazardous substances: Phosphoric acid Pennsylvania RTK: Phosphoric acid Minnesota: Phosphoric acid Massachusetts RTK: Phosphoric acid Massachusetts spill list: Phosphoric acid New Jersey: Phosphoric acid New Jersey spill list: Phosphoric acid Louisiana spill reporting: Phosphoric acid California Director's list of hazardous substances: Phosphoric acid TSCA 8(b) inventory: Phosphoric Acid; Water SARA 313 toxic chemical notification and release reporting: Phosphoric acid CERCLA: Hazardous substances.: Phosphoric acid: 5000 lbs. (2268 kg)

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

p. 5

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:47 PM

Last Updated: 05/21/2013 12:00 PM

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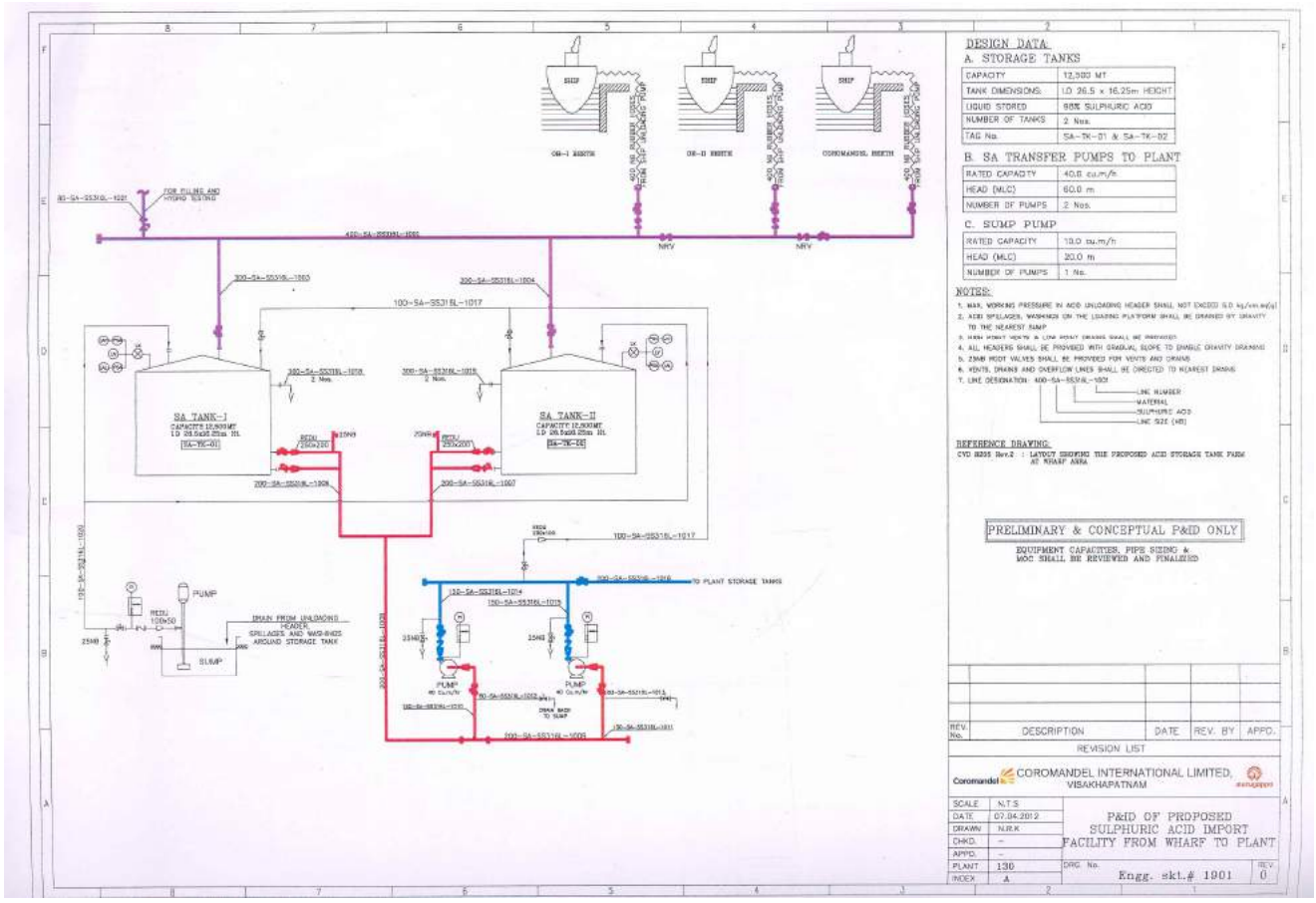
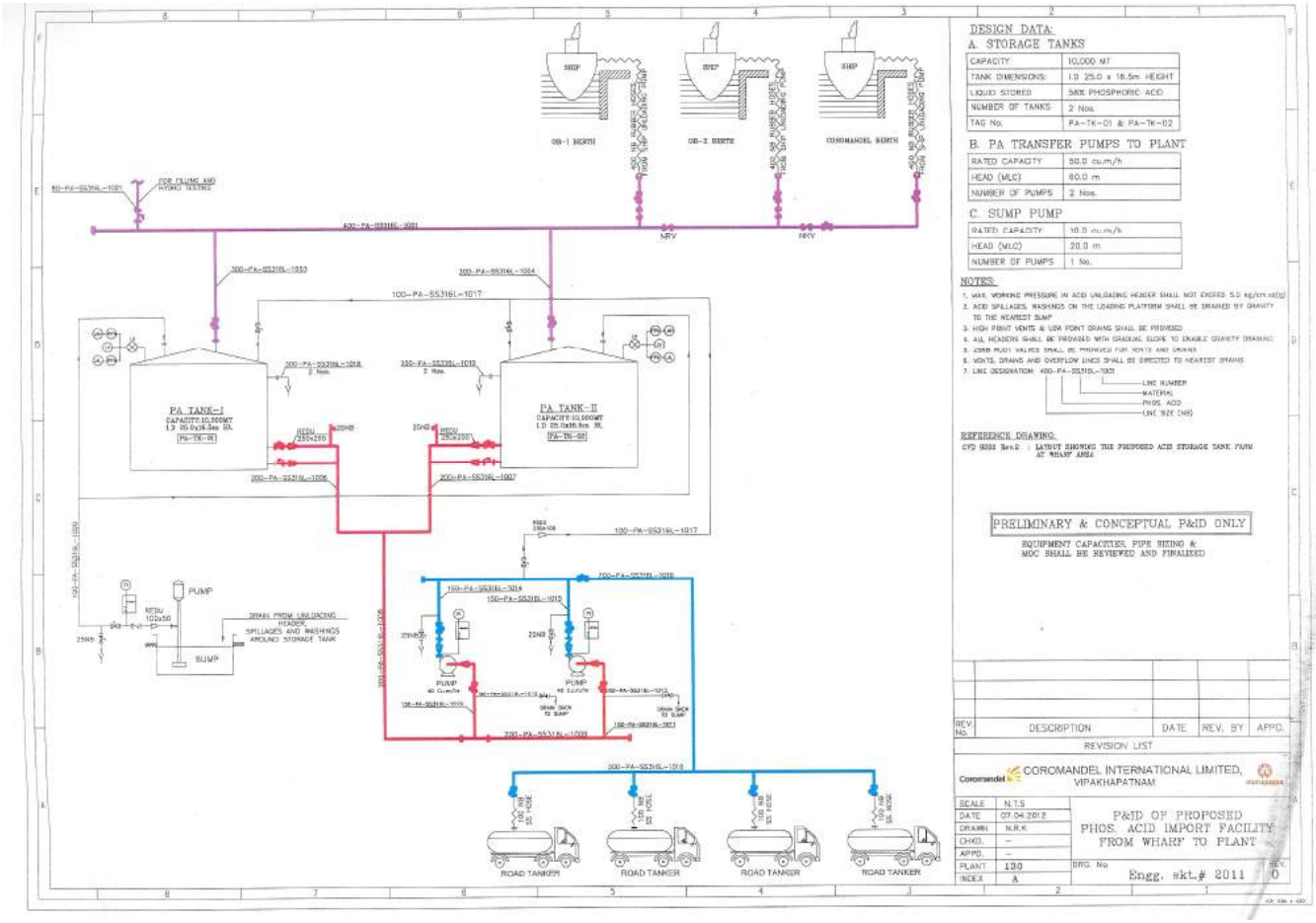
Annexure-III

Process flow diagram for transfer of sulfuric acid to plant



Annexure-IV

Process flow diagram for transfer of Phosphoric acid to plant



Annexure-V

Photographs showing the eco friendly handing of sulfuric acid and phosphoric acid at Visakha plant

Storage Tank Dyke area – Acid Resistant Brick lining – Phosphoric acid plant Coromandel, Visakha Unit

Dyke area drain to sump – Lined with acid resistant brick lining – Phosphoric acid plant Coromandel, Visakha unit

Clamp for arresting acid leakage of the pipe line- Sulfuric acid plant Coromandel, Visakha Unit

Technicians with clamp in hand - Sulfuric acid plant Coromandel, Visakha Unit

Online clamp fixing to arrest acid leakage of the pipe line - Sulfuric acid plant Coromandel, Visakha Unit

Online clamp fixing to arrest acid leakage of the pipe line - Sulfuric acid plant Coromandel, Visakha Unit

SUMP & PUMP IN STORAGE TANK DYKE - SULFURIC ACID / PHOSPHORIC ACID PLANT

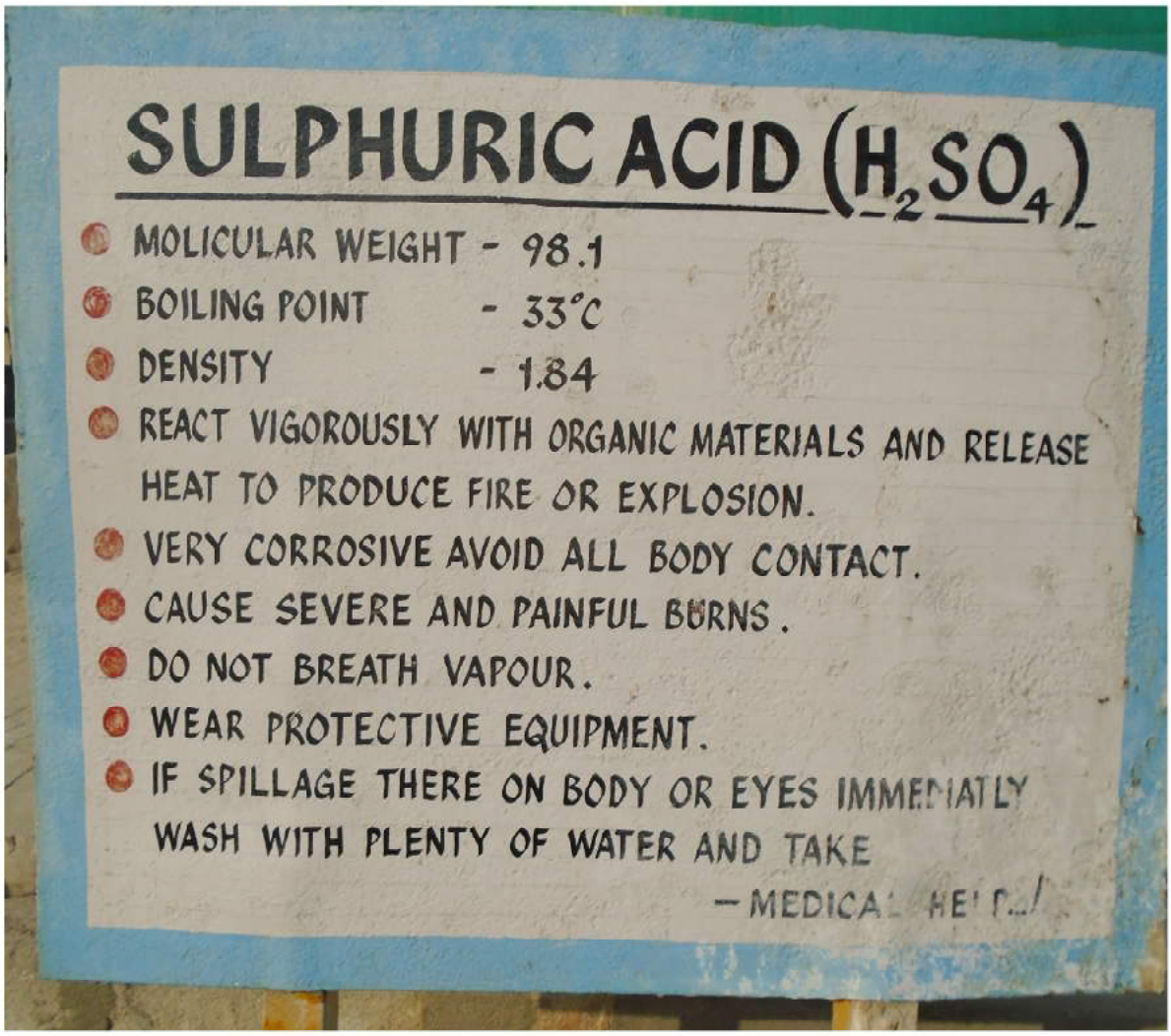
COROMANDEL, VISAKHA UNIT

SULFURIC ACID STORAGE TANKS AT PLANT -
COROMANDAL VISAKHA UNIT

UNLOADING OF SULFURIC / PHOSPHORIC ACID INTO A SUMP AT PLANT COROMANDEL, VISAKHA UNIT

SAFETY MEASURES TO BE FOLLOWED WHILE HANDLING SULFURIC ACID

COROMANDEL, VISAKHA UNIT



ON SITE EMERGENCY RESPSONE PLAN

COROMANDEL INTERNATIONAL LTD.,

VISAKHAPATNAM

FOREWORD

A major emergency in a plant is one, which has the potential to cause serious injury or loss of life and environmental pollution. It may cause extensive damage to plant and machinery and could result in serious disruption to normal operations both within and outside the plant premises. Depending upon the magnitude of the emergency, services of outside agencies may also be required for supplementing the internal effort to effectively handle the emergency and contain the damage.

Although, the emergency may be caused by a number of factors, like equipment failure, human error, earthquake, cyclone, vehicle crash or sabotage, it will normally manifest itself in three basic forms, viz., fire, explosion, release or escape of flammable or toxic gases and spillage of products during manufacturing, import, storage and handling within the premises. Coromandel management had taken effective steps to assess, minimise and wherever feasible eliminate the risks to a large extent. Accident may still occur and it is necessary that we should be fully prepared to tackle all such emergencies if and when they occur.

It is likely that consequences of such emergencies will be confined to the units concerned or might spread to several other units. But if the consequences are confined within the plant boundary, it is considered as an On Site Emergency and will be controlled by the Chief Emergency Controller/ Factory Manager.

When emergency becomes major with a likelihood of the consequences spreading beyond the factory premises and if evacuation is also considered necessary, the situation requires involvement of the District Authority for implementation of Off Site Emergency Plan.

The main aim of hazard control and disaster management is concerned with preventing accidents through good design, operation, maintenance and inspection, by which it is possible to minimise accidents and to reduce the risk if and when an accident occur. Elimination would also require prompt action by the operating staff. Often a quick plant stoppage, isolation and pressure release from the effected equipment, operating emergency water sprays etc can be very effective in minimising the chances of accidents.

In all these steps, speed and coordinated action are the essential elements of an emergency response. As it is not possible to totally eliminate all risks, an essential part of major hazard control must include all possible steps for mitigating the effects of a major accident.

An important element of mitigation is emergency planning i.e., recognising that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on-site and off-site, that would need to be implemented in the event of an emergency. Emergency preparedness and emergency planning have to be considered essential parts of the management strategy for mitigating the effects of a major accident/ emergency.

Emergency planning both on-site and off-site are different but they should be consistent and should complement each other. On-site emergency planning is the responsibility of the site management / occupier and the District authority and the factories inspectorate will be responsible for the off-site emergency plan. The on-site emergency plan detailed here is expected to meet this requirement.

The On-site plan will be circulated to all concerned members of the emergency teams. It is essential that all concerned key personnel familiarise themselves with the overall on-site plan and their respective roles and responsibilities during an emergency. They should also participate regularly in the mock drills that will be conducted so as to keep themselves and the emergency organisation in a state of perpetual readiness at all times to meet any emergency.

HOD – SHE will ensure that the plan is reviewed and updated annually or more frequently as required to make it effective and workable and circulated to all concerned.

The On Site Emergency Plan (OSEP) is prepared according to the guidelines issued by the District Crisis Group, Visakhapatnam and was reviewed and updated considering increase in storage capacity of Ammonia from 10000 MT to 12500 MT and action plan was developed for various identified scenarios.

M.Kumaresan
Sr.Assc.Vice President – Manufacturing

COROMANDEL INTERNATIONAL LIMITED

Factory: Sriharipuram, Malkapuram (P.O), Visakhapatnam – 530 011 (A.P)

ON – SITE EMERGENCY RESPONSE PLAN

DOC NO: E / SH / SF / WI / 001. REV NO: 5
DATE OF ISSUE: NOVEMBER 2015

INCASE OF EMERGENCY DUE TO FIRE / TOXIC GAS LEAK OR ANY OTHER MAJOR INCIDENT

FIRST RESPONDER

(Whoever first sees the emergency)

DIAL --- 111

(EMERGENCY PHONE NUMBER)

Alternate Phone number -- 444

TO TRIGGER THE ON – SITE EMERGENCY PLAN

COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
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	1.2	Objectives of the Onsite emergency plan.	2	3
	1.3	Document control procedure.	1	4
	1.3 B	Document circulation summary	2	5
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	2.1 A	Process flow diagrams	14	6
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5.0		Emergency Management plan.	1	4
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	5.3	Communication Methods	1	4
	5.4	Control centers and Assembly Points	1	6
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PREPARED BY: HOD – S H & E	**REVIEWED BY: HOD - OPERATIONS**	**APPROVED BY: UNIT HEAD**

SEC NO.	SUB SEC. NO.	CONTENTS	NO. OF PAGES	REV. NO.
6.0		Annexures.		
	6.1	Location Map & Area wise Urban population	3 sheets	3
	6.2	Plot plans (Hazardous areas & Escape routes)	3 sheets	4
	6.3	Meteorological data Wind roses	9 sheets	2
	6.4	Lines of emergency communications.	4 sheets	8
	6.5	Roles and responsibilities of key personnel	12 sheets	6
	6.6	Regular and emergency organization charts	6sheets	3
	6.7	General code of conduct during emergency	1 sheet	2
	6.8	Emergency Action code.	2 sheets	2
	6.9	Mutual Aid.	2 sheets	4
	6.10	Safety & Fire equip., Safety Showers, Wind sacs - lists	5 sheets	5
	6.11	Trained First Aiders & Rescue teams - lists	3 sheets	7
	6.12	Evacuation Procedure	2 sheets	2
	6.13	Material Safety Data	7 sheets	3
	6.14	List of important Internal & External telephones	6 sheets	10

INTRODUCTION

SECTION – 1.0

DOC NO: E/SH/SF/WI/001 REV NO: 6

DATE OF ISSUE: NOVEMBER 2015

1.1 Brief Plant Details:

1.1.1 Location and surroundings: The fertiliser complex of Coromandel is located in a 50 acre built-up area in plot of 485 acre land leased from Visakahapatnam Port Trust in Sriharipuram village on the southern part of the city of Visakhapatnam in Andhra Pradesh at a **Latitude of 17^0 41" N & Longitude of 83^0 18" E.**. Hindustan Zinc Township is located on the western side and the HPCL refinery on the eastern side. The Gypsum pond of Coromandel extends up to the railway line on the northern side. Further north is the Naval Air Base and civil Airport. Immediately on the south of the coromandel plant is the Coromandel housing colony followed by Sriharipuram village. Gajuwaka town ship is on the south - western side.

Area map showing the plant location and surroundings is annexed.

Nearest facilities are as follows:

Railway Station	Visakhapatnam	13 KM
Police Station	Malkapuram	5 KM
Fire Station	Hindustan Petroleum Corporation APCL Hindustan Shipyard Naval Dockyard Hindustan Zinc Ltd., Fire Station Govt. Fire Station, Pedagantyada	1 KM 2 KM 6 KM 7 KM 3 KM 4 KM
Hospitals	Hymavathi Nursing Home Indus Hospital Visakhapatnam RK Hospital ESI Hospital, Gandhigram KGH, Visakhapatnam	1 KM 15 KM 4 KM 5 KM 15 KM
Airport	Visakhapatnam	10 KM
National Highway No.5		3 KM

The plant is well connected by road and rail.

ENVIRONS:

East	:	HPCL Refinery	0.5 KM
		Bay of Bengal	5.0 KM
South	:	Sriharipuram and Malkapuram Villages	0.5 KM
		Dolphins' Nose Hill	5.0 KM
West		Hindustan Zinc Limited Factory and Township	0.5 Km
North		Naval Area Base and Aerodrome	1.0 KM
North East		Andhra petrochemicals plant and new storage tanks of HPCL	0.5 KM

Area Map is enclosed at **Annexure 3.**

Meteorological Data

Ambient Temperature:

- Maximum 41^0 C
- Minimum 23.5^0 C

Wind Velocity: Mean wind velocity 10.8Km/hr (Varies from still weather to 40 km/hr)

Wind Direction: Most dominant wind direction is from South-West. The percentage of wind blowing from West and South are also considerable.

Relative humidity 78% (mean)

Monthly Wind Rose diagrams are enclosed as Annexure **No. 6.3**

1.1.2 **On-site Activities**: The Coromandel factory complex was commissioned in December 1967. The on-site activities are primarily concerned with the production of N-P-K complex fertilisers of various grades under the trade name Gromor. Phospho- gypsum is an important byproduct. Following are the operating units at the Coromandel complex.

	Units/ Plants	**Capacity** (MTPD)
i)	Sulfuric Acid Plant	1700
ii)	Phosphoric Acid Plant	700
iii)	Complex Fertilizer Plant (3 streams)	3900
iv)	Bentonite sulfur plant	100
v)	Water-soluble fertilizers	10
vi)	Customized Fertilizer Plant	300
vii)	Pilot plants	
	1) Complex fertilizer	24
	2) Phosphoric acid plant	0.83
viii)	Wharf for importing required raw materials and molten sulfur storage facility.	
ix)	Storages for raw-materials, intermediates and products.	
x)	Utilities including Boilers, D.G.sets D.M.Water, Plant air And Inst. Air, Process water and firewater supply and Atmospheric pressure Ammonia storage tanks.	
xi)	Misc. Off-site facilities like workshops, garage, stores for spare parts etc.	

Process description of the operating units is given in **Chapter 2.0**

By-Products

i) Gypsum	3227 MTPD
ii) Hydro-fluorosilicic acid	15 MTPD

1.2 Objectives, Scope and Contents of On-site Emergency Plan:

1.2.1 The Objective: The objective of emergency planning is to maximize the resource utilization and coordinate the efforts of all concerned in tackling the emergency situation and would broadly cover the following:

1. To localize the emergency and if possible to eliminate it.
2. To minimize the effects of accidents on people and property.
3. To take correct remedial measures in the quickest possible time to contain the incident and to control it with minimum damage.
4. To mobilize the internal resources and to utilize them in the most effective way.
5. To get help from local community and Govt. officials to supplement company manpower and resources.
6. To minimize the damage in other sectors.
7. To keep the required emergency equipment in stock at right places and ensure their working condition.
8. To keep the concerned personnel fully trained in the use of emergency equipment.
9. To give immediate warning to the surrounding localities in case of emergency situation emerging.
10. To arrange rescue, transport medical treatment of the injured.
11. To educate the public in the surrounding villages regarding hazards connected with the materials handled in the depot and educate them on safety measures to be taken.
12. To identify the causalities and communicate to relatives
13. To rehabilitate the area effected.
14. To provide information to media and government agencies.
15. To preserve records, evidence of situation for subsequent emergency etc.

1.2.2 Scope and Contents of the Plan:

On site emergency plan covers information regarding the properties of hazardous materials handled in the plant, type of disasters and disaster/ accident prone zones, disaster control plan with all authority delegation, controlling and other details. General details like location, plant layout, neighboring industries and the assistance they can render, etc are also provided.

The important elements covered in the plan are:

- Identification and assessment of hazards and risks.
- Hazard consequence analysis.
- Emergency organization.
- Roles and responsibilities of key personnel.
- Alarm and communication procedures.
- Identification and equipping emergency control center; Identifying assembly and rescue points, medical facilities, etc.
- Emergency preparedness plan and procedures. Steps to be taken before, during and after emergency.
- Training, rehearsal, evaluation and updating of plan.

CONTROL DOCUMENTS CIRCULATED INTERNALLY

S.No.	Location	Copy.No.
1.	UNIT HEAD	1.
2.	HOD - Operations	2.
3.	HOD - Maintenance	3.
4.	HOD - Power & Instrumentation	4.
5.	HOD – HR.	5.
6.	HOD - Finance	6.
7.	HOD - S H & E	7.
8.	HOD - Purchase & Stores	8.
9.	HOD - Bagging	9.
10.	Section - Head – Q A & D	10.
11.	Section - Head - Wharf Operations	11.
12.	Section - Head - Complex	12.
13.	Section - Head - Sulfuric acid	13.
14.	Section - Head - Phosphoric acid	14.
15.	Section - Head - Utilities	15.
16.	Section - Head – Power Generation	16.
17.	Section - Head - Electrical	17.
18.	Section - Head – Training	18.
19.	Manager (Shift Operations)	19.
20.	Chief Security & fire Officer	20.
21.	Chief Medical Officer	21.
22.	Emergency control center – 1 (Emergency equipment cupboard)	22.
23.	Emergency control center – 2 (Garage area)	23.

DOCUMENTS CIRCULATED TO STATUTORY AUTHORITIES

S.No.	Location	Copy.No.
1.	Inspectorate of Factories- Visakhapatnam	24.
2.	Director of Factories – Hyderabad	25.
3.	Member Secretary - APPCB	26.
4.	Regional office, APPCB - Visakhapatnam	27.
5.	Zonal office, APPCB - Visakhapatnam	28.
6.	District Collector.	29.
7.	Asst. Director Dock Safety	30.

1.3 Document Control Procedure

On-site Emergency Plan is an important official document of the Factory. It may be necessary to revise and/ or update the document from time to time to take care of changes in the work place, changed personnel and their addresses/ telephones, modifications to plant and processes, changes in the organization, experiences gained through mock drills or experience of similar plants elsewhere etc.

It is, therefore, necessary to ensure the authenticity and validity of all the documents in circulation including the Master copy. Copies distributed to the concerned key personnel. In view of this, document control procedure similar to ISO 9000 has been adopted.

1. The document is made with a loose leaf system of binding to facilitate easy replacement and updating of specific pages of the plan document following any revisions in the plan.
2. Each page carries the revision number and the date of revision. Cover page indicates the latest revision number and date. Updated revision summary sheet showing the latest revision for all pages in a tabular form will be attached at the end of this section.

3. All documents in circulation are serially numbered and summary sheet of such documents to be filed with the master copy for control purposes, along with signatures from the recipients. Revision summary is given in section –1.3 A and list of the control documents in circulation is given at section – 1.3 B.

4. The "Table of contents" is an approved document.

In the revision Dated: 14/11/2015 all pages of the document have been numbered section wise, instead of numbering the pages in serial for the whole document as followed in the previous version**.**

PLANT DETAILS

SECTION- 2.0

DOC NO: E/SH/SF/WI/001 REV NO: 6
DATE OF ISSUE: NOVEMBER 2015

2.0 Plant Details:

2.1 Process Description:

Major products of Coromandel international Limited are complex fertilizers marketed in the trade name of GROMOR, Urea Ammonium Phosphate 28:28:0, Ammonium Phosphate Sulphate 20:20:0 and GROMOR 14:35:14 containing Nitrogen, Phosphorous and Potash nutrients. Achievable capacity of the plant is about 10 to 12 lakh tonnes of complex fertilisers. The plant utilises imported liquefied Ammonia, rock phosphate and sulphur as raw materials.

Within the factory there are three process units viz., Sulfuric Acid Plant, Phosphoric Acid plant and Complex Fertiliser Plant. Operation of Urea Plant has been stopped due to economic reasons from September 1997 and the plant was dismantled during 1st quarter of 2001. The Ammonia plant production also was stopped due to economic reasons in May 1999 and the plant was dismantled during November '02.

Other facilities comprises of boilers, and Atmospheric pressure Storage tanks for Ammonia, TG and DG power plants, laboratory, effluent treatment plant, Fluorine recovery plant, Bagging Plant, wharf liquid Sulphur storage terminal and Ammonia importing facility. Brief description of plants and facilities are given below. Process diagrams of the main plants are attached at the end of this chapter.

The two Horton spheres for storage of Ammonia have been decommissioned. With the decommissioning of Ammonia plant Naphtha usage is eliminated and Naphtha tanks will also be dismantled.

2.1.1 Sulfuric Acid Plant:

Description of process:

Sulphuric acid is an intermediate product and is required for the production of phosphoric acid. The plant operates on the latest DCDA technology to ensure high conversion efficiency and minimise sulfur dioxide emission into atmosphere.

The process involves melting of sulfur (presently, imported molten sulfur is being used) burning the same in a furnace using dry air for combustion. After cooling the hot gases in a waste heat boiler, the gases are sent to converter where sulphur dioxide is converted to sulphur trioxide in stages, with inter-stage cooling. The converted gases are then absorbed in absorption towers before the gases are let out to atmosphere.

Safety related features:
DCS control facility has been provided to ensure smooth plant operation.
Critical pressures, temperatures, flows, etc., are measured online and recorded in a centralised control room. Abnormal deviations of any critical parameters are displayed on alarm panel giving sufficient forewarning for the operators to take corrective action. In addition each process stage is provided with various safety related arrangements, which are enumerated below:

Sulphur melting	Ventilation, fire fighting arrangements
Furnace and boiler	Insulation, relief valves
Converter and its associated equipment	All equipment, are well insulated to prevent heat radiation
Acid towers and storage	Mist eliminators, washing facilities

The plant is well equipped with all required safety related utilities like steam, instrument air, emergency power, cooling water, etc., steam lines are interconnected with utility steam header to ensure required quantity. Instrument air is supplied by offsite plant, which ensures continuous supply by having auto-arrangements. In case of a failure all critical control valves fail in safe position. Critical equipment like air blower is driven by steam turbine to avoid the effect of power failures. In case of cooling water failure, standby pump is provided so that it can be started immediately. In addition fire fighting arrangements like hydrants, extinguishers and washing facilities like shower are also provided.

2.1.2 Phosphoric Acid Plant

Description of the process
Phosphoric acid is an intermediate product and is required for the production of complex fertiliser. The plant employs 'Di-hydrate' route using single tank reactor, designed by Dorr-Oliver USA.
Rock phosphate is ground in a ball mill and is transported mechanically by bucket elevators to ground rock storage silo. From the silo it is transported to Phosphoric acid plant storage bin by pneumatic system / pipe conveyor. The Rock phosphate is reacted with sulfuric acid in a reactor to produce phosphoric acid and gypsum slurry. The acid is then filtered and sent to storage. A portion of the acid is concentrated in evaporators. Gypsum being transported through conveyors and stacked in a gypsum pond separately.

Safety related features

Critical procedures, temperature, flows, etc., are measured on line and recorded in a central control room. Abnormal deviations of any critical parameters are displayed on DCS system giving sufficient forewarning for the operators to take corrective action. In addition each process stage is provided with various safety related arrangements, which are enumerated below:

Process Stage	Safety Related Arrangements
Rock grinding	Operated with negative pressure to prevent dust pollution. Bag filters are provided to prevent escape of dust into atmosphere.
Reaction Section	To prevent fumes escaping into environment high capacity fan and fumes scrubber are provided.
Filtration Section	Ventilation and splashguards are provided to prevent fumes and acid spillage.
Concentration	Evaporation is carried under vacuum. Heat exchangers are provided with relief valves. Drains are provided for collecting acid drains and spills.

Plant is provided with fire fighting arrangements such as hydrants, extinguishers, washing facilities, showers, etc., All fume generating points are ventilated and diverted to a scrubber before venting out to atmosphere.
Heat exchanger used for sulphuric acid cooling is provided with auto cut off arrangements in case of cooling water failure.

Heat exchangers in evaporator section of this plant use only low-pressure steam and these are provided with relief valves. In addition control valves are provided to each exchanger, which can be closed from control room itself in case of power failure.

Drains with acid proof brick lining are provided to collect spills, leaks etc., from all possible points and divert them to the recovery/effluent section. Wash facilities like showers are provided all around the area to minimise effect of acid burns in case of acid contact.

2.1.4 Complex Fertiliser Plant

Process Description:

Following are the process steps involved in the production of complex fertilisers namely 28-28-0, 14-35-14, 20-20-0, 16-20-0, 24-24-8S and 18-46-0:

i. Reaction of ammonia with phosphoric acid.
ii. Ammoniation – granulation.
iii. Drying and cooling.
iv. Scrubbing.

Metered quantity of ammonia and phosphoric acids are fed to a continuous stirred tank brick lined reactor where ammonia phosphate slurry is formed. This slurry is pumped to a granulator where the urea prills get coated by the ammonia phosphate slurry. The wet granules are dried in a LSHS fired concurrent drier and cooled in a counter current rotary cooler after screening before sending it to product godown or bagging plant. Originally the plant had only 2 streams for producing the above grades of complex fertilizers, namely "A" train & "B" train. To augment the production capacity, one more stream i.e., "C" train has been commissioned in the month of July 2000. The manufacturing process in "C" train differs slightly from the "A"&"B" trains. Instead of brick lined reactor or pre-neutralizer, the prime reaction takes place in the pipe reactor. Dust scrubbers and tail gas scrubber have been provided for "C" train to reduce the pollution load and to improve the raw material conversion efficiency. A & B trains also have been revamped and dust scrubbers and tail gas scrubber have been provided to reduce pollution in during February – March 2001.

Safety related features:

i. Hi-level alarm provided for the reactor to prevent slurry overflow.
ii. Emergency power system for control room.

2.1.5 G -Sulfur

Process Description

Liquid sulphur is pumped to the agitated preparation pit, Bentonite (8 - 10 %) is added to the sulphur manually. After several hours of batch preparation the sulphur-bentonite mixture is then transferred via a double filter station to the agitated surge vessel.

In order to avoid sedimentation of bentonite particles the mixture is now continuously agitated in the surge vessel and circulated through a second double filter station while preparation of a new batch can already be started simultaneously in the preparation pit. All product piping, product pumps, vessels, filters and the dropformer are heated by steam. For pastillation the production valve in the branch line to the Rotoformer is opened and the pastillation process starts.

The heat released during solidification and cooling is transferred by the stainless steel belt to the cooling water. The cooling water will be returned to the steel belt cooler via a plate heat exchanger where it will be recooled. The primary loop of the recooling system consists of a water collecting tank, a recirculation pump and a cooling tower.

At the cooler end the pastilles are taken off with a discharge knife and pass via chutes to a bucket conveyor, which transports the pastilles into the hopper of bagging and weighing system.

Safety related features:

Fire fighting arrangement has been provided in case of any sulfur fire.

2.1.6 Effluent Treatment Plant

Process Description

Effluents from sulfuric acid and phosphoric acid plant will be transferred to Equalization tank and is equalized by uniform air sparging through air blowers. The effluent will then fed to the Reaction tank1 through two pumps where effluent pH is raised top 5 to 6 by addition of lime for removal of phosphates and fluoride. Calcium chloride is also added to reaction tank 1 for obtaining low residual value of fluoride .Polyelectrolyte will also be added to make flocs of precipitates. The reaction tank1 is provided with agitator for better mixing.

$$2F+Ca(OH)_2 \text{ ----------} \rightarrow CaF_2$$

The effluent from Reaction tank1 will further be sent to 1st Clariflocculator, where the settling of precipitate will take place .The sludge from Clariflocculator will be pumped to sludge tank by two pumps.

The supernant solution from Clariflocculator 1 will then be sent to buffer tank, and then it will be sent to the Reaction Tank2, where pH is increased to 10-11 by addition of lime. Ferric chloride is added as a flocculant in the tank. Polyelectrolyte will also be added to make flocs of precipitates. The reaction tank 2 is provided with agitator for better mixing.

The effluent from Reaction tank2 will further be sent to 2nd Clariflocculator, where the settling of precipitate will take place .The sludge from Clariflocculator2 will be pumped to sludge tank by two pumps.

$$2Ca(HPO4)_2 + Ca(OH)_2 \text{ ------} \rightarrow Ca_3(PO4)_2 + 2H_2O$$

$$2H_3PO_4 + Ca(OH)_2 \text{ ----------} \rightarrow Ca(H_2PO_4)_2 + 2H_2O$$

The Supernant solution from Clariflocculator 2 will then be sent to Reaction Tank 3, where addition of sulfuric acid is done to bring the pH to 7-8 (neutralize) the effluent. The supernant solution from Reaction Tank 3 will then be sent to Holding Tank having retention time of 4 hours.

The treated effluent from holding tank pumped to Phosphoric acid plant to reuse in the process, preparation of lime solution and preparation of calcium chloride and ferric chloride solutions.

The sludge from the Clariflocculator 1 & 2 pumped to Sludge tank. From sludge tank sludge it will pass through the filter press where sludge will separated and send to HDPE lined storage area for utilization in the phosphoric acid plant

Lime solution tank, Sulfuric acid tank, calcium chloride tank and ferric chloride tanks are installed in the plant with agitators.

2.1.7 Fertilizer Pilot Plant

Phosphoric Acid Pilot Plant

The raw materials required for the production of phosphoric acid are Rock phosphate and sulfuric acid.

The principal mineral constituent of rock phosphate, Fluor apatite, contains calcium, phosphate, fluoride, carbonate and other elements held together in a crystal lattice. When the rock is treated with a strong mineral acid, such as sulfuric acid, the phosphate constituent is solubilized as phosphoric acid. In order to obtain a realistic description of the phosphate rock, we consider the following major impurities: SiO2, Al2O3, Fe2O3, MgO and Na2O.

Ca3(PO4)2 + 3H2SO4 + 6H2O □□□2H3PO4 + 3CaSO4□2H2O

In actual process, reactor conditions are maintained in such a way that Rock phosphate initially reacts with weak phosphoric acid to produce mono calcium phosphate which then reacts with Sulfuric acid to produce phosphoric acid and gypsum as by product.

Chemical reaction in the reactor

1. Formation of mono ammonium phosphate

   $NH_3 + H_3PO_4 \longrightarrow (NH_4)H_2PO_4$

2. Formation of Di ammonium phosphate

   $NH_3 + (NH_4)H_2PO_4 \longrightarrow (NH_4)_2HPO_4$

3. Formation of ammonium Sulphate

   $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

Side reaction takes place in the reactor due to presence of solids, free Sulphuric acid, and Hydrofluorosilicic acid in the phosphoric acid, some of the phosphates also react with the iron and Aluminium.

$CaSO_4 + H_3PO_4 + 2NH_3 \longrightarrow CaHPO_4 + (NH_4)_2SO_4$

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

$H_2SiF_6 + 6NH_3 \longrightarrow NH_4F + SiO_2$

$Fe_2O_3 + 2H_3PO_4 \longrightarrow 2FePO_4 + H_2O$

$Al_2O_3 + 2H_3PO_4 \longrightarrow 2AlPO_4 + H_2O$

Safety Related features

Plant is provided with fire fighting arrangements such as hydrants, extinguishers, washing facilities, showers, etc., All fume generating points are well ventilated so that there is no impact on people on job at work place.

Drains with acid proof brick lining are provided to collect spills, leaks etc., from all possible points Wash facilities like showers are provided in the area to minimise effect of acid burns in case of acid contact.

2.1.8 - Water Soluble Fertilizer Plant

The manufacturing Process of the water soluble fertilizer included basic unit operations only. Apparently there is no unit process involved. The production of water soluble MAP is the process. Each batch produces a certain quantity of water soluble fertilizers (19:19:19, 28:28:0, 24.24.0). The production rate is controlled by a critical operation which needs longest time or which is the slowest process in the whole operation.

Vividly the process steps are - Reaction (Dissolution of crude MAP to get water soluble MAP) > Filtration > Drying > Blending > Packing

1. Reaction (Dissolution of Nutrient rich substance): In this process, raw MAP is dissolved in water. In general, it is about 30-45min per batch. The quantity of water used is based on the solubility data.

2. Filtration: The MAP slurry from reactor is fed to the filter press through screw pump. The filter press is set for maximum pressure of 7 kg/cm2. During filtration, the filtrate liquid comes out from the taps of each block of the filter. This clean filtrate is collected in collection tank and the MAP cake gets deposited between the blocks of the filter press. In filter cleaning operation cake is

removed sent to complex plant. The solution in the collection tank is further filtered and fed to the feeding tank. It is pumped to the spray dryer for drying operation.

3. Drying: Drying operation takes place in a spray dryer unit. The 15% MAP solution is sprayed into the spray dryer and air is preheated to 220 0C and routed to spray dryer. The MAP solution comes in contact with hot air and water is evaporated @ 1000 kg/hr. The dried powder product (water soluble MAP) will have 0.5% moisture content, is collected from the bottom of dryer cyclone separator and stored. The solid powder obtained after drying is taken out, a sample is to lab for analysis.

4. Blending : The water soluble MAP and the other solid ingredients like ground Urea, KNO3, K2SO4 and color dye are mixed in the ribbon mixer manually in the required proportions, the micronutrients such as Boron, Copper Sulphate, Ferrous Sulphate are also added in the recommended proportion.

The whole solid material is thoroughly mixed in the ribbon mixer. Once the mixing is completed (by checking the composition in lab), and then the total material is unloaded from the ribbon mixture and stored for packing.

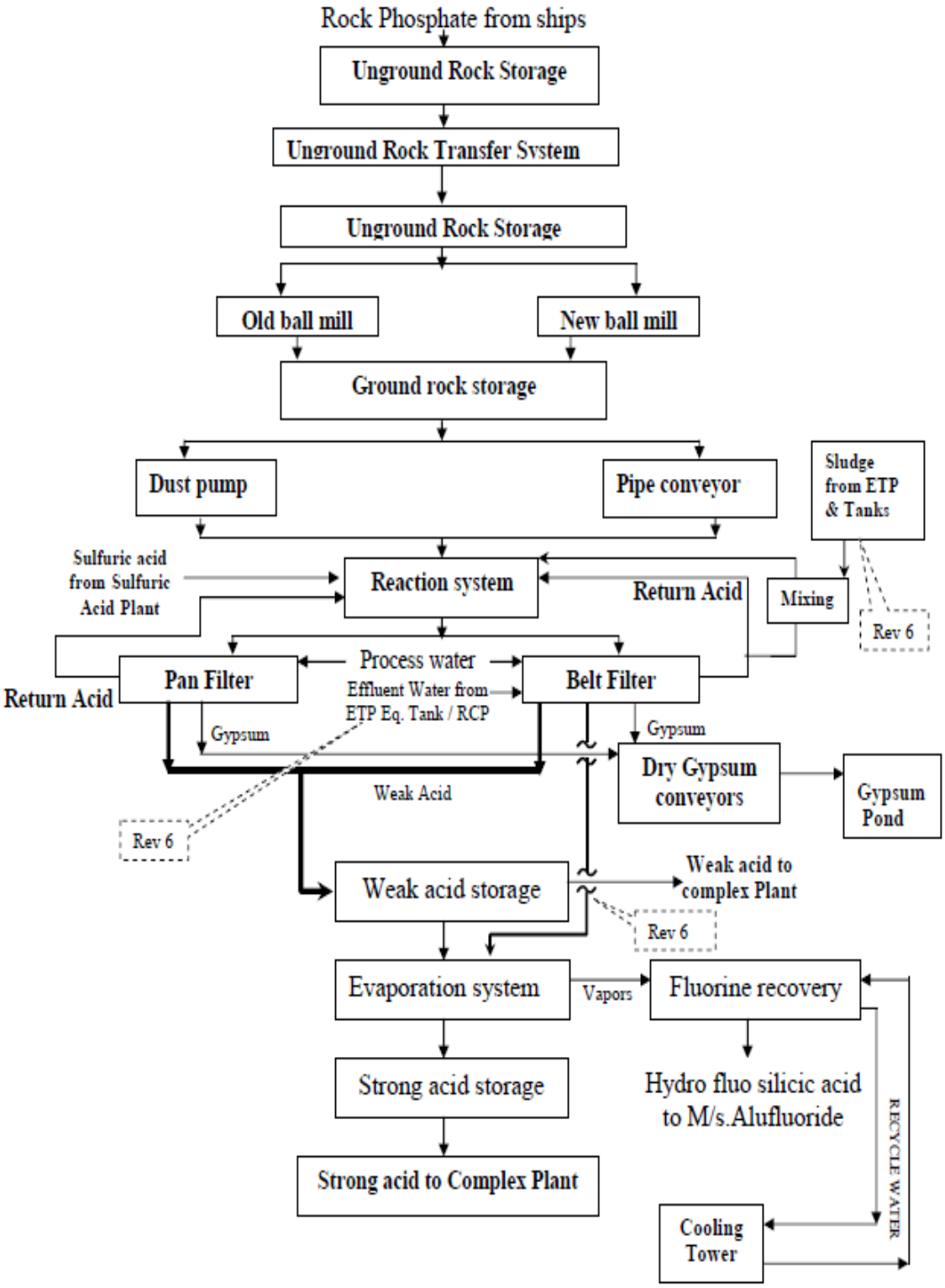
5. Packing :Based on the marketing advise, packing will be done in different packages from 100 gm to 25 kg.

Safety Related features

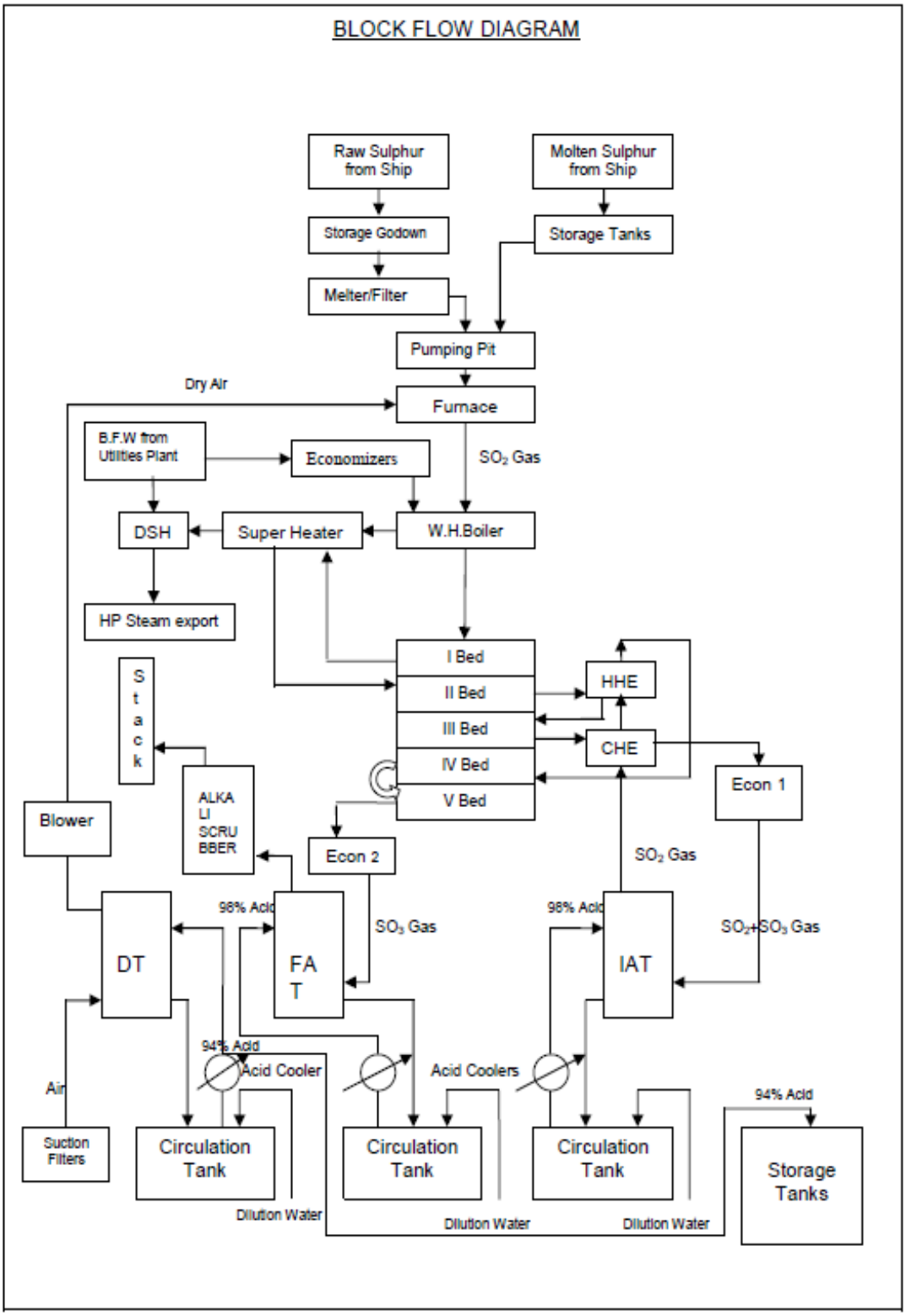
Plant is provided with fire fighting arrangements such as hydrants, extinguishers, washing facilities, showers, etc.,

Drains with acid proof brick lining are provided to collect spills, leaks etc., from all possible points Wash facilities like showers are provided in the area to minimise effect of acid burns in case of acid contact

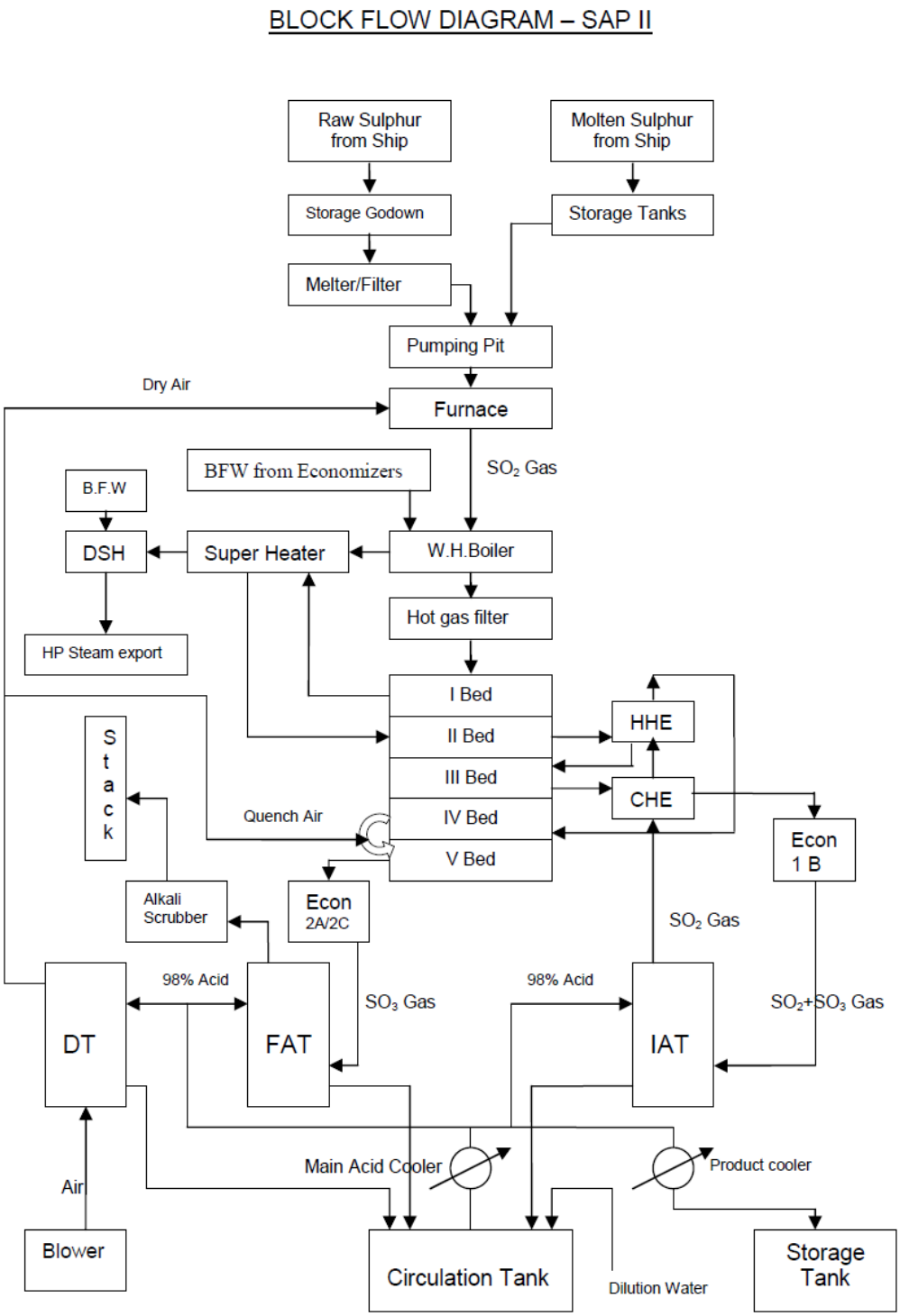
Phosphoric Acid Plant



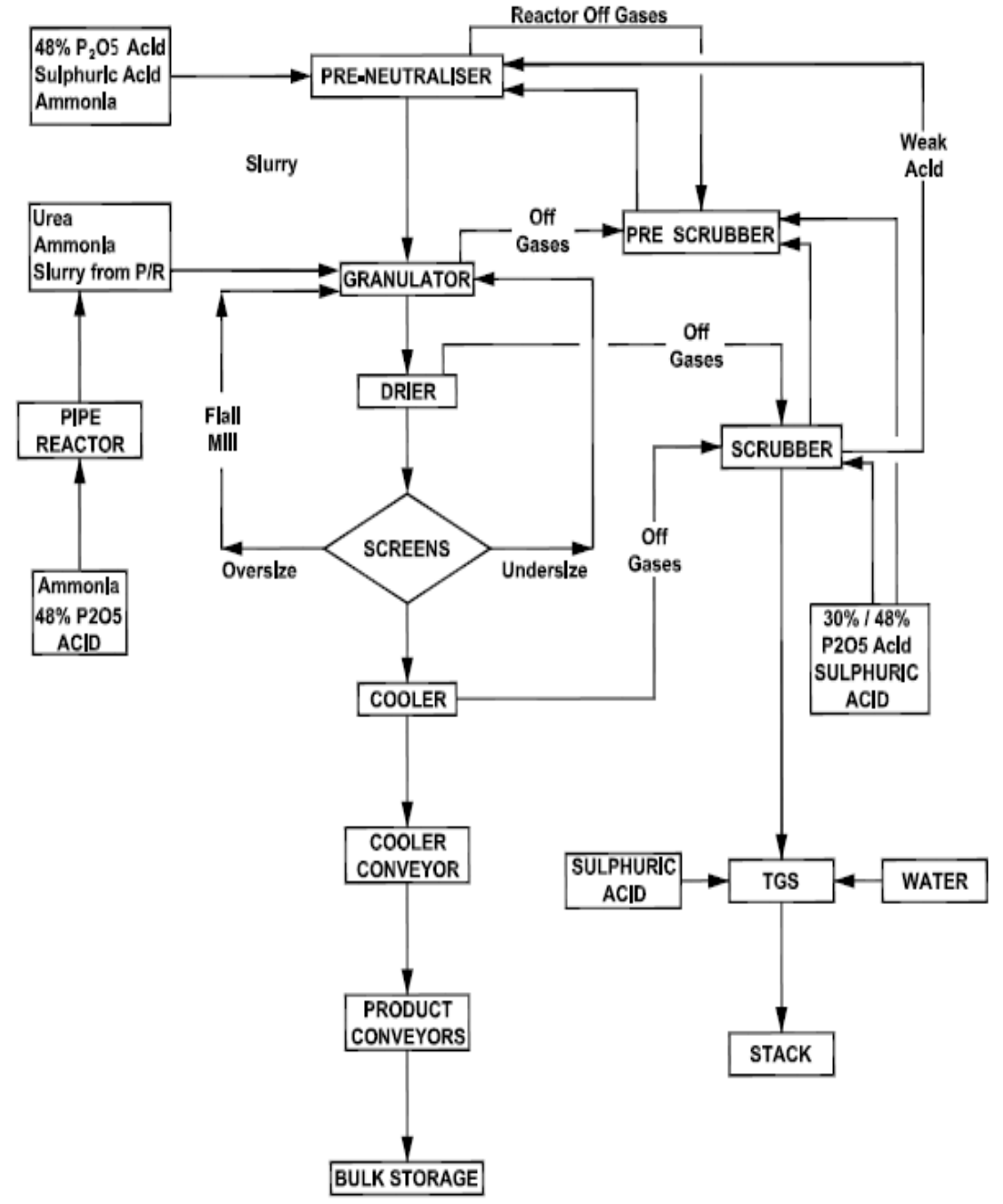
Sulphuric Acid Plant _ 1



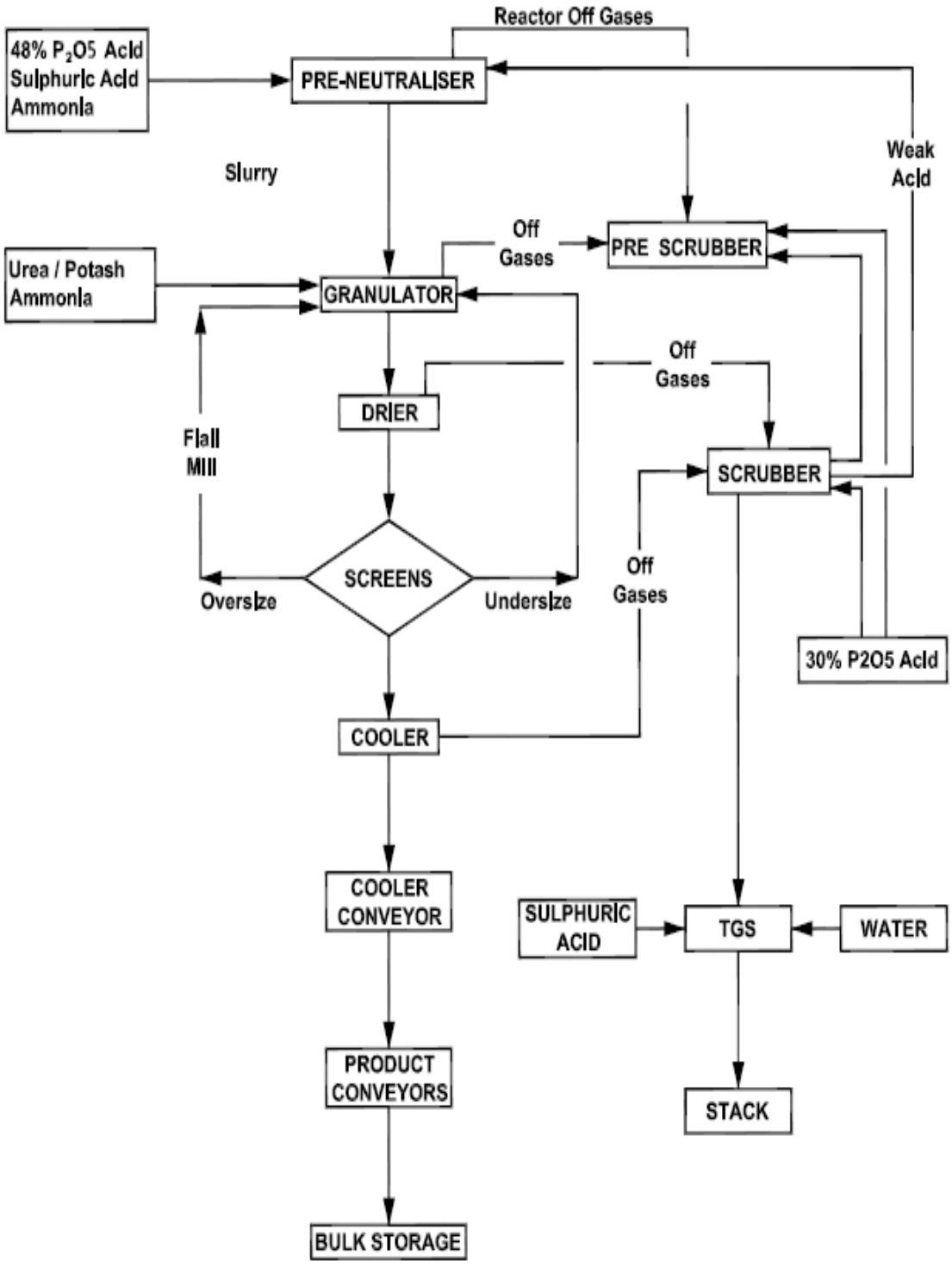
Sulfuric acid Plant - 2



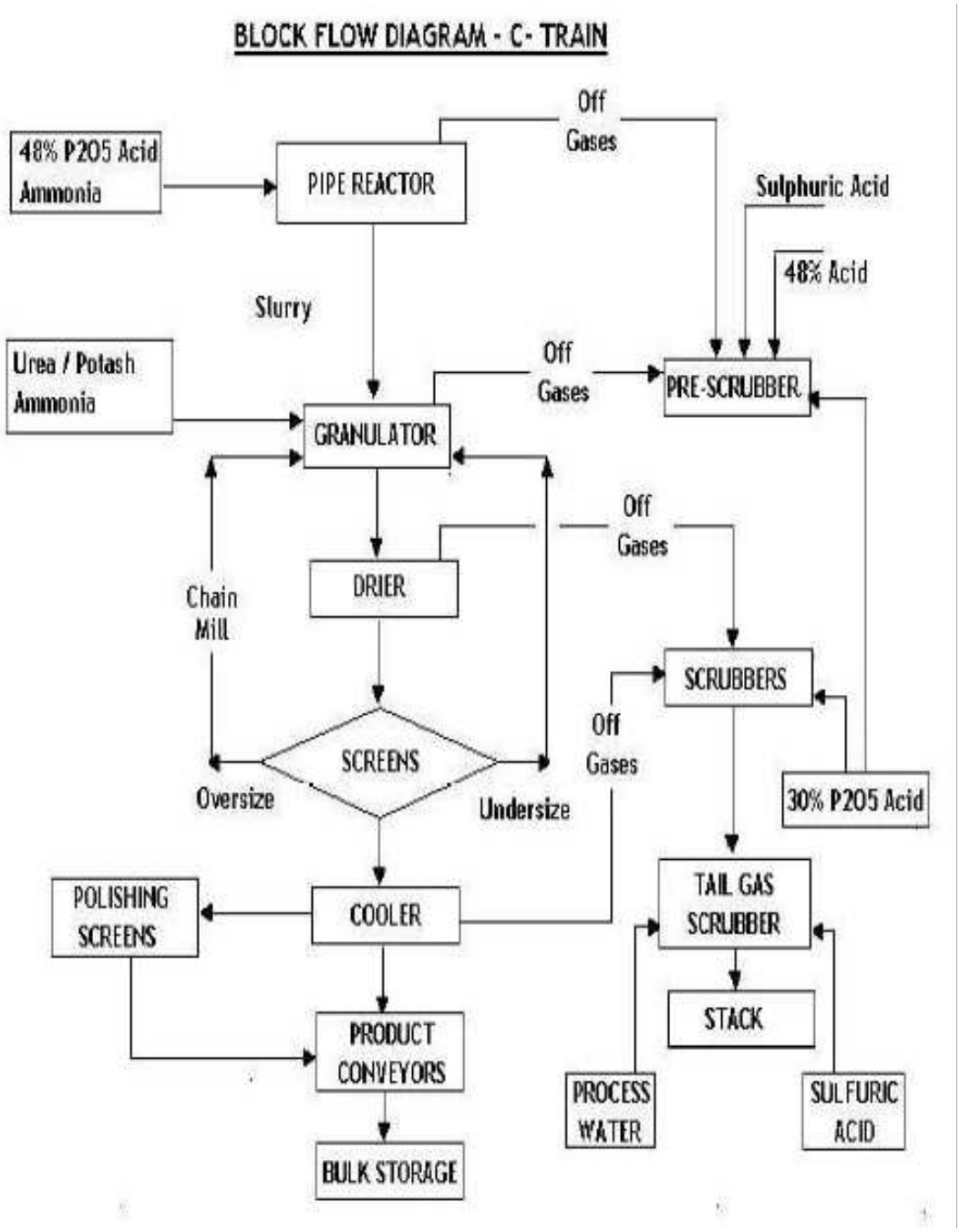
Complex Plant – A Train



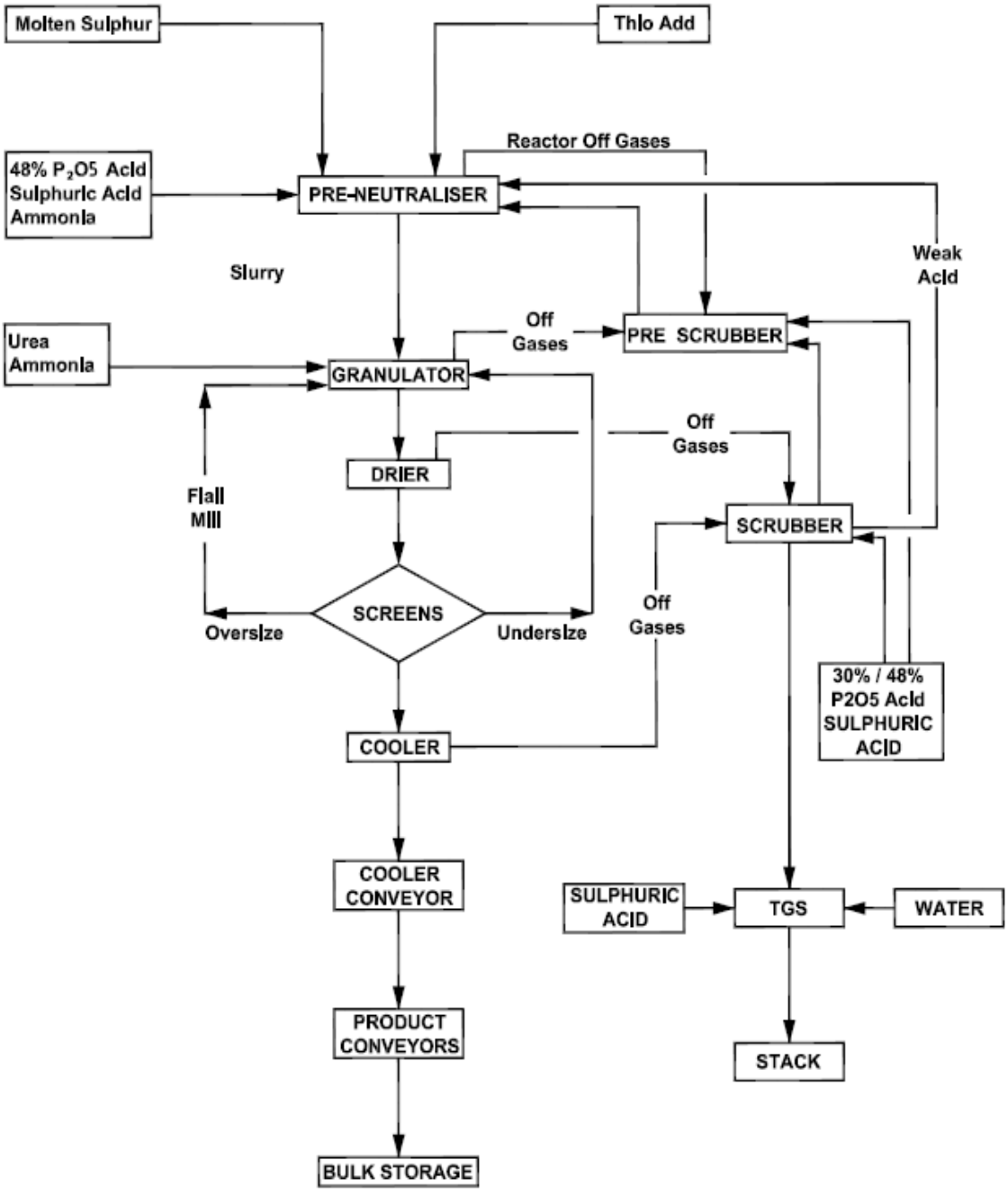
Complex Plant – B Train



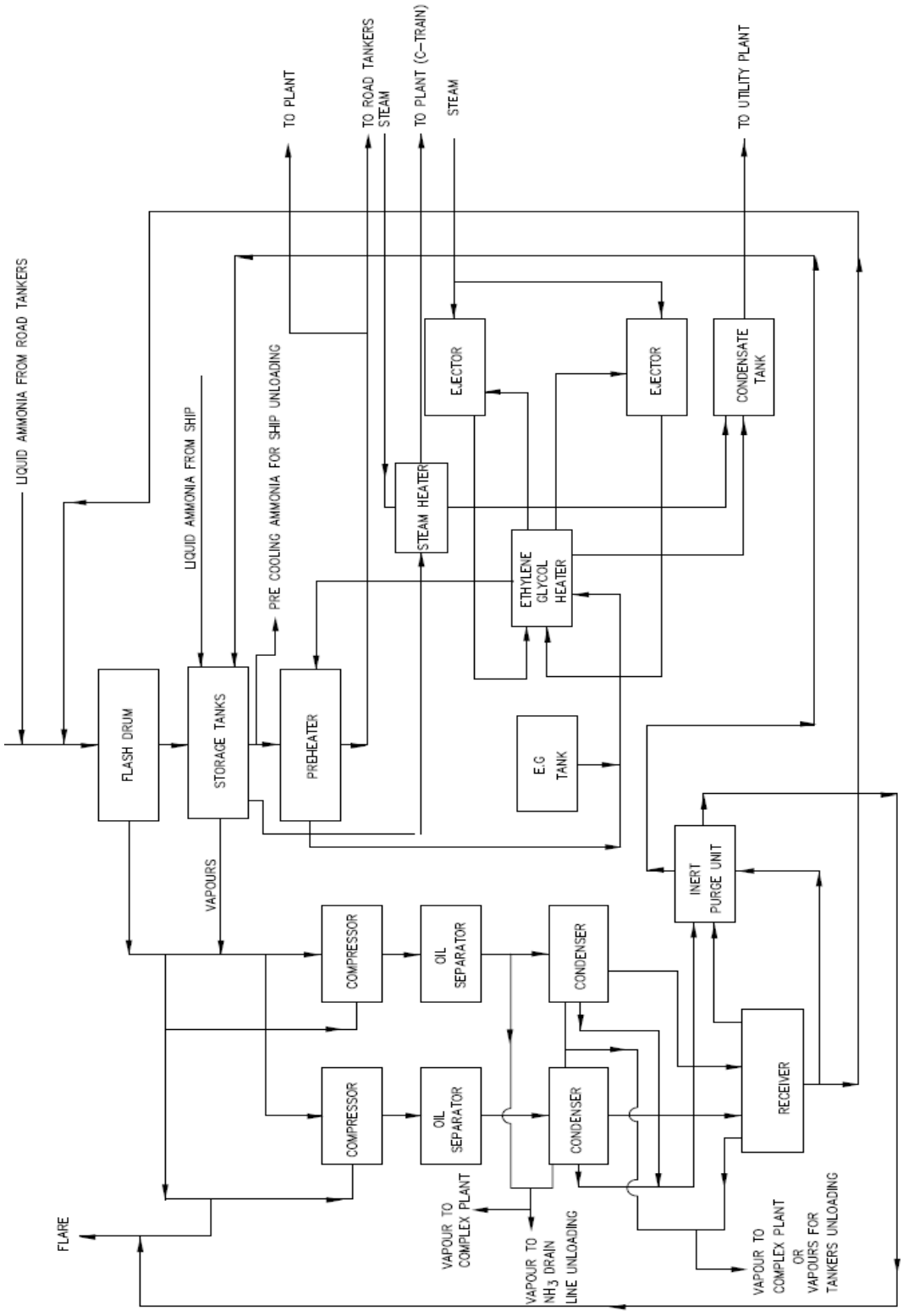
Complex Plant C Train



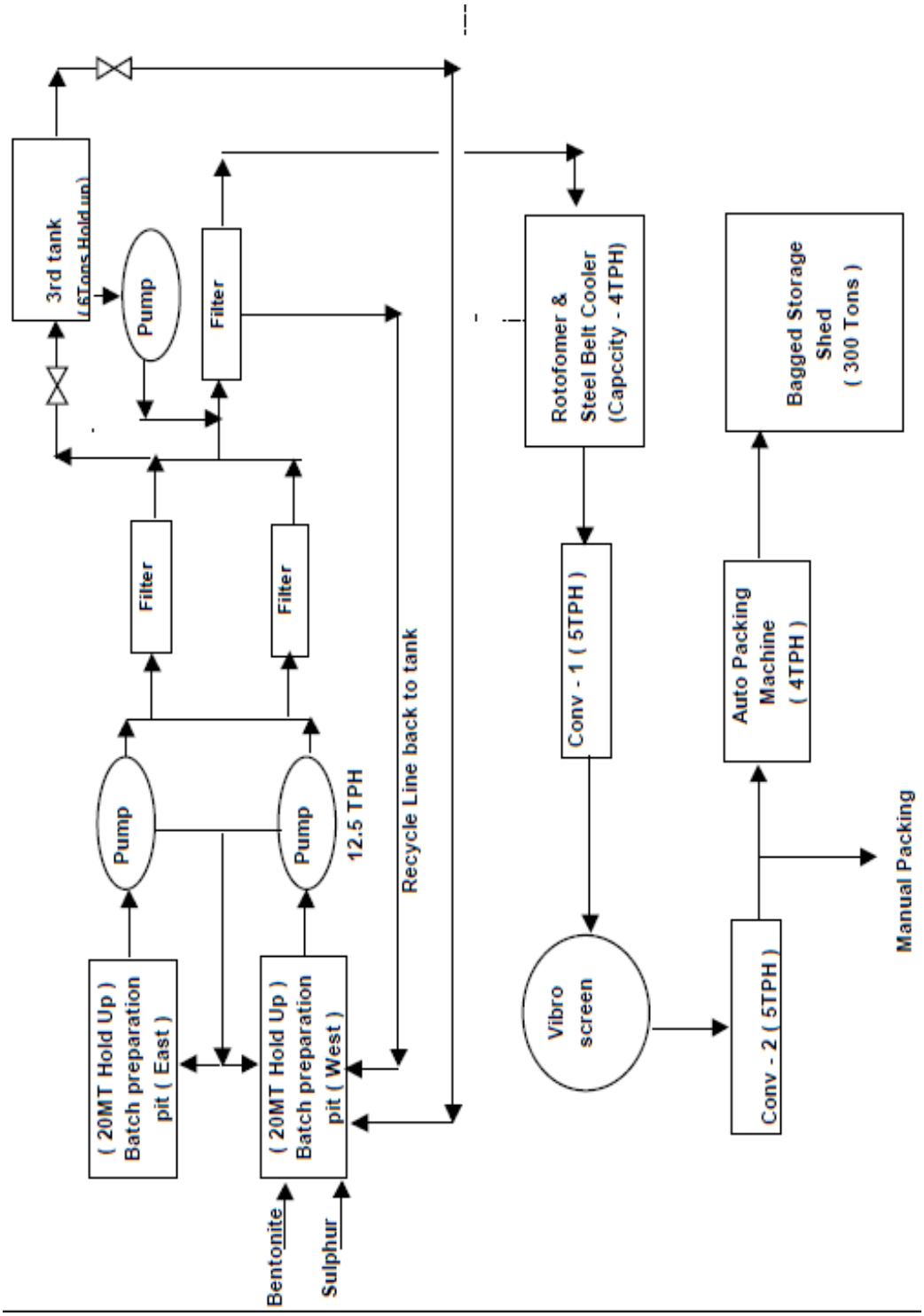
Complex Plant – DAP 4 S



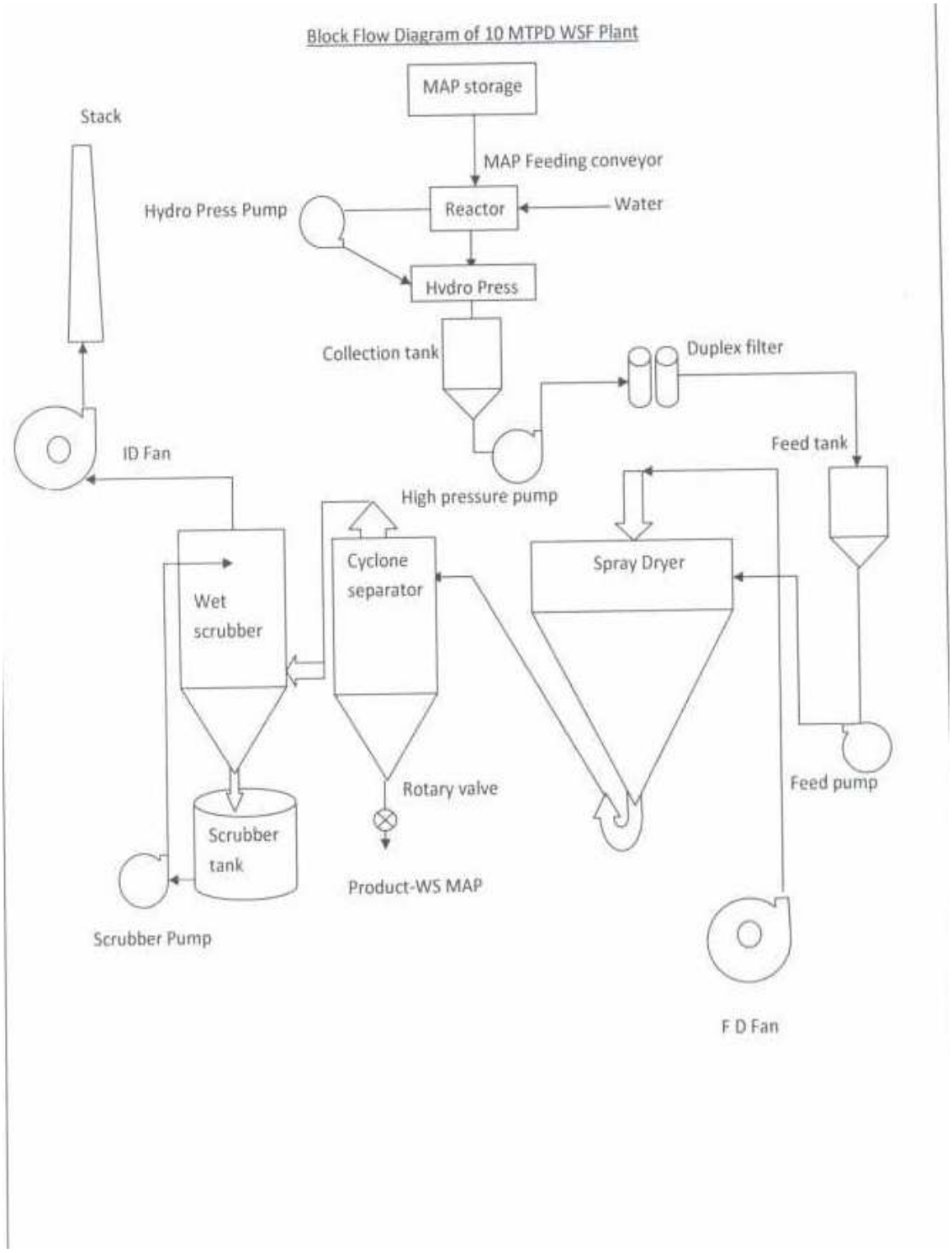
Ammonia Storage Tank Facility



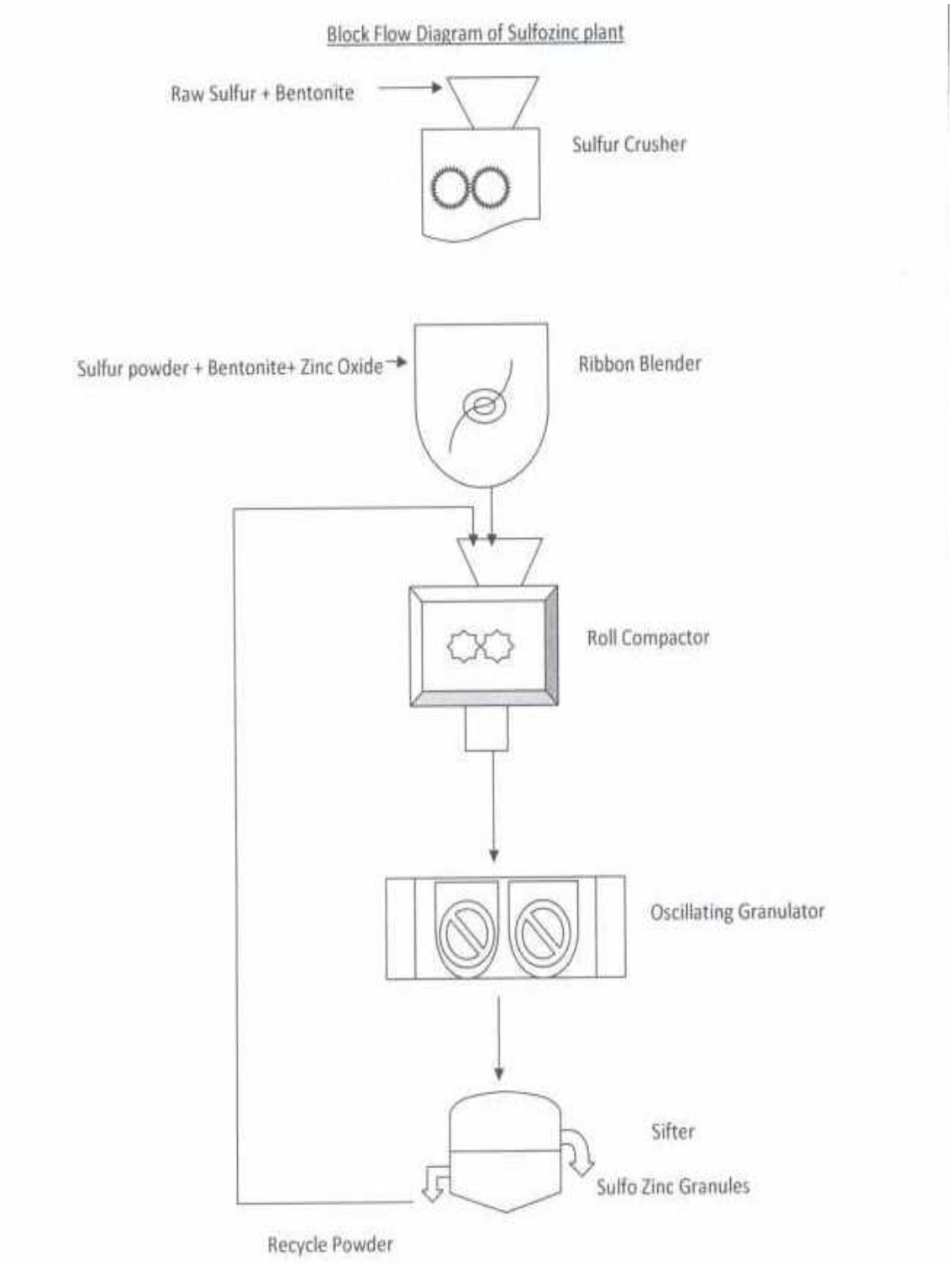
G Sulphur Plant



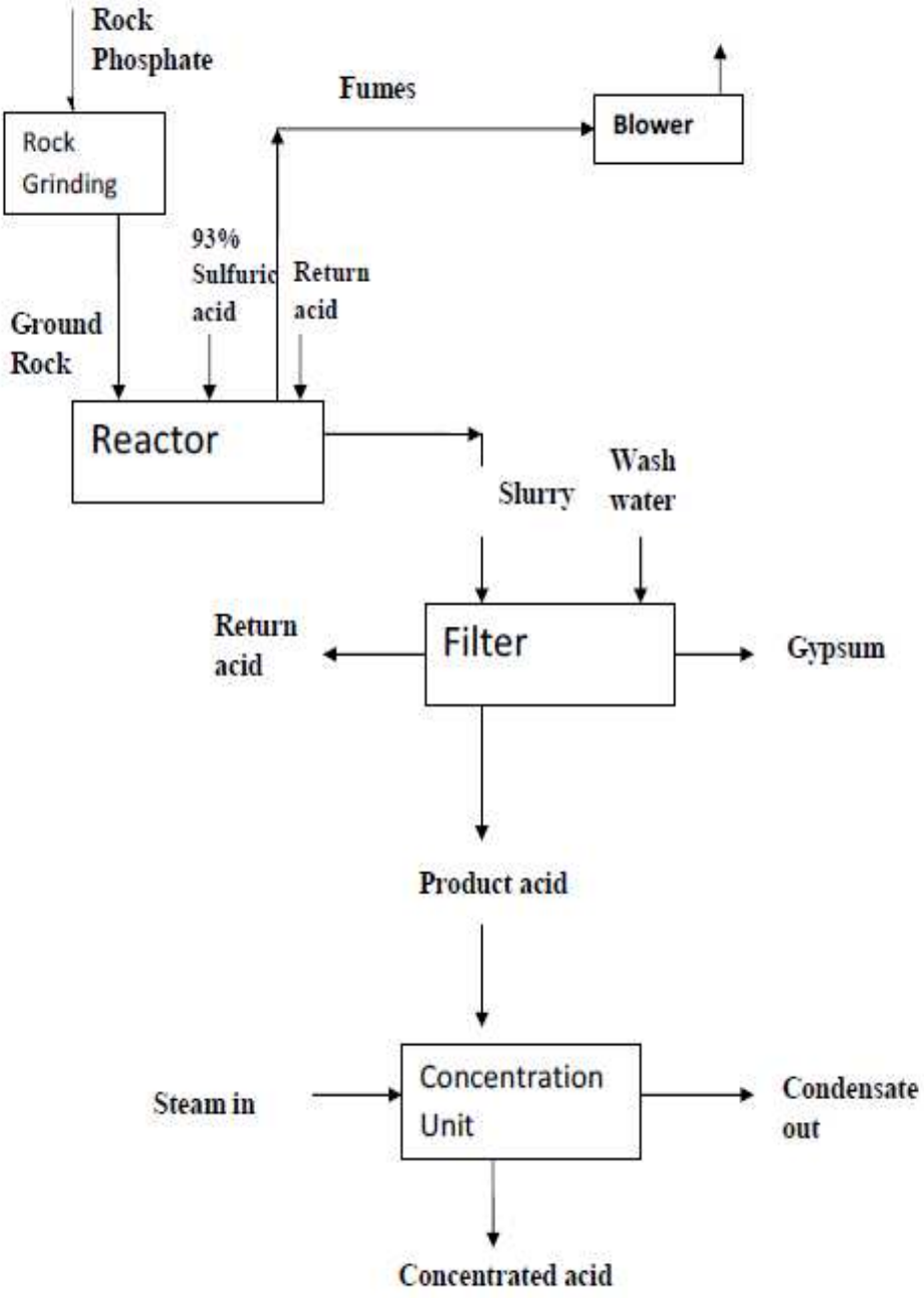
Water Soluble Fertiliser Plant



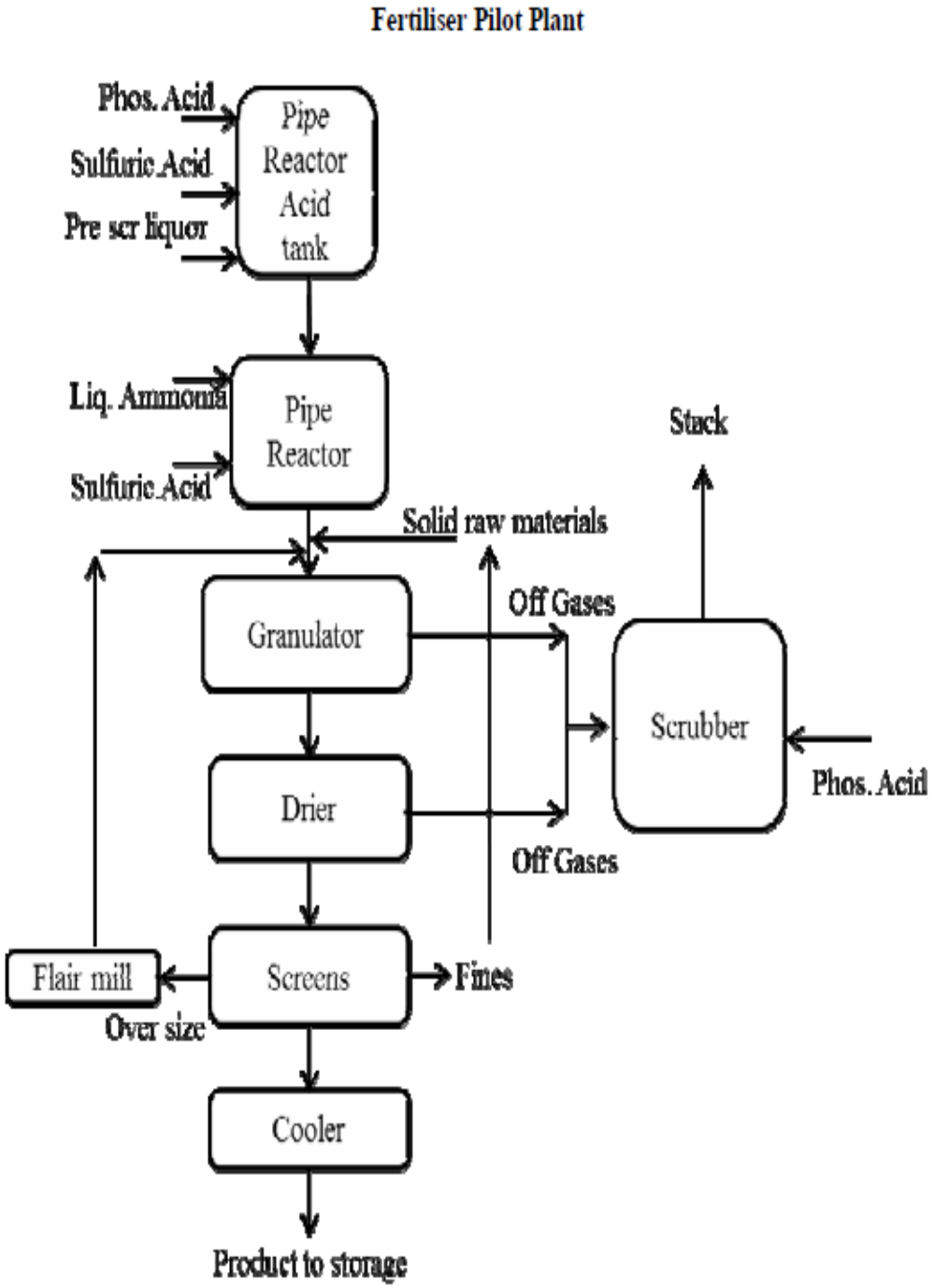
Sulfo Zinc Plant



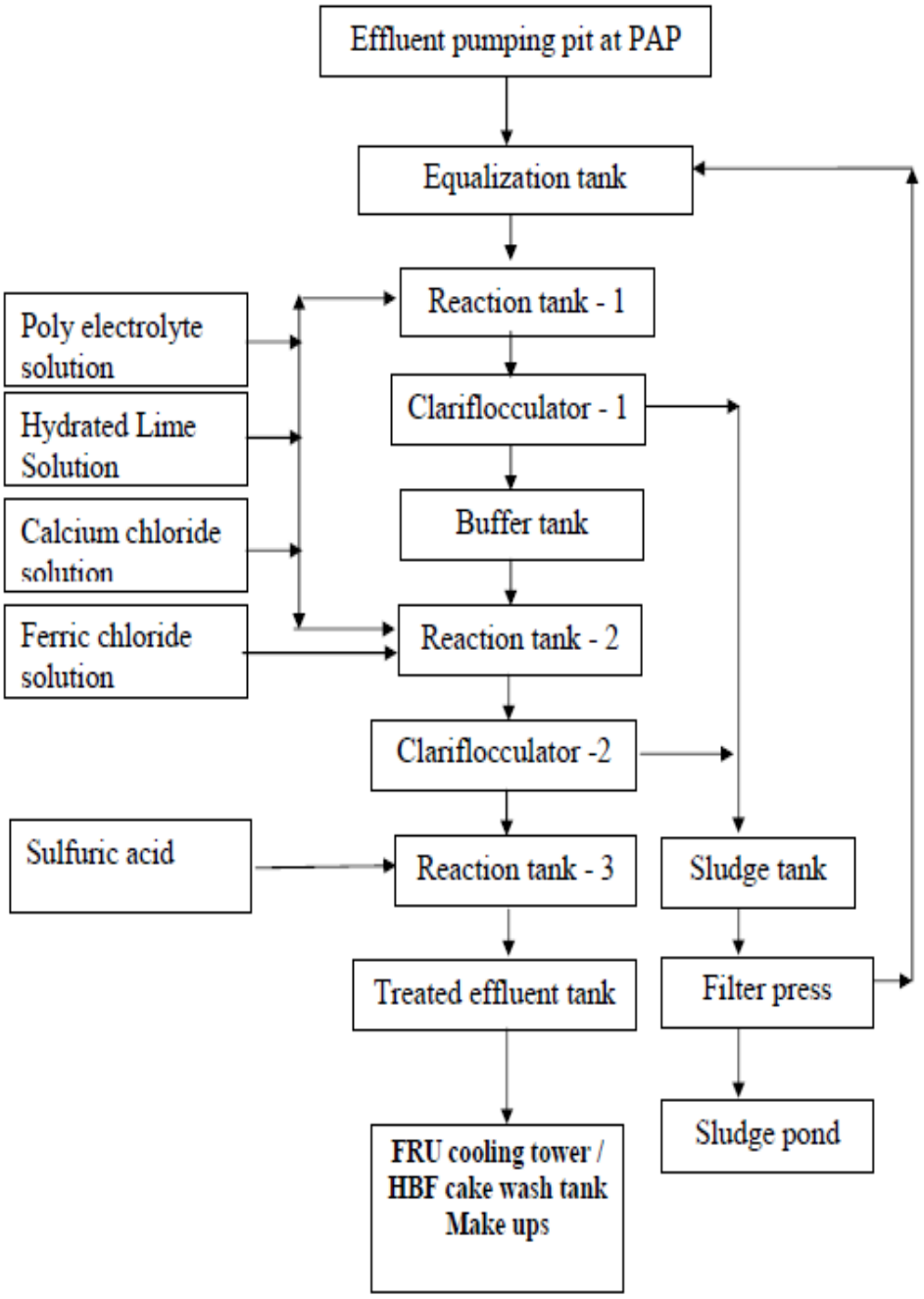
Fertiliser Pilot Plant – PAP



Fertiliser Pilot Plant – Complex



Effluent Treatment Plant



2.2 Hazardous Materials Storage:

Hazardous Materials	Type of storage	Capacity (Nominal)	Number of tanks	Max. Inventory	Hazardous Class *
Ammonia	Atmospheric Pressure Storage	5000 MT-1 No 7500 MT-1 No	2 Nos.	12500 MT	T & F
Phosphoric Acid	Rubber lined MS Tanks	610 m3 300m3	7 nos. 2 nos.	4270 m^3 600 m^3	C
Hydrofluorosilisic acid	Rubber lined MS Tank & Bullets 2no's	35 MT	1 No	30 MT	C
Sulfuric Acid	Carbon Steel	4000 × 1 2500 × 2 2000 × 1	4 Nos.	11000 MT	C
Molten Sulfur	Carbon Steel	7500 × 2	2 Nos.	15000 MT	C & F
Petrol (MS)	Under ground	10 Kl	1 No.	10 Kl	F
Diesel (HSD)	Under ground Above ground	10 Kl 16 Kl	1 No. 2 Nos.	10 Kl 32 Kl	F F
Diesel (LDO)	Above ground	10 Kl	1 No.	10 Kl	F
LSHS	Above ground	256 Kl 160 Kl 16 Kl 33 Kl	1 Nos. 1 Nos. 1 Nos. 1 Nos.	256Kl 160 Kl 16 Kl 33 Kl	F
Caustic lye	Rubber lined MS Tank	50KL	1	50KL	C
	SS Tank (100%)	35 MT	1 No	35 MT	C
LPG	Cylinders	14.5 Kg	40 Nos.	570 Kg	F
Kerosene	MS tank Above ground	50 Kl	1 No.	50 Kl	F

Hazardous Materials	Type of storage	Capacity (Nominal)	Number of tanks	Max. Inventory	Hazardous Class *
Sulphuric acid Ctrain	Carbon steel	23 MT	1	23 MT	C
Sulphuric acid day tank utility	Carbon steel	9 MT	1	9MT	C
G-Sulphur east and west pits	Pits	30MT	2	60 MT	C&F
Sodium sulphite	Rubber lined MS tanks	50KL	1	50KL	C
Sulphuric acid pilot plants	Carbon steel	14MT	2	14	C
Phosphoric acid	MS rubber lined	$23.75M^3$	1	$23.75M^3$	C
Sulphuric acid dosing tank	Carbon steel	$2.03M^3$	1	$2.03M^3$	C

*** Flammable (F)**
Corrosive (C)
Toxic (T)

2.3 Off- Sites and Utilities:

General :-

Utilities plant consists of De-Mineralized water plant, Steam generation boilers, and power generator, and instrument & plant air generation compressors. Utilities also handles Atmospheric Ammonia storage tanks (AAST), LSHS storage tanks, & water reservoirs. Installed capacities of Utility units are as below:

1) Emergency power — DG sets - 500 KVA X 1 ; 750 KVA x 1

2) Water Supply:

Raw Water Consumption	7417 KLD
Sea Water	65000 KLD for cooling purposes.
D.M. Water	2400 KLD
Domestic Water	650 KLD

3) Water treatment facilities.

The principle hazards, safety items that are associated with the above mentioned facilities are described briefly in the following pages.

2.3.1 D.M. Plants:

The purpose of demineralisation plant (DM plant) is to remove the suspends and dissolved solids in raw water for subsequent use as boiler feed water in boilers. The principle involved in demineralisation to remove the dissolved solids is by ion exchange process.

The DM plant consists of filters, cation units, degasser and anion units. Raw water is passed through the filters to remove suspended solids. It is then passed through cation exchange region in order to remove the cation part of dissolved solids. Water from the cation units is then routed to a degasser where carbon dioxide is removed by stripping with air. After degasification, the water is passed through an anion exchange region where the anion part of dissolved solids is removed. The water thus coming out of anion exchanger is free of dissolved solids and is stored in a tank and is later used for boiler feed water generation.

Safety related features:

The only hazardous, if any, can come from the use of sulphuric acid for regeneration of cation resin and caustic lye for regeneration of anion resin. Since both the chemicals are handled by using pumps and piping, no direct contact with operating personnel is possible. The operating personnel however use acid-proof gloves whenever the equipment is operated for handling the acid and lye.

2.3.2 Steam generation:

There is one steam-generating boiler of 30 MT / hr. capacity. Steam is generated at 315 to 320 ^{0}C. Boiler is water-tube boilers and LSHS is used as fuel in all of them. The boiler has economizers, for conserving heat and increasing boiler efficiency. The super heated steam coming from all boiler is connected to a common header for distribution to process plants.

Apart from the above boiler, steam is also generated at Sulfuric acid plant using waste heat from the sulfur furnace and distributed through the common header

Safety related features:

The boiler steam drums are equipped with two safety relief valves that are set at 35.0 kg / cm^{2}g (500 psi) and 35.7 kg / cm^{2}g (510 psi) . In the super-heater outlet line, a safety valve is provided – set at 34.3 kg/cm^{2}g (490 psi) .

There is 3 - element control of steam-flow, drum level and boiler feed water flow. For Boilers 1 the atomisation steam and fuel oil pressure are controlled through a differential pressure regulator, which maintains a constant difference of 20 psi between the two. Alarms are provided for high and low drum levels, low level oil pressure, low atomisation steam pressure and flame failure, for all the boilers.

2.3.3 Power Generation:

In order to meet the various power cut situations imposed by the State Electricity Board, Coromandel installed, 1 no. X 5 MW TG set, 2 nos. X 4 MW DG sets for captive power generation. The TG is supplied by M/s BHEL, Hyderabad and is of condensing type. The DG sets are supplied by M/s Wartsilla Diesel. The TG and DG sets can be operated on synchronous mode with APSEB supply.

For the DG sets, diesel is used as fuel for startup and LSHS for continuous operation. TG set uses super heated steam 31 kg/cm^2 pressure and 315^0C temperature. Condensing pressure is 0.15 ata.

Safety trips provided include, Low vacuum trip, low HP steam pressure, over load trip, low lube oil pressure, over speed trip, restricted earth fault relay, over current and differential relay trips.

Installed Power generation capacities of TG &DG plant are:

1. Power contracted demand 12 5MVA
   (Incoming supply at 132 KVA from APSEB / AP Transco)

2. Captive Power Generation 13 MW

   DG - Sets (2 nos.of 4 MW + TG set – 1 no of 5 MW and
   1 no. of 500 KVA + 1 of 750 KVA DG set) for emergency power generation.

2.4 Auxiliary Facilities:

2.4.1 Effluent Treatment Plant:

Following are design parameters for effluent to and from the plant.

		Effluent in	Final effluent
pH	:	2	6.5 to 8
Fluorides (PPM)	:	20000 mg/l	<10 mg/l
Phosphates (PPM)	:	1000 mg/l	< 5 mg/l

Effluent treatment process in brief is as follows:

Process Description

Effluents from sulfuric acid and phosphoric acid plant will be transferred to Equalization tank and is equalized by uniform air sparging through air blowers. The effluent will then fed to the Reaction tank1 through two pumps where effluent pH is raised top 5 to 6 by addition of lime for removal of phosphates and fluoride. Calcium chloride is also added to reaction tank 1 for obtaining low residual value of fluoride .Polyelectrolyte will also be added to make flocs of precipitates. The reaction tank1 is provided with agitator for better mixing.

$$2F+Ca(OH)_2 \text{ ----------} \rightarrow CaF_2$$

The effluent from Reaction tank1 will further be sent to 1st Clariflocculator, where the settling of precipitate will take place .The sludge from Clariflocculator will be pumped to sludge tank by two pumps.

The supernant solution from Clariflocculator 1 will then be sent to buffer tank, and then it will be sent to the Reaction Tank2, where pH is increased to 10-11 by addition of lime. Ferric chloride is added as a flocculant in the tank. Polyelectrolyte will also be added to make flocs of precipitates. The reaction tank 2 is provided with agitator for better mixing.

The effluent from Reaction tank2 will further be sent to 2nd Clariflocculator, where the settling of precipitate will take place .The sludge from Clariflocculator2 will be pumped to sludge tank by two pumps.

$$2Ca(HPO4)_2 + Ca(OH)_2 \text{ ------} \rightarrow Ca_3(PO4)_2 + 2H_2O$$

$$2H_3PO_4 + Ca(OH)_2 \longrightarrow Ca(H_2PO_4)_2 + 2H_2O$$

The supernant solution from Clariflocculator 2 will then be sent to Reaction Tank 3, where addition of sulfuric acid is done to bring the pH to 7-8 (neutralize) the effluent. The supernant solution from Reaction Tank 3 will then be sent to Holding Tank having retention time of 4 hours.

The treated effluent from holding tank pumped to Phosphoric acid plant to reuse in the process, preparation of lime solution and preparation of calcium chloride and ferric chloride solutions.

The sludge from the Clariflocculator 1 & 2 pumped to Sludge tank. From sludge tank sludge it will pass through the filter press where sludge will separated and send to HDPE lined storage area for utilization in the phosphoric acid plant

2.4.2 Fluorine Recovery Unit

The vapors evolved during evaporation of phosphoric acid are the single largest stream containing fluorine in concentrated form. Prior to installation of fluorine recovery plant, these vapors were directly condensed in the water barometer condensers, thereby overloading the effluent and its treatment system. In fluorine recovery unit, these vapors are first absorbed in circulated water in absorbers to recover the fluorine vapors as hydrofluo-silicic acid. The unit serves to recover 15 MT per day of 18% hydrofluosilicic acid, which is being used, for the manufacture of aluminum fluoride by M/s Alu Fluoride Ltd. adjacent to Coromandel International Limited. Thus the pollutant is converted to a useful byproduct.

2.4.3 Liquid Sulfur Terminal:

Description of Facility

Coromandel requires 1 to 1.20 lakh MT of sulfur per annum for its sulfuric acid as raw material. To avoid sulfur dust emissions and to make the sulfur handling system more safe and environment friendly, Coromandel installed necessary facilities for importing molten sulfur handling and storage facilities at the wharf. Sulfur is brought to the terminal by insulated molten sulfur vessels and is unloaded from the vessel with the help of discharge pumps through a pipeline to the storage tanks located at the wharf. The system is capable

of unloading 500 MT/hr of liquid sulfur. 2 Nos. storage tanks with 7500 MT capacity each are provided at the wharf area for storage of molten sulfur.

From the storage tanks liquid sulfur is loaded into 20 MT capacity road tankers with the help of molten sulfur pumps. The road tankers unload the sulfur into the clean sulfur pit in the sulfuric acid plant. 2 nos. of Package boilers of 1.5 MT/ hr capacity each are provided for generating and providing saturated steam at 4.5 kg/cm^2 and 145^{0}C to heater coils in the storage tank, steam tracing of the molten sulfur piping and pumping systems to keep the sulfur in molten condition. Of the two boilers one will be kept in line and the other will be kept as stand by.

Safety related features:

i. Nitrogen gas generator and a bank of Nitrogen gas cylinders and piping for blanketing the molten sulfur storage tanks and for inert purging of molten sulfur pipelines as required.

ii. Dykes and bunds for the molten sulfur and LSHS storage tanks to prevent spreading of any leakage to other areas.

iii. Steam supply for keeping sulfur in molten condition at all times

iv. Smoothening steam provision to prevent any accumulation of H_2S in the molten storage tank.

v. External water spray for the tank to take care of any emergency.

vi. Breather and safety pressure relief valves on storage tanks

2.1.1. Atmospheric Ammonia Storage and unloading facility:

Description of Facility

Atmospheric Ammonia storage facility. The tanks are of double wall double integrity cup-in-tank type design and operate at 200 to 1000 mm Wc at –33^{0}C to –32^{0}C temperature. Facility has been provided to receive imported ammonia from the ship pumping line and also to transfer ammonia from one tank to another.

Coromandel has commissioned Ammonia unloading facilities to unload imported Ammonia

from ships utilizing the existing wharf facilities. The ship pumps will be used to pump ammonia to the atmospheric Ammonia storage tanks via a 5 km long pipeline from the wharf to the storage tanks. The pipeline is laid adjacent to the dock road and the seawater intake channel.

Safety related features: For Ammonia Unloading facilities:

i. Motor operated emergency shutoff valve has been provided on the transfer line at the jetty. This is interlocked with differential pressure across the same to activate closure of the motor operated valve. This valve can be closed remotely from the plant also.

ii. Control valve has been provided on the ammonia transfer line at the ammonia tank area at the plant. This is interlocked with high level and high pressure of the tank.

iii. Numbers of ammonia leak detector sensors have been provided at the jetty and another 5 numbers at the each storage tank area.

iv. Liquid ammonia hold up in the 5 km pipeline is displaced with ammonia vapors and kept at storage pressure after the ammonia transfer operations are through.

v. Personal protective equipment like ammonia canister masks, ammonia suit and self-contained breathing apparatus etc are kept at both terminals.

For Atmospheric pressure Ammonia Storage Tanks:

Following instruments and safety systems are provided:

i. Float type level indicator.
ii. DP type level indicator.
iii. Temperature recorder.
iv. Level indicator for annular space.
v. Pressure recorder and Pressure indicator.
vi. 5 nos. Ammonia leak detectors at the each ammonia tank area
vii. 2 Nos. each vacuum and pressure relief valves for protecting the tanks from vacuum and over pressure respectively.
viii. Pressure control vent valve (emergency vent valve)
ix. Flare system for venting/ flaring ammonia vapor to maintain tank pressure in case of emergency.

2.5 Safety Related Utilities:

2.5.1 Fire protection systems:

Fire hydrant network is provided for all the plants and facilities.
A dedicated two million-gallon capacity reservoir is provided. Fire hydrant header pressure is maintained by jockey pump and one motor driven and one diesel driven firewater pump are provided to meet the requirements of firewater in case of emergency. Motor driven pump is also connected to the power source from captive power plant. These pumps should always be on auto mode so that they start automatically in case of drop in pressure of the fire hydrant header below present valves. Details of the pumps are given below :

For Ammonia storage and DG power set facilities.

Sl.No	Description	Drive	HP/KW	Capacity M^3/hr	Head MWC	Nos.
1	Fire water pump	Diesel Engine	315 HP	410	88	1
2	Fire water pump	Motor Driven	125 KW	273	88	1
3	Jockey Pump	Motor Driven	20 HP	12.3	88	1
For Other Areas						
1	Fire water pump	Motor Driven	125 KW	273	80	1
2	Jockey pump	Motor Driven	20 HP	32	80 MW	1
3	Fire Pump trailer	Diesel Driven	-	1800 Lpm	-	1

Fire Tender:

Fire foam tender is available which was procured from Minimax in the year 1993 at site. Capacity of the foam tender is 5000 litres water and 500 litres foam. Fire pump capacity is 108 m^3/hr at 80 m head. In addition the fire water is equipped with the 2 Nos. self breath apparatus, 2 Nos ELBA's and 8 Nos Canister mask with cartridges' are also kept in the fire foam tender which can be used by the Firemen while approaching toxic gas affected areas.

Mutual Aid:

Coromandel has mutual aid agreement with HPCL and APL for handling major fire emergencies. As per this scheme, help will be sought by a member industry to supplement or augment the Internal resources available with them. A section of trained men and a portion of the fire equipment and appliances as per agreement will be made available to the distressed organisation to combat the fire emergency.

Portable extinguishers:

Portable fire extinguishers are provided at required locations in various plants and facilities.

Following fire fighting and safety appliances are available in Coromandel:

1.	Fire Tender	1 No.
2.	Fire Trailer Pump Diesel Driven, 1800 Lpm	1
3.	Fire hoses 30 mtrs. length	5 Nos
4.	Fire hoses 15 mtrs length	53 Nos
5.	Foam making branch pipes	10 Nos
6.	Fog / triple purpose nozzles (Jet/Nozzle)	67 Nos
7.	Pick up tubes	Nil
8.	Extension ladder	2 Nos
9.	Fire approach suits	2 Nos
10.	Dry Chemical powder extinguishers 75 kg capacity	2 Nos
11.	Dry Chemical powder extinguishers 50 kg capacity	1 Nos
12.	Dry chemical powder extinguishers 10 kg capacity	167 Nos
13.	CO_2 extinguishers	187 Nos
14.	3M canister gas masks	40Nos
15.	Self contained breathing apparatus	40 Nos
16.	PVC suit	40 Nos
17.	Foam Compound	4500 lts
18.	Suits for working at liquid ammonia atmosphere	2 Nos.
19.	Mayuri type spray nozzle	14 Nos.
20.	Automatic oscillating monitor	3 No.
21.		

Details of portable fire extinguishers, hydrants and monitors installed in different plant and facilities are given below :

Location of Portable Fire Extinguishers & Hydrants/ Monitors

Location	DCP	CO_2	Hydrants	Water Monitors	Remarks	Foam
Prod. Handling	2	3	Nil	Nil		
Utilities	17	9	5	Nil		
AAST	14	14	5	6		
Complex AB trns.	19	14	1	Nil		
Complex 'C' train	26	7	1	Nil		01
Phos. Acid	18	14	Nil	Nil		
Rock Grinding	3	3	1	-		01
Sulphuric Acid & R.M. Handling	17	15	9	6		01
Bagging	18	6	2	Nil		02
Laboratory	1	6	Nil	Nil		
Garage	8	Nil	2	Nil		2
Assy.& M.Shop. P & I shop	4	9	1	Nil		
Ware House	11	3	2	Nil		05
TG, DG, 132 KV sub stn	34	43	12	1		03
Contract shed	Nil	Nil	1	Nil		
Wharf	11	17	11	4	Liq Sulphur tanks 50Kg DCP-1 CO2-1	02
Cafeteria	4	1	1	Nil		
ETP	1	7	Nil	Nil		
Fire Tender	2	4	Nil	Nil	75kg DCP – 2	02
Administration Building	13	02	01	Nil		

Location	DCP	CO_2	Hydrants	Water Monitors	Remarks	Foam
Old urea plant			07			
Ambulance	03					
Club house	11	2				
WSF plant	03	05	03			
Pilot plant	05	03	03			
G.Sulphur plant	02	09	01			
Learning centre	01					
I.T.Department	01					
Record room	01	02				
Gate no.4 Security room	01					
Gate no 5 out side		01				
Shared service centre	03	01				
Yard office	01		02			
Customized fertilizer plant	03	01	01			
GFCL Terminal	16	04				
CMC		01				
TOTAL	274	206	72	17	DCP 75Kg 02 CO2 50Kg 01	19

2.5.2 Safety Systems and Organisation

Safety Organisation:

HOD - SHE (Safety, Health and Environment) looks after the safety systems, procedures and compliance. He reports to Unit Head. He is assisted by Four Safety officers & one Officer-Environment.

Safety Systems:

Process Safety Management System (PSMS), a proactive safety system from OSHA – USA, has been adopted and is being followed. Jobs are undertaken under

safety work permit for which clear-cut procedures have been laid down as per PSMS.

Safety Equipment:

Safety equipment and appliances are provided at required places. Safety department takes care of their upkeep and replenishment with the coordination from the plant \ unit concerned. List of safety equipment and their location is given at **Annexure 6.10.**

Medical and First Aid facilities:

A First Aid centre operates in the factory round the clock. A full time doctor takes care of the first aid centre from 8 AM to 4:30PM and he is available in the CFL Colony adjacent to the factory to take care of any emergency during the non-working hours and holidays. Qualified Ambulance Room Assistants are posted in shifts and are available round the clock. An ambulance van is also available at the Ambulance Room round the clock with dedicated drivers for driving the Ambulance Van.

Facilities at the Ambulance Room:
Following facilities and equipment are available at the First Aid centre.:

i. Emergency O_2 apparatus.
ii. Automated portable Suction Apparatus.
iii. Surgical Instruments for minor surgery.
iv. ECG machine.
v. Multi Parameter Monitor-ECG,NIBP,SP02
vi. VPAP4 Auto BIPAP
vii. Defibrillator
viii. Spirometer
ix. Multi Parameter Patient Monitor
x. Audiometer
xi. Pulse Oxymeter
xii. BI sugar analysis.
xiii. Electronic digital BP monitor.
xiv. Eye vision drum electricity operated
xv. Observation Table.

Following antidotes are available in addition to routine medicines.

i. Atropine ampules for ammonia exposure.
ii. Adrenaline ampules for shock.
iii. Antidote for snake venom.
iv. Rabipur for dog bite.

Following facilities are available in the ambulance van:

i. O_2 apparatus.
ii. First Aid kit.
iii. IV fluid giving provision.
iv. Stretcher.

First Aid Training:

Staff is given periodic training in first aid and a list of the staff trained in first aid is maintained and is enclosed at Annexure 7.

Nominated hospitals:

Nominated hospitals facility is available in case of emergency and needing special attention. Nearest available facilities are as follows:

Hospital/ Nursing Home	**Distance from factory (**km**)**	**Beds available**
Hymavathi Nursing Home	1	18
Malkapuram	4	123
St.Ann's Hospital	2	200

RISK SCENARIOS

CHAPTER 3.0

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3.0 Risk Scenarios

3.1 Risk Identification

A detailed Risk Assessment study for the Coromandel plant was conducted to identify potential risks and their consequences. The consequences can be classified into three main categories.

(i) Fires and radiation effects.

(ii) Inflammable gas dispersion, explosion and over pressure.

(iii) Toxic gas plume dispersion.

(iv) Natural disaster triggered emergency

Failure case scenarios identified during the study are summarized in the following table.

Failure Case Scenarios

Sr.No.	Failure cases	Consequences
Offsite Areas		
1.	Fuel oil tank fire	Fire & Radiation effects
2.	Dyke fire – fuel oil tanks	- do -
3.	Random failure of Atmospheric Ammonia storage tank (AAST) & connections causing ammonia vapor release.	Toxicity
4.	Ammonia issues pump mechanical seal failure	- do -
Ammonia Unloading Facility and AAST		
5.	300 mm dia Ammonia Vapour line	- do -
6.	150mm dia liquid ammonia line of pump suction	- do -
7.	400 mm dia liquid Ammonia line	- do -
8.	80 mm dia Pre-cooling line	- do -
9.	Ammonia unloading arm	- do -
10.	Catastrophic failure of 5000 MT & 7500 MT of ammonia storage.	- do -

Failure Case Scenarios (contd)

Sr.No.	**Failure cases**	**Consequences**
Sulphuric Acid Plant		
11.	Holes / cracks on SO_2 / SO_3 gas ducts	- do -
12.	Gas release through stack	- do -
13.	Sulfur go down fire	Fire , Radiation & Toxicity
Complex Fertliser Plant		
16.	Ammonia Transfer line to A, B & C trains	Toxicity
17	Ammonia station	-do-

Fertilizer Pilot Plant		**Consequences**
18	Ammonia Transfer line	Toxicity
19	Ammonia Line at plant premises	-do-
20	Sulfuric acid tank	Fire , Radiation & Toxicity
21	LPG cylinders	Flammable

External Impacts i.e emergency from outside sources		**Consequences**
22	Heavy rain, Severe Cyclone ; Severe Earth quakes and Tsunami	Toxicity & Fire
23	Bomb Threat	Fire , Radiation and Toxicity
24	Fire at LPG transfer line of Gas Authority of India Ltd., / HPCL Oil installations	Fire , Radiation and Toxicity
25	Employee Commuting Bus accident	Fire & Injuries to employees

Risk Analysis

The consequences of the identified risk scenarios have been analyzed and the results summarized below for reference and for providing necessary guidance in planning for on-site emergency.

Sl.No. (1) & (2) Fuel Oil Tanks and Dyke Fires - Radiation Hazard Zones

Sl.No.	Incident Thermal Radiation Intensity	Hazard Distance from Tank Center (m)			
		37.5 kW/ m^2	**32.0 kW/ m^2**	**12.5 kW/ m^2**	**4.0 kW/ m^2**
1.	**Tank Fire**	7	8	17	30
2.	**Dyke fire**	12	15	57	107

Note: **It must be noted that in case of fire on one tank, the neighboring tank would come under the hazard zone and must be protected by water spray during any fire scenario in the tank farm.**

Emergency Action: (Guidelines)

For Minor Fires :-

Put off fires at the incipient stages using Foam or DCP or CO2 portable fire extinguishers.

- Simultaneously try and isolate the source of leak.

For Major Fires :-

- Raise Fire alarm and declare on-site emergency
- It must be noted that in case of fire on one tank, the neighboring Ammonia installations and other equipment and structures in the area would come under the radiation hazard zone and must be protected by water spray during any fire scenario in the tank farm. Use hydrants, water monitors and water curtains as provided.
- Ensure containment of leak within the dyke by keeping the dyke drain valve closed.

Sl.No. 3 to 10 ; Sl. No : 18 to 20 ; Sl No.23 & 24 : **Ammonia Leaks from Ammonia Unloading Facility, AAST's, and the Transfer Pipeline** - Toxic Effects Area

Toxic effects

The release rates, dispersion results and distances to LC_{10} (10 min.) 5479 ppm and LC1 (10 min.) 3241 ppm for selected scenarios are presented in Table 4.7 for two wind velocities 1.4 m/sec. and two stability classes D, E&F.

Table 4.7: Toxic damage distances

Sl. No.	Scenario Description	Release Rate Kg/Sec	Toxic damage distances for (lxr) m									
			LC_{10} (10 min.) (5479 ppm)					LC_1 (10 min.) (3241 ppm)				
			D_1	E_1	D_4	E_4	F_1	D_1	E_1	D_4	E_4	F_1
1	5% leak of 150 mm liquid ammonia line of pump suction (3m)	2.01 e^{-1}	40.5 × 8.0	39.4 × 7.4	13.2 × 1.4	19.4 × 1.6	58.9 × 8	47.4 × 9.6	46.9 × 9.4	19.2 × 2.1	25.8 × 0.7	83.5 × 8
2	20% leak of 150 mm liquid ammonia line of pump suction(3 m)	3.76	48.7 × 23	54.8 × 35	34.1 × 7.6	33.6 × 9.0	75.2 × 30.5	79.6 × 50	78.6 × 68.4	47.5 × 12.1	45.1 × 14.5	84.9 × 75
3	100% rupture of 150 mm liquid ammonia line of pump suction (3 m)	1.125 e^{2}	50 × 1.4	45.6 × 1.6	18.7 × 0.6	50 × 1.2	75.7 × 1.8	50 × 1.5	59.6 × 2.2	50 × 1	35.8 × 0.7	50 × 2.3
4	5% leak of 300 mm vapor line	1.76 e^{-1}	10.0 × 0.4	13.5 × 0.4	-	-	17 × 1.2	12.9 × 0.5	17.8 × 0.5	16.8 × 1.2	16.8 × 1.2	24.8 × 1.8
5	20% leak of 300 mm vapor line	3.2 e^{-1}	-	-	-	-	-	-	-	-	-	-
6	100% rupture of 300 mm vapor line	2.55	-	-	-	-	-	-	-	-	-	-
7	5% leak of 80 mm liquid ammonia line of pump delivery (15 m)	5.7 e^{-2}	25.7 × 4.4	25.2 × 4.0	9.9 × 0.4	11.6 × 0.23	31.7 × 6.2	30.5 × 5.2	31.2 × 6.2	12.3 × 0.9	18.9 0.6	60.5 × 5.9
8	20% leak of 80 mm liquid ammonia line of pump delivery (15 m)	9.1 e^{-1}	42.4 × 18.6	39 × 23	24.5 × 4.5	23.9 × 5.6	59.8 × 15.3	50 × 24.3	47.9 × 31.1	32.5 × 6.5	31.7 × 7.3	82.8 × 20.8
9	100% rupture of leak of 80 mm liquid ammonia line of pump delivery (15 m)	9.76	56.3 × 11.9	55.9× 15.4	24 × 7	23.7 × 7.5	68.7 × 15.2	69.1 × 21.3	68.1 × 27.4	29.6 × 9.9	30 × 12.1	78.8 × 18.5
10	150 mm PSV popping	64 e^{-1}	-	-	-	-	-	-	-	-	-	-
11	Catastrophic failure of 5000 MT ammonia storage	Instant-aneous	790 × 41.0	1246 × 21	635 × 26	1143 × 34	2455 × 37.4	1190 × 58	1671 × 46	834 × 23.8	1110 × 22	3183 ×49
12	Catastrophic failure of 7500 MT ammonia storage	Instant-aneous	831 × 27	1287 × 40	635 × 33.2	1170 × 41	2593 × 42	1247 × 33	2131 × 62	838 × 11	1156 × 36	3994 × 69.3

Note: D – Neutral conditions
E – Slightly stable conditions
F – Moderately stable conditions

Emergency Action: (Guidelines)

For Minor Leaks:

- Use water spray on to the ammonia leak.

- Simultaneously try and isolate the source of leak.
- Use ammonia gas masks / self-contained breathing sets / Use of Ammonia Suit for personnel protection.

For Major Leaks :-

- Raise alarm and declare on-site emergency. This may also call for immediate initiation of an off-site emergency and stopping the traffic on the high way.
- Ammonia transfer to be stopped and ROV at the Jetty closed and the ammonia transfer line kept floating on atmospheric storage tank. Transfer liquid ammonia from the line with vapor ammonia keeping the line pressure at the storage pressure.
- Use water spray, water curtains etc extensively to prevent spread of ammonia vapors into the neighboring operating areas. As the fire hydrants do not cover the entire length of the pipeline Fire engines from the Coromandel plant as well as from the mutual aid partners have to be mobilized extensively for this purpose.
- Use ammonia gas masks / self-contained breathing sets / Ammonia Suit for personnel protection.
- Ensure that all control rooms and confined spaces are protected from ammonia entry by closing all doors and windows and stopping room air conditioners etc.
- If necessary and depending upon wind direction resort to evacuation of the plants/ areas likely to be effected/ effected by the ammonia plume.

<u>Sl.No. 11 to 12 , 22</u> :- SO_2 gas release, Toxic Effects - Sulfuric Acid Plant

Case scenario	**wind speed (m/s), Stability category**	**Toxic Effects Distance (**m)	
		5 PPM (STEL)	**2 PPM** (TLV)
1" hole on SO_2 duct			
wind speed 2 m/s, stability 'F'		75	120
Wind speed 3 m/s, stability 'D'		30	45
½" hole on SO_2 duct			
Wind speed 2 m/s, stability 'F'		35	60
Wind speed 3 m/s, stability 'D'		-	22
8" hole on SO_2 duct			
Wind speed 2 m/s, stability 'F'		-	-
Wind speed 3 m/s, stability 'D'		-	-

<u>Emergency Action</u>: (Guidelines)

- If leak is minor plant can be operated with close watch.
- If major leak shut down plant and fix up leak.

Sr.No. 16 & 17: **Complex Plant (Misc. Ammonia leaks) - Toxic Effects Area**

	Wind Speed (m/s)	Stability Category	LTL 50 (m)	LTL 10 (m)	LTL 01 (m)
1" liquid ammonia drain at Vaporizer					
	2 m/s wind, Stability 'F', 10 min exposure		713	883	1080
	- do - , 30 min exposure		939	1174	1442
8 mm Instrument line at Ammonia Vaporizer					
	3 m/s wind, Stability 'D', 10 min exposure		234	298	370
	2 m/s wind, Stability 'F'. 10 min exposure		189	221	270

Emergency Action: (Guidelines)

For Minor Leaks:

- Use water spray on to the ammonia leak.
- Simultaneously try and isolate the source of leak.
- Use ammonia gas masks/ self-contained breathing sets for personnel protection.

For Major Leaks:

- Use water spray on to the ammonia leak and simultaneously try and isolate the source of leak.
- If isolating leak is not possible, shut down plant, stop all solid handling equipment and leave all exhaust fans running to exhaust leaking ammonia through the stack.
- Use ammonia gas masks/ self contained breathing sets for personnel protection and evacuate the plant.
- Inform utilities plant to cut off ammonia supply to the plant.

Emergencies from outside sources :

Based on the Risk Analysis carried out by the neighboring industries, it appears that the effects of accidents originating from these industries are very serious in terms of radiation or overpressure effects.

Emergencies from natural calamities like Heavy rains (leading plant flooding) ; Earth quakes, cyclones and Tsunami etc., ; Emergencies arising out of sabotage attempts \ bomb threats ; Emergencies from major fire incidents in the nearby industry installations (GAIL gas pipe lines ;

HPCL oil pipe lines ; HPCL Cooling towers) cause one or all of the risk scenarios discussed above and the emergency action plan given for the above scenarios holds for these emergencies also. However emergency action guide lines for likely emergencies from out side sources are cited below :-

Bomb threat:

This emergency in case of explosion, can cause one or all of the risk scenarios discussed above. In case of bomb planting threat the first responder shall inform the same to the Chief security officer or Duty Security officer. CSO \ DSO shall inform the same to the nearest police station and to the NBCD office located at Eastern Naval Head quarters and can seek their help in detecting and de-fusing operations. The phone numbers of NBCD office and Police are given at Annexure – 6.14.

Leak of LPG transfer line of Gas authority of India Ltd:

GAIL has laid a LPG line for transport of LPG from HPCL refinery to it's battery limit. This line is crossing Coromandel dock road, causing it to cross under Ammonia pipeline and run parallel under it for some distance. Adequate protection has been taken by GAIL to prevent corrosion of line and there by avoiding any possible leakages. However in case Of line rupture \ leak, fire hazard is existing. In case of LPG minor leak, it is to be informed to security who in turn informs the same to the GAIL office located at: 7-5-175; 2nd Floor, Pandurangapuram, Visakhapatnam – 530 003.Phone: 0891 – 2556855. Fax: 0891 – 2539197.

For major leak On –site emergency plan is to be activated.

Fire Hazard in a nearby Oil industry facility (HPCL oil / gas / Cooling Tower installations) :

Coromandel operations installations like Liquid Ammonia Unloading facilities at Wharf and Ammonia pipelines are at few places operate very closely. Since Fire is a major hazard in hydrocarbon industries there is a chance of Coromandel operations may get crippled because of its proximity. However due to heat radiation Ammonia service infrastructure may get damaged and may lead to minor toxic release of gas (residual gases in the pipe lines)

In case of any such scenario likely happen the following are the guidelines to be followed :-

1. Deploy all Emergency Response plan action as suggested in this document in case of toxic gas leaks.
2. In case of no toxic release and there is a likely damage of Coromandel infrastructure :- Re-inspection of Ammonia service infrastructure (mechanical; Civil; electrical and instrumentation) for any physical damages.

3. After completion of all corrective actions – implement Process Safety – Pre Start Up Safety Review checklists and after ensuring the compliance to check list requirements only normal operations shall be started.

Natural Disasters (Heavy rains leading plant flooding ; Severe Earthquakes ; Severe Cyclones ; Tsunami etc.,)

Now a days due to advanced technology support (Remote sensing satellites) Indian Govt. Meteorology dept. is able to forecast the Natural disasters with micro level precisions. Hence possibility of a surprise in terms of Heavy rains; severe cyclones and Tsunamis are not envisaged.

Due to very early forecasting from National and local Govt. authorities there is ample time available for planning the preparations for such natural disasters and its likely consequences as mentioned in the below table. .

	Emergency trigger	**Emergency scenario**	**Likely consequence**
1	Heavy rains – plant operations area under flooding	*Rain water (flood water) inundation to MCC rooms , distribution panels and underground electrical cable conduits.*	*1. Electrical short circuits* *2. Non availability of power for longer periods*
		Rain water (flood water) inundation to Manufacturing process control rooms (SAP , AAST , Utility , TG / DG)	*1. Crash shut downs leading to release of toxic chemicals and abnormal discharges*
		Rain water (flood water) entering into ware house (Hazardous chemicals storage areas)	*1. Accidental escape escape of chemical containers and release of toxic chemicals into water streams*
		Rain water (flood water) entering into Hazardous waste storage areas	*1.Accidental escape escape of hazardous waste containers and release of toxic waste chemicals into water streams*
		Rain water (flood water) crippling the AAST compressor operations which are supposed to be continuously available	*Accidental release of toxic chemicals in the work place*

2	Earthquake	Precautionary crash shutdown	Minor Toxic release of gas
3	Severe Cyclone (more than 100 to 150 km / hr. wind speeds)	Damage to roof sheeting structures of ware houses / conveyor gables etc.,	Release of nutrient / chemical rich water to water streams (low pH)
		Damage to cold / heat insulation covers to storage tanks	Increase in vapour pressures leading to toxic release of gases (Ammonia ; Sulfur Dioxide)
		Damage to cold / heat insulation covers to process equipment	Increase in vapour pressures leading to toxic release of gases (Ammonia ; Sulfur Dioxide)
		Damage to cold / heat insulation covers to process pipelines	Increase in vapour pressures leading to toxic release of gases (Ammonia ; Sulfur Dioxide)
		Damage to pipe bridges – damage to pipelines (hair line cracks / welding joint failures)	Release of toxic chemicals (residual gases) in the pipe lines – Ammonia , Acid , Sulfur Dioxide
		Damage to trees / plantations obstruction to road traffic movement	Road blockages obstructing the emergency response actions
		Damage to electrical supply infrastructure	
		Damage to fire water supply infrastructure	
		Damage to communications system – non availability of mobile services , table top telephones	
		Damage to fuel storage tanks	Release of flammable fuels into water streams / on to the ground
		Damage to cooling systems (normal air cooling / cryogenic cooling systems	
		Damage to flare stack - non availability of flare flame to	

		release the vapour pressure	
4	Tsunami	Damage to shore line Ammonia infrastructure escape of residual gases	Minor Toxic release of gas

Guidelines to Natural disasters - Preparatory phase

	Preparatory guidelines	**Responsible team**	**Any remarks**
1	Natural disaster - forecast by the Indian Meteorology department to be tracked every hourly at least 05 to 06 days ahead of the likely disaster (in case of Tsunami – one hour notice will be there ; in case of Earth quake no notice is expected)	SHE team or Technical Services team	
2	To contact other Industries (anywhere in India or abroad) to know their experiences while handling the disaster	Operations team Mutual Aid Team	
3	To contact retired / senior employees to know their past experiences in handling similar situations	SHE team Operations team Fire & safety team HR & Admin team	
4	To establish & maintain contacts with the Factories department authorities; Visakha Port authorities, AP Pollution Control Board Authorities and also District Collector office.	SHE team Fire & safety team HR & Admin team Commercial team	
5	Contacts to be established and maintained with the Mutual Aid industries – HPCL and APCL.	SHE team Fire & safety team	
6	To quickly implement disaster preparedness precautions sent by Factories department authorities; Visakha Port authorities, AP Pollution Control Board Authorities and also District Collector office..	Emergency Response team	

Guidelines to Natural disasters - Preparatory phase by Manufacturing operations team

	Preparatory guidelines	**Responsible team**	**Any remarks**
	Plant operations & Maintenance teams to implement under "emergency" protocol which is a guidance documented by the plant as a part of Process Safety Management system	Operations & Maintenance teams	

	All raw materials procurement to be reviewed for Ex.: Liquid Ammonia cargo ships , Acid ships , Molten sulfur ships , Rock ships , Sulfur ships etc.,	Commercial teams	
	Ammonia unloading arm which is on the critical equipment to be safely grounded / positioned to prevent any damage	Wharf team	
	BMH unloader which is on the wharf berth which is on the critical equipment to be safely grounded / positioned / locked to prevent any damage	Wharf team	
	Fuels stocks are to be re-viewed for auxiliary back up power supply (for 7 to 10 days) to maintain the Liquid Ammonia cryogenic systems without any safety issues / emergency power back ups	Purchase & TG – DG teams	
	Manufacturing capacities are to be lowered to facilitate easy and safe shut downs in case of any eventuality (a pro-active decision to shut down ahead of the disaster)	Operations team	
	Employees were communicated constantly about the incoming disaster and alerted to take all additional precautionary decisions.	HR & Admin team	
	Employees are encouraged to stay back at home on the day of cyclone.	HR & Admin team	
	Auxiliary emergency response staff (Electrical, Instrumentation, Safety, OHC, Operations, Mechanical Maintenance, Civil, HR and Security) was encouraged to volunteer and stay back close to manufacturing plant to combat any process emergency during and post cyclone.	Emergency Control Room team	
	Empowerment to be given to operations to take decisions that ensures Safety and avoids disaster at appropriate times	Unit Head	
	Cleaning of all major drains from blockages and the same are to be verified	Civil team	
	No hazardous chemicals are to be kept on ground and all were ensured to be above 0.5 to 1.0 meter level	Ware house team Operations team Maintenance teams	
	Additional transport facilities were kept on stand by mode	HR & Admin team	
	Ware house stocks are to be reviewed for necessary items like – Rain coats ; Torch lights , Life Line ropes , ladders, Tarpaulins etc.,	Ware house team Purchase team	

	Food materials are to be maintained in full that are sufficient to maintain the food supply to the employees	Canteen team	
	Canteen and guest house facilities are to be kept ready for emergency staff.	HR & Admin team	

Guidelines to combat (Handling) the Natural disaster – on site activities

	Unit head or his designate and members of the Emergency Response Team as well as Incident Control Teams and any other key personnel are available in the plant during the period of emergency The following decisions are to be taken as a part of disaster handling - Electrical supply - Manufacturing operations - Works at height - Hot works - Proactive tree cutting - Proclains / Pay Loaders to be made available - Emergency communications thru SMS alerts - Dewatering pumps to be made available	ERP team	

Guidelines to Operations recovery activities (post natural disaster)

	Emergency response teams headed by Unit Head quickly to make a visual survey of the impact to infrastructure as follows :-	ERP team	
	Access to the residential colony and plant by removing fallen trees by using pay loaders and JCB	Garage team	
	Critical equipment (as per Process Safety Management Systems)	Operations & Maintenance teams	
	Control rooms	Operations & Maintenance teams	
	Material conveying systems (conveyor belts etc.,)	Operations & Maintenance teams	
	Ware houses	Commercial & ware House teams	
	Material storage systems (Silos ; Tanks etc.,)	Operations &	

		Maintenance teams	
	Green Belts	HR & Admin	
	Electrical systems	Electrical	
	Instrument systems	Instrumentation	
	Communication systems	Instrumentation	
	Emergency response teams headed by Unit Head quickly to start developing the plant recovery plans as follows		
	Ensuing the Pre-start up safety check lists were run and inspection reports are reviewed by the Operations & maintenance heads		
	- Cooling towers	Cross Functional teams comprising members of Operations Maintenance Technical Services SHE team (experts as per options)	
	- Conveyor structures		
	- Manufacturing equipment		
	- Storage tanks		
	- Building & ware houses		
	- Electrical power supply infrastructure		
	- Instrumentation infrastructure		
	- Railway infrastructures		
	- Roads		

Special pre-cautionary measures to be implemented as applicable

Original Equipment Manufacturers, Technology providers, Industry experts may be requested to inspect the respective areas and submit the "**Fit For Use Certificates"** as a part of operations recovery plan.

Regulatory authorities / 3rd party safety Auditors / Inspection teams may be requested to witness the respective areas to witness the recovery actions

Employee Commuting Bus (enroute) accident:-

Due to increasing no. of human populations in nearby places , increasing no. of vehicles and traffic infrastructure issues, road accidents are now a days are frequently taking place. Coromandel operates its own fleet of employee commuting bus service on daily basis. Each bus carries about 15 to 40 people depending on the capacity of the bus.

Hence a likely chance of bus engaging in a minor road accident and as a result employees inside the bus getting minor injuries are likely consequence envisaged. In this regard a separate

emergency response guidelines are developed to take care of the immediate needs of the employees to minimize the consequence.

- Accident information shall first reach (by phone) the following at the earliest - Shift Superintendent / Ambulance / Duty Security officer / Duty Safety Officer whoever is first available. Information shall have a brief detail – how the incident took place, what is the location and what immediate assistance is required. Latest phone nos. are displayed in each employee commuting bus.
- Once the accident information reaches any one of the above contacts i.e – Shift Superintendent / Ambulance / Duty Security officer / Duty Safety Officer - immediately message shall be further communicated to the remaining three contacts.
- Subsequently Shift superintendent will escalate the message to – Unit Head ; Duty Security officer will escalate the message to Dy.Manager – HR and Chief Security Officer ; Duty Safety officer will escalate to – HOD – SH&E and Sr.Manager – Safety and Ambulance team will escalate the matter to Chief Medical officer.
- Basing on the instructions from Unit Head the following sequence of steps are suggested which are to be implemented as per the applicability :-
- Chief Medical officer to ensure the availability of Ambulance / s at the incident spot and also ensure shifting the injured employees to nearby hospitals (first preference to the Coromandel tied up hospitals and then to other nearby hospitals as per the need)
- Dy.Manager – HR to ensure availability of additional transportation arrangement to shift the employees from the incident spot to their residences. Also to address other requirements like - drinking water as well as essential food if situations demands.
- Chief Security Officer to rush to the spot and ensure the availability of rescue staff as well as rescue equipment along with Fire staff as per applicability. Also to take care of the belongings of the employee left back in the bus if any.
- HOD – SH&E and Sr.Manager – Safety to immediately rush to the spot - help rescue the employees as well as help co-ordinate in rescue efforts. Also to observe / gather and record the evidences from the incident spot which are useful for later incident investigation.
- Basing on the information provided from the incident site – Unit Head and other senior leaders may reach the incident spot.
- Dy.Manager – HR while attending the rescue of employees shall also delegate to another person that – injured employees family members are to be informed.

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Sulfuric Acid

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	**Location**
Sulfur godown	Sulfur fire	Fire hazard and SO_2 emission.	While driving pay loader exhaust causes fire.	If it is a small fire use water spray.	Operator.	Check pay loader exhaust for spark generation.	Fire hydrants fire monitors and water sprinkler system of sulfur godown	Sulfur godown.
			Pay loader bucket friction may cause fire.	If it is a major fire follow internal reporting procedure.				
			Faulty electrical equipment.					
			Smoking and throwing cigarette butts by unauthorized persons	Open water sprinkler system and direct fixed water monitor.	Shift in-charge/Section Head	Check electrical equipment condition periodically.		
			Unauthorized hot work in the area					
			External Impacts		Operator/ Fire crew.	Stop unauthorized entry into the sulfur godown.		
Sulfur meltor	Sulfur fire	Fire hazard and SO_2 emission	Same as above	Same as above	Same as above	Same as above	Open smothering steam. Spray water if fire is un-controlled with steam.	Smothering steam provided on meltors. Fire water hose reel provided at meltors area.

Sulfuric Acid

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Furnace, converters, exchanger, gas ducts etc	Gas leak.	SO2 emission and toxic effects, environmental problems.	Equipment shell and gas duct failures due to corrosion or failure of refractory & heat effect. or External impacts	Shutdown plant, fix up the leak and restart the plant.	Section Head	Check condition of furnace, refractory periodically. Check hot insulation of ducts and equipment to prevent corrosion due to condensation.	SO_2 canisters, SCBA sets	Control room.
Stack of Final Absorption tower.	Bad stack.	SO_2 / SO_3 emission from stack. Toxic effects and environmental problems.	Process upset or Natural disasters triggered impacts or non-uniform acid distribution in FAT/IAT towers or packing failure . or External impacts	Restore process condition.	Operator /Shift In-charge	Check and maintain process conditions frequently during operations.	SO_2 canisters, SCBA sets	Control room
				Shutdown plant and check acid distribution and restart. If necessary check and replace tower packing.	Shift In-charge/ Section Head	Constantly monitor stack during start up and shut down.		
				Alert people at down wind direction to take shelter.				

Sulfuric Acid

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Acid lines	Bursting of acid lines or flange gasket leaks	Leak of acid and formation of strong sulfuric acid.	Corrosion of pipelines or failure of gaskets. or External impacts	Shutdown the effected Section / Plant, rectify leak and restart plant.	Operator/ Shift In-Charge	Periodic inspections And timely maintenance. Replacement of pipelines and gaskets.	Acid gloves, goggles, acid hoods, acid suits, gum boots.	Control room.
Acid storage tanks.	Misc. acid leaks or catastrophic failure of tanks.	Leak of acid and formation of strong sulfuric acid.	Corrosion of tank shell roof plate flange gasket failures etc. in tank area. . or External impacts	If leak is small use lime to neutralise acid and flush with large quantities of water. If leak is a major one ensure containment of acid in the bund area by keeping the dyke drain closed. Transfer acid to other tanks. Repair and recommision	Operator/ Shift In-Charge/ Section Head	Periodic inspections and timely maintenance. Replacement of pipelines and gaskets.	Acid gloves, goggles, acid hoods, acid suits, gum boots	Control room.

COMPLEX PLANT. A & B TRAINS

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Ammonia lines at control valve flanges or OSBL or granulators, pipe reactor or main reactor area.	Liquid / vapour ammonia leak.	Toxic effects and heavy ammonia vapour concentration with in the complex building	Valves gland leaks /Flange gaskets failure/Pressure relief valve passing or malfunctioning.	Close ammonia flow to complex plant.	Operator	Condition monitoring of piping and equipment periodically.	Gas masks for minor leaks.	Control room
				Inform utilities and close ROV	Shift-in-charge/ Section Head	Ensure that all drains and vents etc are closed before taking in ammonia into the plant.	SCBA for major leaks. Long duration air cylinders. Continuous air line respirator	
				If leak is major declare on-site emergency				
			Pipe line damage.	S/D plant and all equipment except exhaust fans and evacuate the building.	Section Head			
			External impacts					
				Ammonia gas masks and SCBA sets to be used.				

COMPLEX PLANT. – "C" TRAIN

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Ammonia vaporizer	Liquid / vapor ammonia leak.	Toxic effects and heavy ammonia vapour concentration with in the complex building	Vaporizer tube failure. Drain left open. Relief valve malfunction/ Lifting. Leaking connections and other misc. failures.	Close ammonia flow to complex plant. Inform Utilities and close ROV provided	Operator	Condition monitoring of piping and equipment periodically.	Gas masks for minor leaks.	Control room.
				If leak is major declare on-site emergency	Shift In-Charge/ Section Head			
				S/D plant and all equipment except exhaust fans and evacuate the building.		Ensure that all drains and vents etc are closed before taking in ammonia into the plant.	SCBA for major leaks	
				Ammonia gas masks and SCBA sets to be used.				
Granulator back / Liquid ammonia PCV & LCV valves area	Liquid / Vapor ammonia leak.	Same as above	Flange leaks and line rupture	Same as above	Same as above	Same as above	Same as above	Same as above

UTILITIES PLANT.

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Mass flow meter area	Ammonia leak from connected pipeline such as flange leaks due to gasket failure.	Heavy ammonia concentration around the area	Use of wrong gasket materials	Leakage to be minimised by isolating the leak by operation of ROVS or stopping pumps.	Operator	Use proper quality gasket materials.	Ammonia gas masks for minor leaks.	Utilities plant or Atm. Ammonia tank control rooms.
	Leak from drain valves etc.	Toxic effects and environmental problems.	Improper operation maintenance	Use water spray or initiate water curtain to minimize toxic effects and facilitate emergency operations.	Operator	Periodic condition monitoring.	SCBA or Ammonia suit for major leaks	
				If leak is a major one initiate declaration of on-site emergency by raising an alarm.	Operator/Shift In-Charge	Attend to minor leaks promptly and minimize chances of major failures.		
				Stop all hot work in the area.	Shift In-Charge			
				Cordon off the area and evacuate people from affected areas.	Section Head/ Emergency services team.			

UTILITIES PLANT.

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Ammonia transfer pumps	Ammonia leak through pump seal /Glands.	Heavy ammonia leak into the surroundings.	Failure of pump seal	Stop pump and isolate pump.	Operator	Use proper quality seals,	Ammonia gas masks for minor leaks	Utility control room and sphere area cabin.
	Pump discharge line leak	Toxic effects and environmental problems.	Defective drain valve plugs.	Drain valve to be isolated	Operator	Check pumps, drain valves periodically.	SCBA or Ammonia suit for major leaks	- do –
	Drain valves at pump disc. kept open.		Leaking flanges.	Use water spray or initiate water curtain to minimise toxic effects and facilitate emergency operations	Operator/ Shift In-charge		PVC suit	Utilities control room.
			External impacts		Operator/ Shift In-charge/ Section Head			
				If leak is a major one initiate declaration of on-site emergency by raising an alarm.	Shift in-charge/Section Head			
				Stop all hot work in the area.	Shift in-charge/ Section Head/ Emergency services team.			
				Cordon off the area and evacuate people from the effected areas.				

UTILITIES PLANT.

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Ammonia transfer pumps.	Liquid ammonia leak from pump seals pump disc. suction lines etc.	Liquid Ammonia spill into the atmosphere.	Improper material for pump compressor seal and flange gaskets.	Close ROV. Close tank outlet valve and pump suction and disc valves.	Operator	Use proper quality material for pumps/ compressor seals and gasket materials.	Canister masks for minor leaks.	Atmos ph-eric Ammo nia storage tank control room.
		Toxic effects and environ-mental problems.		Use water spray or initiate water curtain to minimize toxic effects and facilitate emergency operations.	Operator /Shift in-charge			
		Heavy ammonia concentration in the atmosphere.	External impacts or dumper hit	If leak is a major one initiate declaration of on-site emergency by raising an alarm.	Operator /Shift in-charge /Section Head	Check connected pipelines periodically for defects. Fix up minor leaks promptly		
Atmospheric Ammonia storage tanks compressor	Ammonia vapor leak	Toxic effects and environmental problems.	Pressure gauge points, drain valves giving way	Stop all hot work in the area.	Section Head/ Emergency services team		For major leaks use SCBA sets plant air line respirator PVC suits etc	
			External impacts or dumper hit	Cordon off the area and evacuate people from the effected areas.				

Utilities Plant- Atmospheric Ammonia Storage Tanks (A A S T) – 1 & 2

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
AAST –1 & 2	150 mm dia liquid Ammonia line (Pump suction) leak.	Heavy ammonia concentration around the area Toxic effects and environmental problems.	Corrosion	Keep water spray at the point of leak	AAST Operator/ Shift in-charge (Utilities)	Use proper quality material for pipelines.	Canister masks for minor leaks.	AAST control room.
			External impacts	Cordon off the area			For major leaks use SCBA sets plant Airline respirator PVC suits etc.	
				Shut off -- XV 25103				
			Weak points like drain plugs or pressure gauge tappings giving way	Run pumps till the pumps loose suction after bypassing the interlock between XV25103 and pumps				
				Close discharge valves of pumps open pumps casing drain to drain pots attend leak after the line is empty		Attend minor leaks properly and as and when arise.		
				Normalize after completion of the job declare onsite emergency depending on the situation				

Utilities plant .- Atmospheric Ammonia Storage Tanks (AAST) – 1 & 2

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
AAST–1 & 2	50 mm dia cup drain line leak (Pin hole)	Toxic chemical release	Improper material usage.	Arrange water. Spray at the leak spot. Try to arrest the leak mechanically	Operator/ Shift in-charge (Utilities)	Conduct periodical checks on pipe lines as recommended	Canister masks for minor leaks.	AAST control room.
			External impacts	Cordon off the area				
			Weak welding joints	Evacuate people from the area.	Section Head-Utilities and Emergency staff.	Attend minor leaks properly and as and when arise.	For major leaks use SCBA sets plant air line respirator PVC suits etc.	
			Weak drain plugs.	Declare onsite emergency depending on the situation				

Liquid Ammonia transfer pipeline -- Wharf

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
AAST –1 & 2 to Wharf pipeline	80 mm dia pre-cooling line leak.	Toxic chemical release there by heavy concentration on dock road and adjacent area	Corrosion	Stop pre-cooling and isolate the required valves as per the standard operating procedure. Psms/SOP/AM/13/REV 0	AAST Operator / Utilities Wharf Operator Engineer	Frequent inspections of pipe line for any corrosion / leaks Speed breakers maintenances Restrictions on vehicle movements	Canister masks for minor leaks.	Wharf safety equipment room.
			External impacts / Dumper Hit	Inspect the type of leak and take required measures for preventing / reducing the leak by wearing the required P.P.E	Wharf Engineer / Duty Safety officer		For major leaks use SCBA sets plant air line respirator PVC suits	
			Bursting of pipeline because of over pressurization / dumper hit				Low temp ammonia suit	

Liquid Ammonia transfer pipeline -- Wharf

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
AAST -1 AAST -2	300 mm dia Ammonia vapor line leak (Compre-ssor suction line)	Toxic chemical release, there by heavy ammonia concentration in the atmosphere.	Corrosion	Isolate the particular pipe line immediately by closing the necessary valves as per procedures given below:	AAST Operator/ AAST Shift in-charge	Frequent inspections of vapor line for any corrosion	Canister masks for minor leaks.	AAST control room.
			External impacts / dumper hit	Close suction valves of all the three compressors		Checking of inter lock system, relief valve periodi-cally	For major leaks use SCBA sets plant air line respirator PVC suits	
				Close AAST vapor outlet valve to compressor suction.				
				Close bypass valve and down stream valve of PV 25103				
			Bursting of pipeline because of over pressurization /external impacts	Stop all hot works in the area.		Speed breakers maintenances	Low temp ammonia suit	
						Restrictions on vehicle movements		
			Pressure gauge points, drain valves giving way	Open HIC25104 to depressurize the line		Vehicle inspections		
				Keep flare on line.				
				Organise water spray				
				Declare on site emergency plan depending on the situation.				

Atmospheric Ammonia Storage Tank -- AAST-1 & 2

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
AAST -1 & 2 to wharf pipeline	400 mm dia liquid ammo-nia line	Toxic chemical release there by heavy concentration in the atmosphere area also	Corrosion	Stop unloading and isolate the pipeline as per the standard operating procedure. Psms/SOP/AM/13/ Rev 0	Patrolling staff to intimate	Frequent inspections of 400 mm dia pipe line for any corrosion	Canister masks for minor leaks	Wharf safety equipment room.
			External impacts / dumper hit	Inspect the type of leak and take required measures for preventing/ reducing the leak by wearing the required P.P.E	Both AAST operating staff as well as ship unloading staff	Restriction on vehicle movement	For major leaks use SCBA sets plant air line respirator PVC suits	
				Organise water spray		Speed breakers maintenance		
				Declare onsite emergency plan depending on the leak status		Vehicle inspections		
		There is a chance of heavy concentration not only on the dock road but also in the vicinity area that is on adjacent public road depending on wind direction may effect the HPCL operations	Pipeline leak due to over pressure	Declare off site emergency plan depending on requirements	Section Head and Emergency staff	To be vigilant and regulate speed of the trucks plying on dock road – restriction of vehicle movement ;vehicle inspections etc.,	Low temp. ammonia suit	To be arranged from emerg-ency control center.
			Blind flanges leaks	Stop vehicles and other traffic adjacent to public road depending on the need	HOD – Operations		Ammonia sensors for frequent checking in the vicinity to control traffic near by.	
					HOD-Safety and related staff			

WHARF

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Molten sulfur storage tank	Molten sulfur spills	Molten sulfur releases H_2S or catches fire generating SO_2 gas.	Catastrophic failure of tanks.	Cordon off the area and restrict flow of molten sulfur using dry sand or solidify with water.	Shift in-charge.	Condition monitoring of tanks periodically.	Canister gas masks for SO_2.	Wharf Shift Eng. room.
				Stop liquid sulfur transfer operations.	Operator.		Use SCBA set if SO_2 concentration is high.	
		Toxic and radiation effects. Environmental concerns.	Pipe line rupture.	For minor fires : spray water or use co2	Shift in-charge			
				For major fires: Initiate declaration of on-site / off-site emergency. Call for external help if necessary.	Operator /Shift in-charge			
Sulfur silo	Solid sulfur catching fire.	Fire hazard and SO_2 release.	Dust explosion.	Provide snuffing steam to the silo for putting off fires.	Operator / Shift in-charge			
			Frictional heat due to metallic parts	Use water spray system to put off silo fires	Operator.			

WHARF

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Fertiliser berth.	NH_3 leak from unloading arm's flange joints.	Heavy NH_3 concentration around the area and toxic effects and environmental problems.	Improper gasket material.	Minor leak: Provide water spray.	Operator/ Shift in-charge	Use proper quality gasket material.	Green / Red canister mask or 3M filter for minor leaks.	Shift Engineer; Manager room.;
			Pipeline leak.	Major leak: inform ship staff to stop operations.	Operator/ Shift in-charge	Mechanical integrity check of unloading arm & pipeline.	SCBA & Ammonia suit for major leaks.	
			Drain valve left open.		Operator.			
			Relief valve mal functioning.	Isolate leak by closing ROV.	Shift in-charge	Usage of Water curtains		
			Improper operations	Declare on-site emergency.		Annual inspection of arm & pipe line.		

BAGGING PLANT

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Empty bag storage \ Saw dust storage.	Fire.	Fire/smoke and radiation damage.	Hot work without permit.	For minor fires: Put out by using portable fire extinguishers	Operator Shift in-charge	Hot work with out permit should not be allowed.	Fire hose reels and nozzles.	Shift Engineer's room.
			Smoking and leaving lighted butts.	For major fires : use fire hydrants from machine floor as well as from ground floor	Shift in-charge	Ensure strict "no smoking" regime		
					Section Head.	Check electrical system for sparks and loose connections.		
			Faulty electrical appliances	Declare on-site emergency.		Check smoke detector system for proper functioning.		

DG Plant

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
HSD storage tank area	Fire.	Fire / smoke and radiation damage. Equipment / work environment damage. Property loss	Hot work without permit.	**<u>For minor fires</u>**: Put out by using portable fire extinguishers	Operator Shift in-charge	Hot work with out permit should not be allowed.	Portable fire extingui-shers. Fire hose reels and nozzles. SCBA set in case of heavy smoke	DG control room.
			Smoking and leaving lighted butts. Dry leaves at the area catching fire	**<u>For major fires</u>** : Use fire hydrants located in the near by area. **Declare On-Site Emergency.**	Shift in-charge	Ensure strict "No Smoking" regime		
					Section Head.	Check electrical system for sparks and loose connections.		
			Faulty electrical appliances			Keep the area clean from dry leaves etc.,		
Trans-former at substation	Fire / explosion	Fire / smoke. Equipment / work environment damage. Property loss	Electrical short circuiting / Insulation break down.	**<u>For minor fires</u>**: Cut off power supply if not tripped already. Put out by using portable fire extinguishers like DCP / CO2. **<u>For major fires:</u> Declare On-Site Emergency.**	Operator Shift in-charge. Shift in-charge Section Head.	Check the system periodically for proper insulation	Portable fire extingui-shers.	Located at the area.

Ware House :-

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Rubber material / other flammable material like paints, chemicals etc.,	Fire.	Fire / smoke and radiation damage. Equipment / work environment damage. Property loss	Faulty electrical circuits causing short circuit Hot work without permit. Smoking and leaving lighted butts.	**<u>For minor fires</u>**: Put out by using portable fire extinguishers. **<u>For major fires:</u> Declare On-Site Emergency.**	Operator Shift in-charge. Shift in-charge Section Head.	Install electrical system properly and check periodically for any possible insulation damages and loose contacts. Provide smoke detectors with alarms for immediate detection of fire. Hot work with out permit should not be allowed.	Portable fire extingui-shers. Fire hose reels and nozzles. SCBA set in case of heavy smoke	Located at ware house

ADMINISTRATION BUILDING / EDP SECTION :

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Stationery room	Fire.	Fire / smoke Equipment / work Environment damage. Property loss Important Documentation loss	Faulty electrical circuits causing short circuit Smoking and leaving lighted butts.	**<u>For minor fires</u>**: Put out by using portable fire extinguishers. **<u>For major fires:</u> Declare On-Site Emergency.** **Evacuate personnel from building by giving siren located in Quality Lab.**	MSO / Shift chemist / shift Duty officer MSO / Shift chemist / shift duty officer	Install electrical system properly and check periodically for any possible insulation damages and loose contacts. Reporting fire / smoke immediately after noticing	Portable fire extingui-shers. SCBA set in case of heavy smoke	Located in the admin building. Located in ECR 1.
IT room	Fire	Property loss Important Documentation loss. Equipment / work Environment damage.	Faulty electrical circuits causing short circuit	**<u>For minor fires</u>**: Put out by using portable fire extinguishers. **<u>For major fires:</u> Declare On-Site Emergency.**	MSO / Shift chemist / shift duty officer	Check electrical system periodically. Reporting fire / smoke immediately after noticing	Portable fire extingui-shers.	Located in a near by place

CAFETERIA :

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
LPG storage shed / Cooking area	Fire.	Fire / smoke Equipment / work Environment damage. Property loss	LPG lines leaking / LPG cylinder faulty Hot work without permit at LPG area	**For minor fires**: Put out by using portable fire extinguishers. **For major fires: Declare On-Site Emergency.**	Operator Shift in-charge. Shift in-charge Section Head.	Check the LPG line periodically for corrosion & damages. Replace leaky cylinders immediately. Any hot work to be carried by taking hot work permit and necessary precautions.	Portable fire extingui-shers. Fire hose reels and nozzles. SCBA set in case of heavy smoke	Located at Cafeteria.
Cafeteria supplied food	Food poisoning	Health hazard	Food getting contaminated / stale food	**Follow up procedure as per OHSAS – 18001 OCP for mitigating of food poisoning Procedure No: OHS\ERD\Caf\WI\001 – Rev. No. 0.**				

Employee Commuting Bus (enroute) accident

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	**Location**
Outside the Factory premises	Road accident	Fire / smoke / physical damage to bus and injuries to driver , helper and employees inside	Break failure ; rash driving ; another vehicle hitting ; skidding	**<u>For minor fires</u>**: Put out by using portable fire extinguisher provided inside the bus. **<u>For Injuries to employees :</u>** **Follow separate guidelines provided (please see Section 3.2 ; PP 6-7 of ERP)**	**First Communication** by any employee from the incident site	Emergency actions as per detailed in separate guidelines given (please see Section 3.2 PP 6-7 of ERP)	Portable fire extinguisher First Aid Box Emergency Contact numbers	Inside all Employee Commuting bus

Location	Incident	**Hazard consequence**	**Possible causes**	**Action to be taken**	**Action by**	**Recommended measures**	**Safety equipment**	
							To be used	**Location**
Inside the Factory premises	Heavy rains – plant operations area under flooding	Likely rain water (flood water) inundation to **MCC rooms, distribution panels and underground electrical cable conduits.**	1. Electrical short circuits 2. Non availability of power for longer periods	1.Power shut down to MCC to the affected area	Shift Engineer / Manager Electrical	1. Dewatering pumps to be kept ready 2. Continues drain clearance 3. Use search lights for emergency lighting 4. Tree cutting team to be ready 5. Alternate communication (no mobile / no land line)	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Line ropes Life Boats (raft type)	Impact Area
		Likely Rain water (flood water) inundation to **Manufacturing process control rooms ((SAP , AAST , Utility , DG / Wharf / Rock Grinding)**	Crash shut downs leading to release of toxic chemicals and abnormal discharges	1. Follow Emergency shut down procedures by respective process plants 2. Flaring of vapor ammonia to control tank pressures 3. If flare fails – dilute in water in controlled manner	Shift Operator /Shift Engineer	1. Rescue non-essential employees to CRC 2. Ensure Drinking water 3. At flare stack - LPG additional stocks to be maintained	Respiratory PPE Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	Impact area

Location	**Incident**	**Hazard consequence**	**Possible causes**	**Action to be taken**	**Action by**	**Recommended measures**	**Safety equipment**	
							To be used	**Location**
		Rain water (flood water) entering into W**are house - Hazardous chemicals storage areas**	Accidental escape of chemical containers and release of toxic chemicals into water streams	1.Water soluble , water reactivity bagged Chemicals to be shifted to elevated areas 2.Ensure proper locking of ware house gates / doors to prevent loss of containers 3.Ensure cylinders are locked with chains	In charge Ware house / Shift Superintendent In charge ware house / Shift Superintendent	1. Sand filled bags kept ready 2. Wooden pallets to be kept ready 3. Additional manpower	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	Warehouse
		Rain water (flood water) crippling the **AAST compressor operations which are supposed to be continuously available**	Release of toxic chemical in atmosphere	1.Follow Emergency shut down procedures by respective process plants 2.Flaring of vapor ammonia to control tank pressures 3.If flare fails – dilute in water in controlled manner	Shift Operator /Shift Engineer	1.Rescue non- essential employees to CRC 2.Ensure Drinking water 3.At flare stack - LPG additional stocks to be provided	Respiratory PPE Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	Location
Main Sub station	Rain water (flood water) inundation to **Main Electrical Substation**	Electrical short circuits Non availability of power for longer periods	Electrical short circuits	Dewatering pumps	Civil	1.Trench water level monitoring 2. Sand bag availability 2. Ensure dewater pumps with diesel engine Manpower planning Antidote availability	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	
				Portable Generator to be kept ready	Electrical			
				Availability of Diesel	Power plant			
				Ensure communication systems	Instrumentation			
				Drain clearance	Civil			
				Transport	HR			
				In coming power feeder cut off	Shift Engineer / manager – E&I			
				Canteen services	HR			
				Snake hazard	Security			

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	**To be used**
Utility services failure	Flood water disturbing water treatment system	Non availability of Drinking water Fire Water Raw water / Process water Instrument / Plant air	Non availability of Drinking water	Ensure DW availability to plant & Colony	HR	Maintain maximum qty. of DW in OH tank/s	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	
			Fire Water	Use Fire Tender, Trailer pump		Ensure working condition		
			Raw water/ Process water	Total shut down of the plant	Fire & Security			
			Instrument/ Plant air	Total shut down of the plant	Shift operator / shift engineer	Diesel operated air compressor		
Warehouse – hazardous waste storage area	Rain water (flood water) entering into Hazardous waste storage areas	Accidental escape of hazardous waste containers and release of toxic waste chemicals into water streams	Escape of oil containers , batteries , spent catalyst bags , LSHS sludge	1. Ensure proper gates to avoid escape of materials 2. Ensure no loose materials on the ground 3. Tarpaulins to be covered 4. Sand bags to be kept ready	Uncharged ware house and Manager - Environment	1.Availability of tarpaulins 2. Monitoring water quality for chemical concentrations	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type) Oil floaters	Ware house Strom drains Y junction 5th gate

Location	Incident	Hazard consequence	Possible causes	Action to be taken	Action by	Recommended measures	Safety equipment	
							To be used	**To be used**
Inside the Factory premises	Severe Cyclone (more than 100 to 150 km / hr. wind speeds)	Damage to roof sheeting structures of ware houses / conveyor belts	Hitting / falling on the people resulting in injuries.	Ensure not to stand under the roof sheets. Ensure not to move in the open area Ensure all people are stay inside the RCC buildings	Shift Engineer Shift Security Shift safety officer	Give early messages for people movement restrictions Window panes to be packed intact Evacuation of people in case if any civil , mechanical structures if found unsafe Inspection of week civil structures prior to the cyclone and strength the civil structures if possible or barricades the area to prevent accesses to the people	Rain Coats Torch lights Search lights Gum boots Life Jackets Life Lines Life Boats (raft type)	Impact area Impact area
		Flying of roof sheets structures of ware houses / conveyor gables etc.,	Hitting / falling on the people resulting in injuries.					
		Breakage of window glass.	Falling on the people resulting in injuries.					
		Collapse of walls of the civil structures on to the people	Falling on the people resulting in injuries.	Suspend all the rigging activities with crane during cyclone and keeping the crane in a safe position as per the manufacture instructions.	Shift engineer			

		Collapse of cranes during heavy wind	Falling on the people resulting in injuries.	Suspend all height work/Roof sheeting jobs during rain / heavy wind	Shift Engineer	Early messages to Garage team and respective contractors for precautions		
		Accidental moving of ammonia unloading arm from wharf berth and falling in to sea.	Damage to ammonia arm and leakage of residual Ammonia gas	Ensure to lock the ammonia unloading arm as per manufactures instructions.	Shift Engineer	Early messages to Wharf & AAST team for precautions		
		Accidental moving of BMH from wharf berth and falling in to sea.	Damage to BMH arm	Ensure to lock the BMH as per manufactures instructions.	Shift engineer	Early messages to Wharf & AAST team for precautions		
		Tilting of molten Sulphur / Acid trucks during heavy wind.	Damage to truck and spill of Molten sulfur	Stop the Acid and Molten Sulphur trucks during heavy winds and ensure sufficient stock in the plant to run the plant if required.	Shift engineer	Early messages to Wharf , SAP & SND teams for precautions		
		Falling of people from height during heavy winds	Injuries to people	Stop work at heights	Shift engineer & safety officer	Suspension of work permits of already permitted		

		Insulation sheets detached from the equipment/pipelines.	Injuries to people due to fall of material from height	Restrict the movement of people around the tanks	Shift engineer	Inspection of insulations for any chance of fall of sheets		
		Damage to trees / plantations obstruction to road traffic movement	Road blockages obstructing the emergency response actions	Arranging and ensure to availability of require manpower and material for removal of fallen trees on the roads / equipment's (JCB / Pay loader / Cutting tool	Civil / HR	Identify possible fall of trees and trim them before the cyclone		
		Non availability of shift reveling manpower due to failure of transportation for critical operations during cyclone.	Release of toxic chemicals (residual gases) in the pipe lines – Ammonia , Acid , Sulfur Dioxide	Pre-planning of sufficient manpower to attend the critical operations during cyclone along with boarding and lodging facilities in the Coromandel guest house.	Plant Manager / HR	Track availability of manpower		

		Damage to cold / heat insulation covers to process equipment / storage tanks / process pipe lines	Increase in vapour pressure leading to toxic release of ammonia gas.	1.Flaring of vapor ammonia to control tank pressures 2.If flare fails – dilute in water in controlled manner	Shift Operator /Shift Engineer	1. Periodical inspections and comply the recommendations as per report in time. 2.At flare stack - LPG additional stocks to be provided 3. Inspection of insulations prior to the cyclone and strength the insulation if possible	Respiratory PPE	
			Thermal expansions leading to toxic release of Sulphur Dioxide	Emergency shutdown of the plant as per procedure	Shift Operator /Shift Engineer	1. Periodical inspections and comply the recommendations as per report in time. 2. Inspection of insulations prior to the cyclone and strength the insulation if possible		
		Damage to pipe bridges – damage to pipelines (hair line cracks / welding joint failures)	Release of toxic chemicals (residual gases) in the pipe lines – Ammonia , Acid , Sulfur Dioxide	Emergency shutdown of the plant as per procedure	Shift Operator /Shift Engineer	1. Empty the lines if possible before cyclone. 2. Identify possible fall of week structures and strengthen them before the cyclone. 3. Identify possible fall of near by trees and trim them before the cyclone.		

		Damage to communications system – non availability of mobile services , table top telephones	Communication failure	1.Mobile communication system 2.Use trunk radios if network is available	Shift Operator / Shift Engineer	1. Track working condition of the PA system 2. Track availability of Trunk radios. 3. Keep all trunk radios are in full charged condition		
		Damage to cooling systems (normal air cooling / cryogenic cooling systems	Equipment damage and release of chemicals	Emergency shutdown of the plant as per procedure	Shift Operator /Shift Engineer			

After controlling the emergency, the normal situation is to be brought back.

Any hazardous chemical spill over during emergency is to be recovered back and the effluents are to be treated before their disposal.

Scenarios for recovery of sulfuric acid spill, Phosphoric acid spill, LSHS spill are given below.

For Ammonia the recovery is impossible only the vapors generating the pool of liquid ammonia spill are to be contained by putting special foam on the liquid pool and containing the vapors by arranging water curtains so that the vapors does not spread fast and are contained in less area.

3.4.1: RECOVERY OPERATION OF PHOSPHORIC ACID LEAKAGE.

Minor Leak: Arising out of line flanges leaks, pumps seal leaks etc.,

Action: Cordon the area, isolate the leak and call the maintenance to attend the leak.

- Wear personnel protective equipment while attending the above works.
- Wash the spill on the floor and take the wash to recycle to reactor if possible or to effluent treatment section for treating it.

Major Leak : Storage tanks of both 30 % & 48% tanks heavy leaks (either shell leak or bottom cone leaks)

Action:

- Inform plant in-charge / shift in-charge.
- Send the contract personnel working in the vicinity to distance away from tanks.
- Barricade the area and see that no unauthorized person enters the area except Operation people who know the Phos. Acid Plant.
- Complex plant to draw more acid if possible to empty the tank in faster way.
- Transfer the acid in to another tank if possible.

Recovery:

- Phos. Acid is not as hazardous as sulfuric acid.
- Concentrated acid of 48% strength may burn skin and mucus membrane when in contract.
- It is irritating and corrosive to eyes.
- Over-exposure results in burns of contacted body tissue.
- Keeping the above, hazards of the acid in view, recovery operation is to be taken up with all pre-cautionary measures.
- Wear all personal protective equipment like PVC suit, gloves, hood etc., depending on the need.
- Arrange airline respirator as the phos. Acid fumes are very pungent and create nausea while inhaling.
- Two recovery pit pumps area available at east and south west of tank area. Start the sump pump to recover the leaky acid before that area is getting filled with acid.
- Organize lime bags to the area to neutralize the remains.
- Run the transfer pumps till all available acid is pumped into tanks. But as the area is having gravel, lot of solids may get deposited and not easy to collect acid and recover.
- Afterwards, clear all the sludge / solids with water and divert all collections into ETP, treat there and send the effluents out.
- Spray lime in sufficient quantities and afterwards flush the same.
- After recovery is completed, inform persons concerned.
- Check the effluents going out for pH and level of phosphates and fluorine.

3.4.2: RECOVERY OPERATION OF LIQUID SULPHUR LEAKAGE:

Minor leak:

Lines rupture, flange gaskets failure. As the liquid sulfur melting point is about 113°C, once it comes out of the tank, it will automatically get solidified in atmosphere and blocks the leak. Isolate the line and call the maintenance to arrest the leak.

Precautions:
Use personnel protective equipment like face shield and asbestos gloves. Stop any hot work near by.

Major leak:

Case -1: Leakage of Liquid Sulfur from one of the tanks at liquid sulfur terminal.
Cause : Manhole bolts gave way at bottom side and liquid started coming out.

Recovery:

- As the liquid sulfur melting point is about 113°C and will be stored inside the tank in the range of 130 - 145°C, once it comes out of the tank, it will automatically get solidified in atmosphere and blocks the leak. Only if it is solidified in pit or tank by pouring water from outside, there is a possibility of hot liquid at bottom layer. But if it spreading by leak and as we are keeping water hoses, all layers will get solidified.

- If leak is heavy arrange number of water hoses around so that it will get solidified. Dyke wall arrangement is there all around so it will not flow out of the dyke.

- Pumping back cannot be done as it gets solidified fast. So leave it for solidification and collect the same by digging afterwards.

- Transport the solid blocks to plant and break them into pieces to feed them to quick melting at Sulfuric Acid plant.

- We have to see that no fire must take place during the total operation.

- If proper fire protection is exercised the recovery operation is simple and we can totally use the sulfur back for our system without any wastage.

- Lot of water spraying is required at dyke to cool the liquid fast while leaking.

- Sulfur fumes may create little pungent and masks, hand gloves are to be used while recovery operation is taking place.

Case – 2: Molten sulfur pumping line rupture while ship unloading.

Action:

- Stop the unloading by informing the ship unloading master
- Cordon off the area and evacuate all the unauthorized personnel
- Cool the sulfur by spraying water. Remove the solidified sulfur
- Call maintenance to rectify/renew the ruptured line.

Properties:

- Sulfur is yellow in color
- Having a melting point by 113°C and boiling point of 444°C. It's auto ignition temp. is 190°C.
- The sulfur will be kept in liquid form around 136°C and its density at this temperature is 1.8. It is insoluble in water. So any amount of water can be used for recovery.

3.4.3: RECOVERY OPERATION OF SULPHURIC ACID LEAKAGE.

Minor Leak:

Arising out of line flanges leaks, pumps seal leaks etc.,

Action:

- Cordon the area, isolate the leak and call the maintenance to attend the leak.
- Wear personnel protective equipment like PVC coat, PVC pant, PVC full size gloves, Gum Shoes etc., while attending the above works.
- Neutralize the spill on the floor with lime and remove it to effluent treatment.

Major leak:

Case –1 : Sulfuric acid circulation / production lines bursting and heavy leaks

Action:

- Cordon the area, Shut down the plant if required, isolate the leak and call the maintenance to attend the leak.
- Wear personnel protective equipment like PVC coat, PVC pant, PVC full size gloves, Gum Shoes etc., while attending the above works.
- Neutralize the spill on the floor with lime and wash the area and remove it to effluent treatment.

Case –1: Storage tank heavy leak.

Action:

- Check whether the dyke area drain valve is perfectly closed or not.
- Inform Shift Manager.
- Tell Security not to allow any vehicles into acid plant area.
- Inform the people working on in the places / buildings in the wind direction side to avoid inhaling the fumes.
- Do not open water hoses nearby.
- Block the roads by the side of tankage area.
- Keep Ambulance at the opposite side of wind direction zone.

As nobody is injured in this incident, recovery of the chemical is to be taken up as next step.

Recovery:

1. Wear personnel protective equipment like PVC coat, PVC pant or acid suit PVC full size gloves, Gum Shoes etc.
2. Arrange airline respirator. If fumes are pungent, we have to take out PVC hood and use air - line respirator mask.
3. Line up the sump pump of dyke area to another tank. Switch on pump breaker. Reach the pump switch with all safety precautions. Keep one man nearby to help you in case of need with a running water hose with him and do not allow water to fall inside the dyke area.
4. Organize the lime bags to the area in sufficient quantity.
5. Start the sump pump; check whether pump is performing well.
6. Run the pump till it lost suction and dyke is empty from acid.
7. Do not forget to gauge the tank before starting the pump and after stopping the pump. You can have better idea how much you have recovered. After pump is stopped close all related valves.
8. After all the acid is pumped, spray lime in huge quantity and then wash the area with huge quantity of water. This operation will have heavy fugitive emissions near all puncture care. When this is giving on, see that the cleaning water should not enter pump pit. Open the drain, which is previously in closed position and push limewater into outside canal, which will ultimately enter into effluent treatment plant.
9. Once total operation is over you can call for normalcy.

Recovery of Situation*:*

1. Inform Shift Manager
2. Inform Security to give clear signal for traffic movement.
3. Send Ambulance back.
4. Inform all the concerned that it is clear.
5. Send recovered acid for analysis immediately. If it is having low strength it will cause harm to the tank (corrosion). So try to issue the same at the earliest and use it.

Check the effluents gone out in canal for pH. Arrange for treatment of acidic water properly before letting it out into the outside canal.

3.4.4: RECOVERY OPERATION OF LSHS LEAKAGE.

Properties:

Low sulfur heavy stock is furnace oil having a flash point by 66°C minimum and maximum is unlimited. Its density is 0.91 to 0.92 at 16°C. We must see that water content should not be more than 1% by volume. There is not toxic hazard by LSHS but direct skin contact may be avoided. There is not fire hazard unless the oil is properly ignited. There is a danger of BLEVE-BOIL LIQUID expanding vapor explosion. (If water content in the storage tank increases). Water should not go into the storage tank in any case.

Incident:

- Heavy leak from storage tank and LSHS spread in and around tank platform within the dyke.

- LSHS is stored in the tank with steam coils 'ON' and once if it comes into open atmosphere, it will become like a paste and spreading time is much. After getting cooled, it will become like tar and can be recovered by digging operation. Into drums and can be heated and can be put back into storage tank.

- As the spilled area becomes slippery, vehicle movement in that area must be stopped. Also see that leaky LSHS not to enter the sewage system.

- Antiskid sore shoes are to be used while doing recovery operations.

- Collected LSHS must not contain any foreign substance or water.

- If the dyke area and storage tank seat area is always kept cleaned, the contamination can be avoided if sudden leak occurred. The recovered past of LSHS can be loaded into small drums or more bigger vessel with steam coils 'ON' so that it can be melted back and transferred to storage tank. Proper barricading of spilled area is must. After recovery operation the area must be thoroughly cleaned and must be kept dry. As the area is 'NO SMOKING ZONE', it must be exercised with all precautions of fire. If it catches fire, please do not use water but use only foam to suppress the same.

EMERGENCY PREPAREDNESS
SECTION - 4.0

DOC NO: E/SH/SF/WI/001 REV NO: 4

DATE OF ISSUE: NOVEMBER 2015

4.0 Emergency Preparedness:

4.1 Policies and Procedures:

4.1.1 Management is committed to the Safety of plant and total facility personnel. This is proposed to be achieved by three basic principles, viz.

(I) Prevention of unsafe conditions,
(II) Early detection of an emerging risk scenario, and
(III) Emergency preparedness and emergency response to meet all likely contingencies by appropriate emergency management planning.

4.1.2 The first priority is for prevention by adhering to well established and time tested design engineering practices, operation and maintenance practices, effective implementation of safety work permit systems etc

4.1.3 Risks have been identified with the help of expert professional agencies and action plan has been prepared to handle all such emergencies at the incipient stage and prevent escalation. These procedures have been made part of the on-site emergency plan. Early warning and detection systems have been built into the process and equipment design.

4.1.4 Well-documented Standard operating procedures and Process safety information manuals are prepared and made available to all concerned staff.

4.1.5 Rehearsals of mock drills are being conducted in tackling plant emergencies followed by table–top drills and shop floor discussions and updating the on-site emergency plan based on experience gained and suggestion received from the participants.

4.1.6 Fire fighting systems and equipment, safety equipment including Personal Protective Equipment (PPE) have been provided at all required field locations besides maintaining a healthy stock in the warehouse. First Aid training has been given to most of the employees to ensure their availability in all shifts.

4.1.7 Public address systems have been provided to Phosphoric acid plants and Bagging plant. Apart from the internal and external telephones, walkie-talkies, pagers, radio trunking system etc have been provided to all key members of the emergency team. Cellular phones have been provided to all the members of Incident control as well as Emergency Control teams.

4.2 Important Internal Documentation:

It will be ensured that the following important documentation will be maintained at all critical locations in the plant, like Unit control rooms, Emergency Control Centers etc.

4.2.1 Individual plant/ unit operating instructions and maintenance manuals, Process and Instrument diagrams, and other relevant technical information regarding the unit concerned.

4.2.2 On-site emergency management plan at all specified locations and the off-site management plan at the Main emergency control room.

4.2.3 List of key personnel, doctors, hospitals, mutual aid members, fire brigade, statutory authorities etc and their telephone numbers

4.2.4 List of all safety and fire fighting equipment and their locations.

4.2.5 Material safety data sheets and up-to-date inventory of all hazardous materials handled.

4.2.6 Layout plan and area map of the surroundings with clear cut marking of roads. The layout plan shows the hazardous areas in the plant, the assembly points and escape routes etc.

4.2.7 Gas masks, SCBA sets etc in sufficient numbers for use by the members of the emergency team.

4.2.8 Wind direction/ velocity indication within the viewing location from the emergency control center.

EMERGENCY MANAGEMENT PLAN

SECTION - 5.0

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5.0 Emergency Management Plan:

On-site emergency management plan is mainly to ensure preparedness of plant personnel and other systems for effective handling of all emergency situations that may be faced in the plant. HOD - SHE will ensure that the plan is reviewed and updated on an annual basis or earlier as required and circulated to all concerned.

5.1 Identification of Key Vulnerable Areas

Key Vulnerable areas have been identified based on the risk analysis studies.
The most vulnerable areas are:

- Ammonia Storages - Atmospheric pr. Storage Tanks.
- Sulfuric Acid Plant and Sulfur godown
- Wharf (liquid Sulfur and ammonia unloading) & liquid sulfur storage tanks.
- DG fuel oil tanks area.
- Substation and transformers.

These areas have been marked on the plot plan and annexed.

5.2 Emergency Organization:

Emergency organization chart, the line of command, duties and responsibilities of key personnel and their alternates, covering the normal and shift working hours, have been detailed out in Annexure IV. Following is a brief outline of the functioning of the on-site emergency organization.

5.2.1 First Responders: The plant operating personnel will be the first responders, who along with the concerned unit shift in charges will handle the emergency from the initial stages of emergency evolution and communicate to all concerned through the internal phone No.111 or 444. The lines of communication to be followed during emergency are given in Annexure IV.

5.2.2 Manager (shift operations): will call upon the services of other personnel/ departments after assessing the situation and declares emergency and authorizes sounding of the plant siren. He will initially assume command as Emergency Controller / Incident controller till such time other senior officers arrive on the scene.

5.2.3 Chief Emergency Controller:

During Normal working hours**:** UNIT HEAD / designate will be the chief emergency controller.

During shifts and Holidays: Manager - shift operations (Shift Supdt.) will be coordinating the activities of Chief emergency controller and chief incident controller till they arrive on site.

5.2.4 Chief incident controller :-

During Normal working hours**:** HOD (Operations) will be the chief incident controller and co-ordinate all emergency operations. Concerned unit Manager will be the alternate.

During shifts and Holidays: Manager - Shift operations (Shift Supdt.) will be coordinating the activities of Chief emergency controller and chief incident controller till they arrive on site. When MSO assumes the charge of Chief Emergency controller, then the plant / unit area in –charge takes the responsibility of functioning as Chief incident controller till the arrival of senior officials concerned.

5.2.6 Other Key Functions:

Allocation of personnel for other key functions and functions of all other staff members who are not covered in the on-site emergency plan have been detailed out in Annex IV. Evacuation procedures are also detailed out in **Annexure 6.12**

5.3 Communication Methods:

Following communication facilities are available:

(a) Plant Siren is used to "declare emergency" and to give "All clear".
(b) In Administration block emergency is also communicated thru PA system messages as well as Local (smoke alarm)
(c) Shared services dept. is provided with an additional alarm which gets triggered from Quality Lab in case of an emergency.
(d) Internal and External Telephones.
(e) Radio trunk phones.
(f) Cell phones
(g) Public address (PA) system at individual units.
(h) If all above systems fail, designated messenger will be used. Jeeps and cars are available in the plant all the time.

5.4 Emergency Control Centers and Assembly Points:

5.4.1 Control Centers :-

Emergency control center – Main (**ECR 1)** is beside the shift superintendent room located in the Admin Building. The control room will be provided with adequate facilities for internal as well as external communication.

All necessary documentation mentioned under section 4.2 will be maintained in the main control center. Personnel protective equipment like SCBAs, gas masks etc are provided in room (Emergency cup- board) sufficient numbers for use during an emergency.

Emergency Control Centre – Alternate (ECR 2) is located in the garage area and all the above-mentioned facilities and documentation are also provided in the alternate center.

Forward Control Centers: The plant personnel will also use the concerned unit control rooms as forward control center during the emergency.

Assembly Points :-

Main Plant :

- Plant gate.
- Contract work men entry gate.
- Dock road entry gate No.5.
- Gypsum pond entry gate No.4
- Colony Basket ball ground (For colony residents)

Wharf

- At the Engineers room opposite.
- At the New silo area – 8th Security gate.

Note: The assembly points are to be selected basing on the wind direction at the time of the incident.

These areas will be covered by the PA system, for effective communication with the assembled personnel during an emergency.

5.5 **Training and Mock Drills**:

Fire fighting and use of fire and Safety equipment:

All plant personnel are trained in Fire Fighting and use of Fire appliances and portable Fire extinguishers. Training is also given to all employees working in the plant area, in the use of personnel protective equipment like gas masks, SCBA sets etc. Refresher training courses will be periodically conducted to cover plant personnel once in a year.

First Aid:

Number of selected employees have been trained in First Aid and will be available in sufficient numbers in each shift. List of persons trained and certified in First Aid is attached . The certificate is generally required to be validated once in 3 years. Chief Medical Officer will monitor the training program to ensure that sufficient number of persons with valid certificates are always available for shift coverage.

5.5.2 **Mock Drills**: It is essential to conduct mock drills to keep all concerned in a perpetual state of preparedness to handle any emergency. It is also mandatory to conduct an on-site emergency mock drill not less than once in six months. Mock drills are, however, planned on quarterly basis. The effectiveness of mock drills will be reviewed by the emergency team and the on-site emergency plan revised if necessary taking into consideration the experiences gained during the mock drill.

Table TOP drills : Table top drills are exercises to prepare for emergency response and planning at incident site.

HOD - SHE is responsible to coordinate the above activity and ensure that mock drills are scheduled, conducted and reviewed regularly. The review meetings will be documented and presented to the Unit Head.

5.6 **Communication to Statutory Authorities**:

In case of a major emergency that is likely to effect the surrounding population, the following district authorities and other officials have to be informed. List of officials to be contacted and their phone numbers are given at **Annexure 6.14**

Off-site Emergency :-

5.7.1 When an emergency situation arises in the plant, it will be first noticed by some worker, technician or a supervisor who will raise an alarm and cause the information to be reached to all concerned through the emergency communication system described earlier.

5.7.2 Unit Head / Designate, as the Chief Emergency Controller when they are present, or the Manager – shift operations, outside the office working hours, till the arrival of unit head / Designate, will assess the situation and initiate action as per the emergency plan. They will use their discretionary powers to order shutting down the concerned plant(s) if they feel that emergency can be contained only by plant / unit shut down.

5.7.3 In case of an emergency, the effects of which are not going to be felt outside the factory premises, he will declare on-site emergency by sounding the factory siren and try to contain and control the emergency with the help of plant personnel as given in the on-site emergency coordination chart.

5.7.4 However, if the emergency is likely to cross the plant boundary or outside help is required to contain the emergency, he will initiate the off-site emergency communication by informing the District Collector or his designate, who is Chief Emergency Coordinator for the off-site plan and Chairman of the District Crisis Group.

5.7.5 The off-site emergency coordinator stationed in Visakhapatnam may, with the help of Police, Medical, Fire brigade, voluntary organizations and other statutory bodies, coordinate the off-site activities in a manner decided and stipulated by the off-site emergency plan.

5.7.6 The Chief Emergency controller of the factory or his deputy will continuously provide all necessary technical and other inputs required by the Off-site Emergency Controller to effectively mobilize the external resources to help contain the damage and to deal with evacuation procedures in and around the factory premises.

5.7.7 Telephone numbers of the external agencies to be contacted is given in **Annexure 6.14**

ANNEXURES
SECTION – 6.0

DOC NO: E/SH/SF/WI/001 REV NO:

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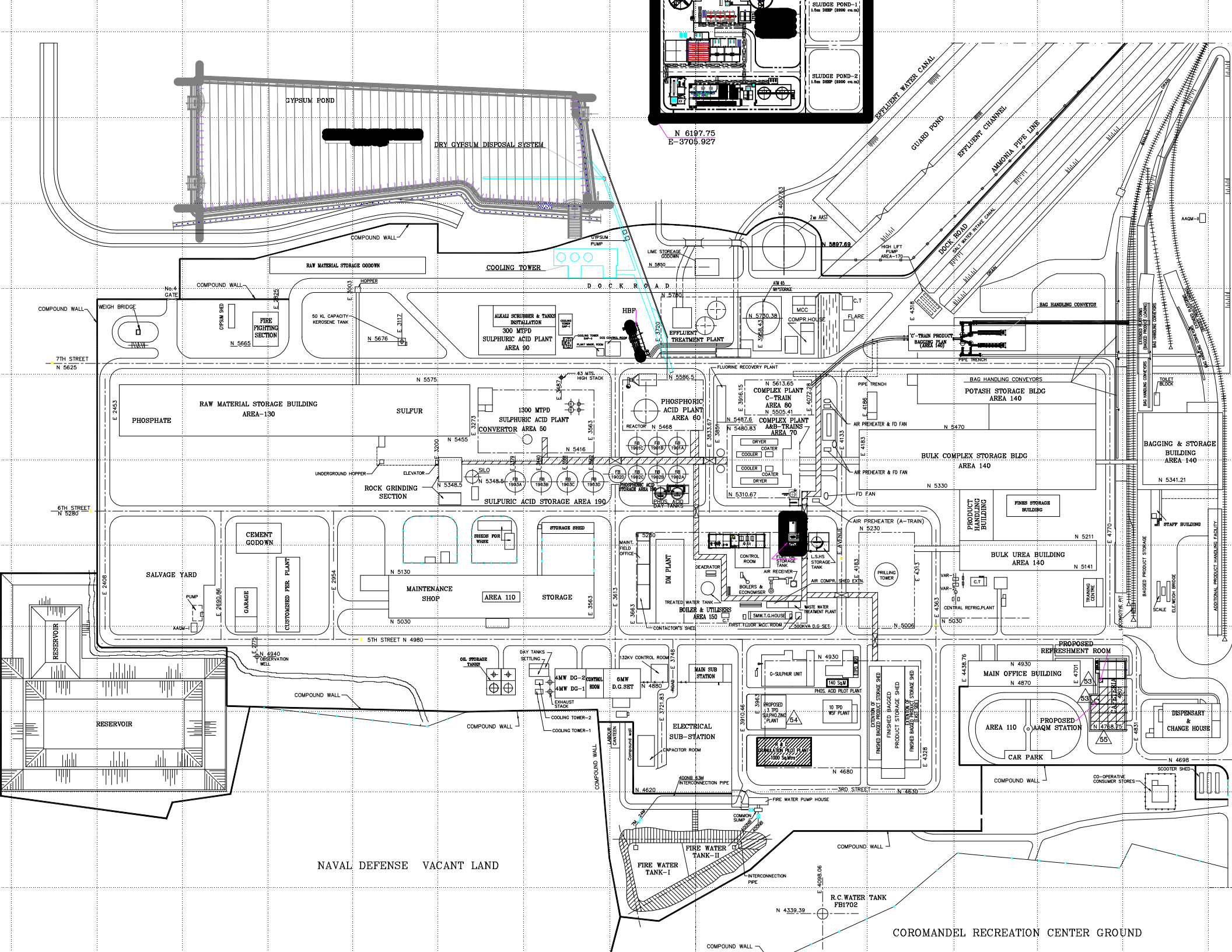
COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
Annexure 6.1	**Locality-wise Population particulars of Visakhapatnam Urban Area**	
Doc.No.E/SHE/SF/WI/001	Revn.No.'3'	Effective date:Dec 2012

Ward No.	Names of the Localities	Population
01	Old post office, Kota veedhi, Ambusarangu Street	13902
02	Kurpam Market, Padma nagar, Wada veedhi, Chilakapeta, Moula panja.	14365
03	Town hall, Rajappa naidu veedhi	15066
04	Burujupeta, Bukka veedhi, VGH area.	15554
05	Purna market, Town kotha road, Velampeta, Parikiveedhi.	13503
06	Sunnapu veedhi, Rangireeju veedhi, Godari gothulu, Poorna market.	13521
07	Chengalrao peta, Golla veedhi, Kotha Agraharam, Jabbari thota	20531
08	Kotha jalari peta, Paindora peta, Ramalayam, Upper Relli veedhi	14260
09	Angati dibba, Tadiveedhi, Salipeta, Manthavari veedhi	18140
10	Kallupakalu,Prasad gardens, Panda veedhi, Reserve police lines	17487
11	Kobbarithota, Bhupesh nagar, behind Manorama talkies, Nethaji nagar	16650
12	Atchiyampeta, Venkateswara metta, Bangaramma metta	20087
13	Suryabagh, Dabagardens	12172
14	Nerella koneru, Chalavathota, Allipuram	14557
15	Ammavari veedhi, Bangaramma metta, Neelamma vepachettu	11040
16	Bheem nagar,Dabagardens, DBK quarters	15114
17	Gollalapalem, Lalitha colony, prakasarao peta, Dwaraka nagar	17885
18	Ramnagar, Pitani dibba	21077
19	Ramajogipeta, Krishna nagar, pandimetta, Maharanipeta, V.Raju nagar, Mutyalammagudi	20130
20	Ootagedda, Venkareswara nagar, Sriranga puram, Official colony, Jalaripeta, Krishna nagar	17194
21	Sramika nagar, Chinna Waltair, Old CBI office area, Panduranga puram, AU out gate area.	21831
22	Peda Jalaripeta, Adarsh nagar, Peda Waltair, Peethala veeedhi, L.B.Colony, East point colony.	27216
23	MVP colony, Harijanawada, Isukathota, Chinagadili, Arilova, Old Venkojipalem.	92325
24	Mangapuram, Reavanipalem, Amarnagar, Rajiv nagar, Pithapuram colony, Peda Waltair.	37197
25	Old Venkojipalem (H.B.Colony), Isukathota, Maddilapalem, Seethammadhara, Bhanunagar.	32949
26	Nakkavanipalem, Gandhi nagar, KRM colony, Seethammadhara	42260
27	Seethampeta, Gangu veedhi, Resavanipalem, RFTC	18851
28	Ashoknagar, Bhagatsingh colony, Vinayak nagar,Tulasipeta, Rama talkies, Rajendra nagar.	17162
29	Santhipuram, Lalitha nagar, IV town police station.	22630

Ward No.	Names of the Localities	Population
30	Sramika nagar, Green park, Madhura nagar, Sankuvaripalem, Ramakrishna nagar, NGGO's colony.	26593
31	Dondaparthi, TSN colony, Subbalakshmi nagar	17643
32	Jagannadhapuram, RK nagar, Akkayyapalem,	14844
33	Muslim thatichetlapalem, Madeti gardens, Gita vidyamandir,Rly.New colony.	30120
34	Rly.New colony, Thatichetla palem, Tharakarama nagar, lakshminarayanapuram, Seva nagar, Narendranagar	26035
35	Satyasai nagar, Singalammapuram, kapparada	17585
36	Dharmanagar, Sanjeevayya nagar,Madhusudan nagar, Santhinagar, Kasturi nagar, Tikkavanipalem, Rly.station, kapparada.	38906
37	Bapujinagar, Pedakothuru, Indiranagar, L.B.nagar, Kancharapalem mettu, Kapparada.	25631
38	Gnanapuram, Saliveedhi.	15223
39	Gnanapuram, RP peta, Kancharapalem, port quarters, Dayananda nagar.	21338
40	Ramalayam, Kanchara palem.	17790
41	ITI junction, manchukonda thota, ASR nagar, Burma colony, Tenneti nagar, Murali nagar, Madhavadhara, Ambedkar nagar, Meher colony.	40290
42	Sivanagar, Karasa, Marripalem, Gandhi nagar.	26553
43	Jakirhussain nagar, 104 area, Tummedapalem, Subhash nagar	93665
44	Butchiraju palem, new Karasa, Old Karasa, Air port, Gowrinagar, Sakethapuram.	93665
45	Yedulavanipalem, Zinc colony, Mullagada, China mullagda, Gondesivanipalem, Sriramanagar, Pilakavanipalem, Kunchamma colony, Raja kamaladevi colony, Ajana colony, Srinivasa nagar (E&W), Pathrudu colony, CFC colony, Himachal nagar, Ganapathy nagar, Nakkavanipalem, NGO's Colony, Mullagada housing colony, Ex-service man colony, Ganga nagar, Hanuman nagar, Nehru nagar, Hanuman sanjeev colony, TPT colony, Ashok nagar (half portion)	**26640**
46	Gullalapalem colony, Sriharipuram, Ram nagar, Annamma colony, Yarada park, Jawahar nagar, Indira nagar, Ashok nagar (half part), Barma colony.	10323
47	Ramakrishna puram, Industrial colony, Janata colony, Prakash nagar (half part), Venkanna palem	8325

48	Malkapuram, Alluri seeta rama raju nagar, Port quarters, Jai Andhra colony, Kakarlova, Chintallova	20535
49	New colony (Scindia), AK corporation colony, ESI colony	80880
50	Scindia old colony, Staff colony	7770


GYPSUM POND
DRY GYPSUM DISPOSAL SYSTEM
SLUDGE POND-1
1.5m DEEP (2000 cu.m)
SLUDGE POND-2
1.5m DEEP (2000 cu.m)
N 6197.75
E-3705.927
EFFLUENT WATER CANAL
GUARD POND
EFFLUENT CHANNEL
AMMONIA PIPE LINE
DOCK ROAD
SALT WATER RYING CANAL
COMPOUND WALL
RAW MATERIAL STORAGE GODOWN
COOLING TOWER
GYPSUM PUMP
LIME STORAGE GODOWN
HIGH LIFT PUMP AREA-170
No:4 GATE
WEIGH BRIDGE
GYPSUM SHED
FIRE FIGHTING SECTION
50 KL CAPACITY KEROSENE TANK
HOPPER
ALKALI SCRUBBER & TANKS INSTALLATION
300 MTPD SULPHURIC ACID PLANT AREA 90
HBF
EFFLUENT TREATMENT PLANT
MCC
COMPR.HOUSE
FLARE
C.T
BAG HANDLING CONVEYORS
C'-TRAIN PRODUCT BAGGING PLANT (AREA 140)
PIPE TRENCH
7TH STREET N 5625
RAW MATERIAL STORAGE BUILDING AREA-130
PHOSPHATE
SULFUR
1300 MTPD SULPHURIC ACID PLANT CONVERTOR AREA 50
63 MTS. HIGH STACK
PHOSPHORIC ACID PLANT AREA 60
REACTOR
FLUORINE RECOVERY PLANT
COMPLEX PLANT C-TRAIN AREA 80
COMPLEX PLANT A&B-TRAINS AREA 70
DRYER
COOLER
COATER
AIR PREHEATER & FD FAN
POTASH STORAGE BLDG AREA 140
BULK COMPLEX STORAGE BLDG AREA 140
BAGGING & STORAGE BUILDING AREA 140
TOILET BLOCK
UNDERGROUND HOPPER
ELEVATOR
SILO
ROCK GRINDING SECTION
SULFURIC ACID STORAGE AREA 190
PHOSPHORIC ACID STORAGE AREA 70
PHOS. ACID DAY TANKS
FD FAN
6TH STREET N 5280
CEMENT GODOWN
SALVAGE YARD
GARAGE
CUSTOMISED PER PLANT
SHEDS FOR WHSE
STORAGE SHED
MAINTENANCE SHOP
AREA 110
STORAGE
MAINT. FIELD OFFICE
DM PLANT
DEAERATOR
CONTROL ROOM
AIR RECEIVER
BOILERS & ECONOMISER
TREATED WATER TANK
BOILER & UTILISERS AREA 150
WASTE WATER TREATMENT PLANT
5MW.T.G.HOUSE
500KVA D.G SET
CONTACTOR'S SHED
AIR COMPR. SHED EXTN.
AIR PREHEATER (A-TRAIN)
PRILLING TOWER
PRODUCT HANDLING BUILDING
FINES STORAGE BUILDING
BULK UREA BUILDING AREA 140
CENTRAL REFRIG.PLANT
TRAINING CENTRE
STAFF BUILDING
SCALE
ELE.WEIGH BRIDGE
ADDITIONAL PRODUCT HANDLING FACILITY
BAGGED PRODUCT STORAGE
LOCOMOTIVE PIT
5TH STREET N 4980
RESERVOIR
OBSERVATION WELL
OIL STORAGE TANKS
DAY TANKS SETTLING
4MW DG-2
4MW DG-1
CONTROL ROOM
6MW D.G.SET
EXHAUST STACK
COOLING TOWER-2
COOLING TOWER-1
132KV CONTROL ROOM
MAIN SUB STATION
ELECTRICAL SUB-STATION
CAPACITOR ROOM
LABOUR CANTEEN
C-SULPHUR UNIT
140 SQ.M
PHOS. ACID PILOT PLANT
10 TPD WSF PLANT
3.5 TPD SULPHO.ZINC PLANT
EXTENTION OF FINISHED BAGGED PRODUCT STORAGE SHED
FINISHED BAGGED PRODUCT STORAGE SHED
PROPOSED REFRESHMENT ROOM
MAIN OFFICE BUILDING
PROPOSED AAQM STATION
AREA 110
CAR PARK
DISPENSARY & CHANGE HOUSE
SCOOTER SHED
CO-OPERATIVE CONSUMER STORES
400NB R.M INTERCONNECTION PIPE
FIRE WATER PUMP HOUSE
COMMON SUMP
FIRE WATER TANK-I
FIRE WATER TANK-II
INTERCONNECTION PIPE
R.C.WATER TANK FB1702
3RD STREET
NAVAL DEFENSE VACANT LAND
COROMANDEL RECREATION CENTER GROUND

Annexure 6.3

Meteorological Conditions and Wind Roses

(5 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 2

DATE OF ISSUE: NOVEMBER 2015

1. METEOROLOGICAL CONDITIONS:

The consequences of the toxic or flammable material released are largely dependant on the weather conditions. For the assessment of major scenarios involving release of toxic or flammable materials, the most important meteorological parameters are those that affect the atmospheric dispersion of the escaping material. The crucial variables are wind direction, speed, atmospheric stability and temperature. Rain fall does not have any direct bearing on the results of the risk analysis; however, it can have beneficial effects by absorption / washout of the released materials. The actual behavior of any toxic release would depend on the prevailing weather condition at the time of release.

2. TEMPERATURE:

The mean minimum temperature during the months of November to February (cold season) in Visakhapatnam varies from 15.8^0 C to 18.3^0 C, whereas, the mean maximum summer temperature in this region (during the months of April to July) varies from 35.5^0 C to 39.1^0 C.
Temperature normally decreases with increasing height in the atmosphere. The rate at which the temperature of air decreases with height is called Environmental Lapse Rate (ELR). It will vary from time to time and from place to place. The atmosphere is said to be stable, neutral or unstable according to ELR is less than, equal to or greater than the Dry Adiabatic Lapse Rate (DALR), which is a constant value of 0.98^0 C/100 meters.

3. HUMIDITY:

Air is generally humid in this region. Relative Humidity (RH) varies from a mean maximum of 84% to a mean minimum of 68%. An average relative humidity value of 80% has been considered for general study of risk analysis.

4. WIND SPEED AND WIND DIRECTION:

The most prevalent wind speed in the whole region in the range of 1 kmph to 19.0 kmph. Moderately high wind speed of 20 kmph or more is also experienced in this region, though rarely.

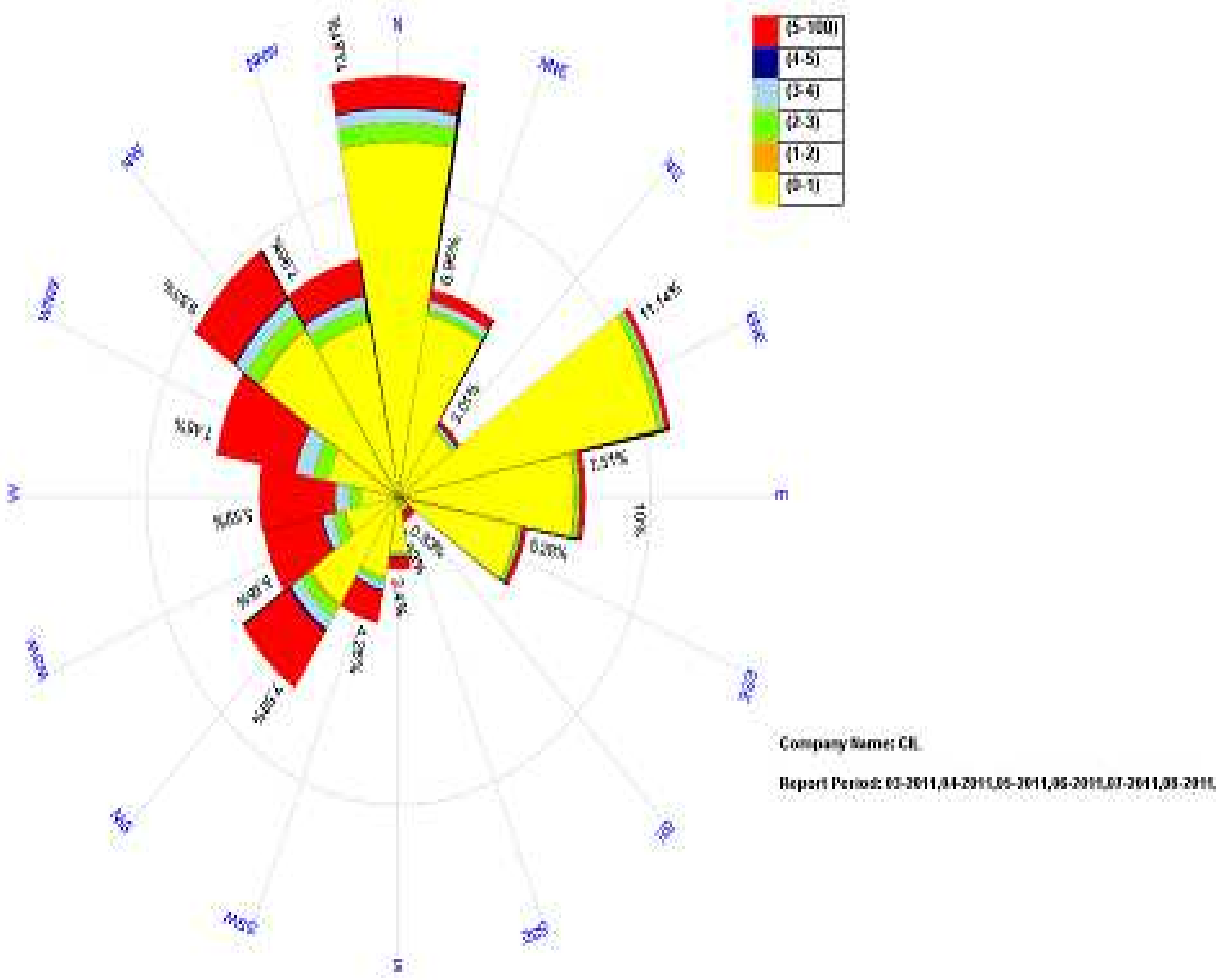
Probability of calm weather is about 25% during nights and about 4% during day time in this region. The predominant wind speed in this region is about 3.0 m/s and the wind predominantly blows from the South – West directions. The dispersion of materials into atmosphere are in addition to wind speed and direction are influenced by atmospheric stability. For most of the time atmspheric stability will be either neutral (D) and stable (E) class.

On e of the most important characteristics of atmosphere is its stability. Stability of atmosphere is its tendency to resist vertical motion or to suppress existing turbulence. This tendency directly influences the ability of atmosphere to disperse pollutants emitted into it from the facilities. In most dispersion problems, the relevant atmospheric layer is that nearest to the ground, varying in thickness from several hundred feet to a few thousand meters. Turbulence induced by buoyancy forces in the atmosphere is closely related to the vertical temperature gradient.

The meteorological data regarding temperature, relative humidity, rain fall, wind speed and wind direction are being continuously monitored and are recorded at Manager shift operations (Shift superintendent) office, which is also the Emergency Control Center –1, and also, at wharf supervisor's office, using a computerized package, developed by LYNX automatic weather monitoring station.

Windrose diagrams are enclosed for reference.

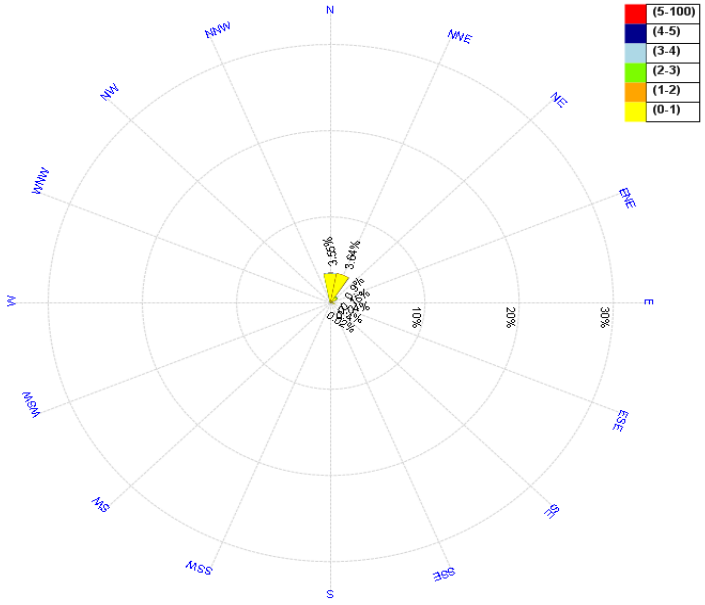
Annexure: 6.3



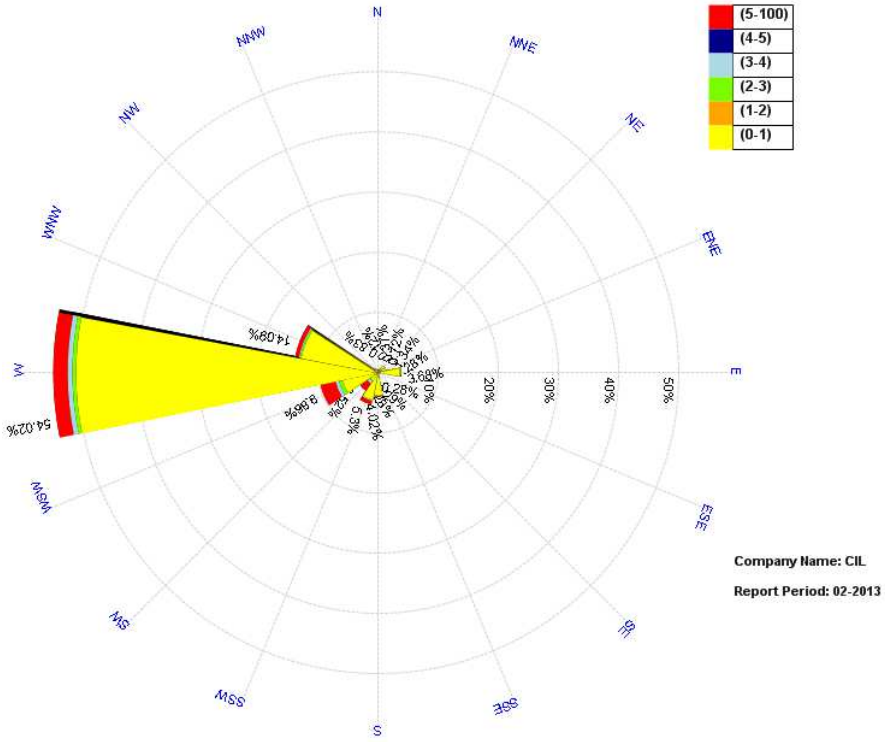
Year 2011-12

Annexure: 6.3

Jan’13

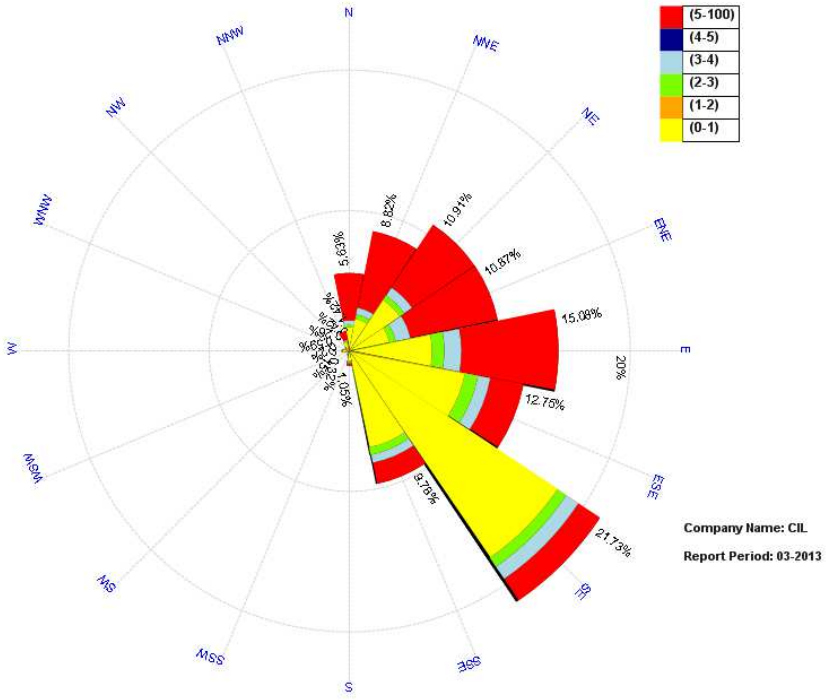


February’13

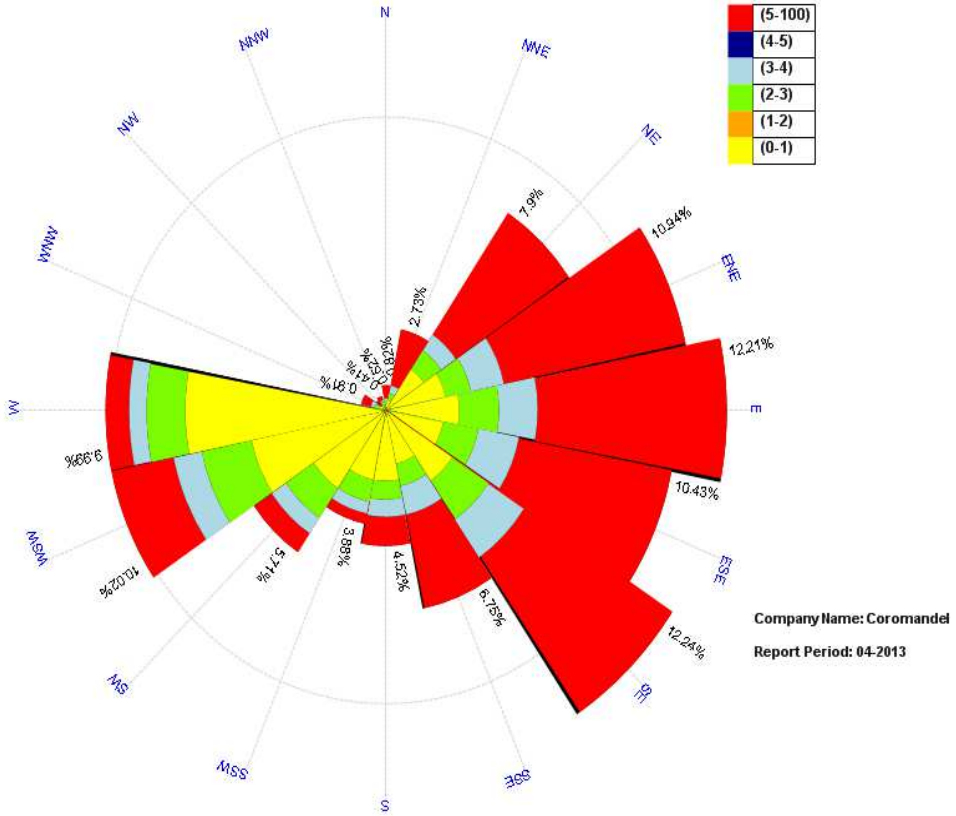


Annexure: 6.3

March'13

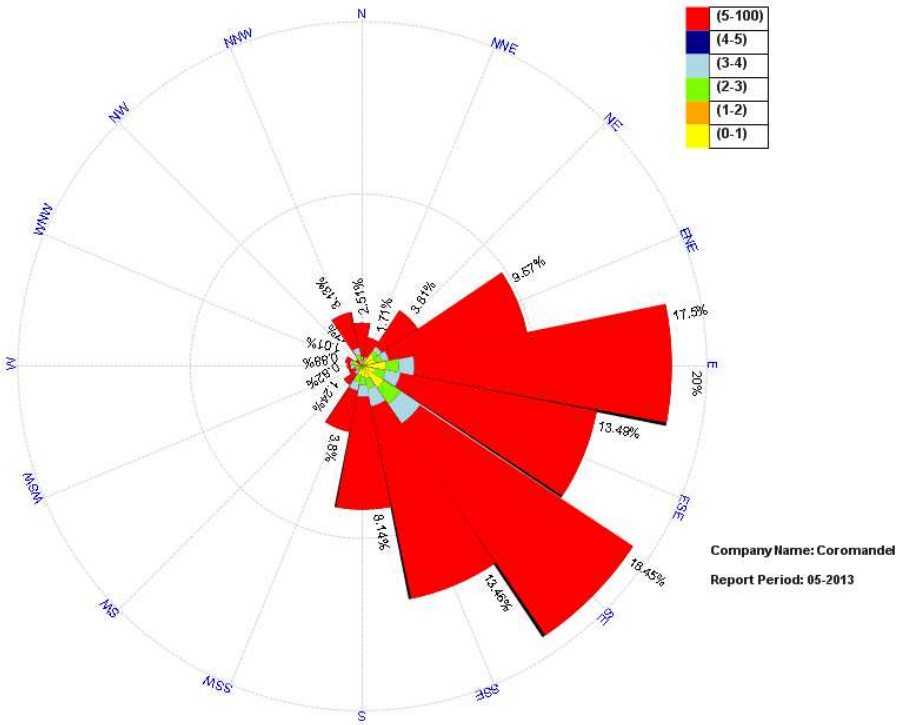


April'13

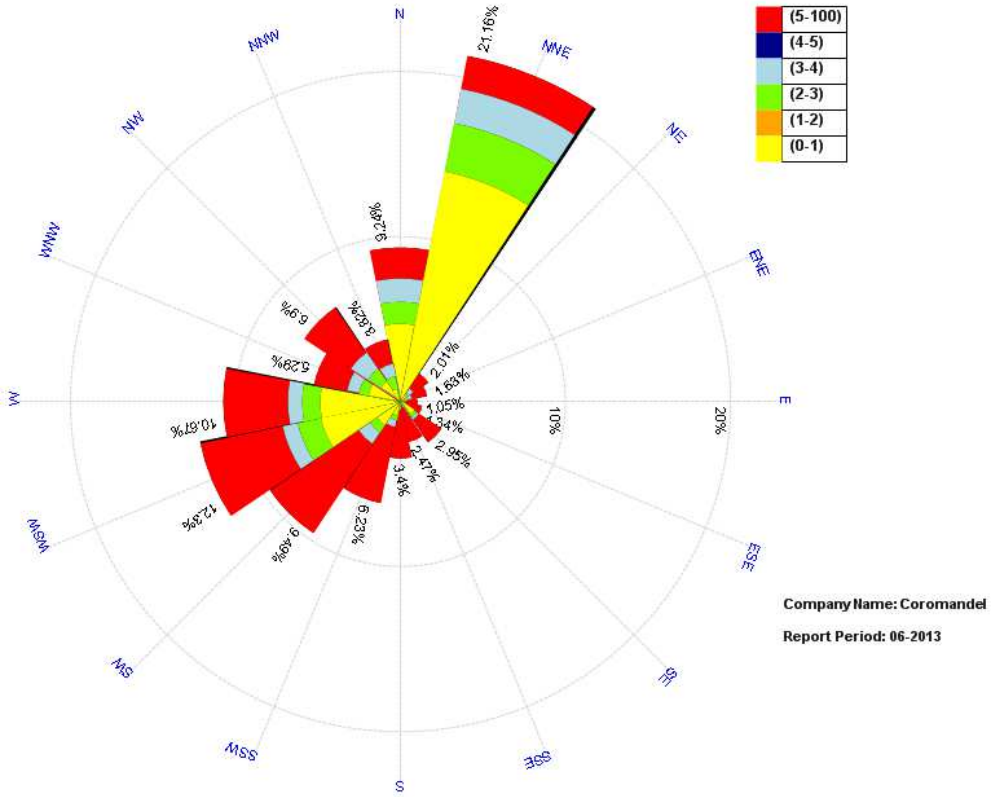


Annexure: 6.3

May'13

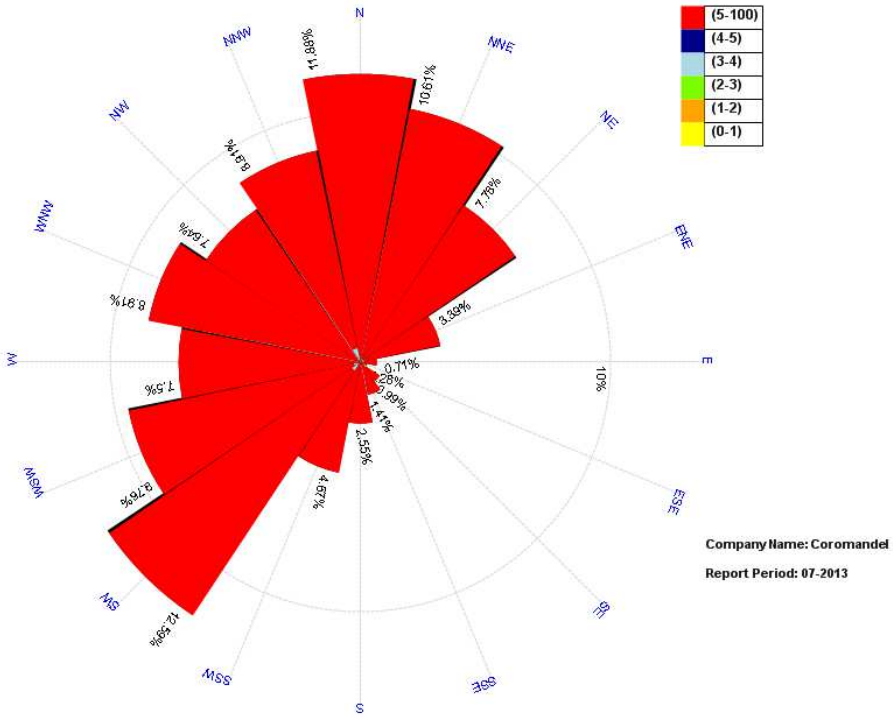


June'13

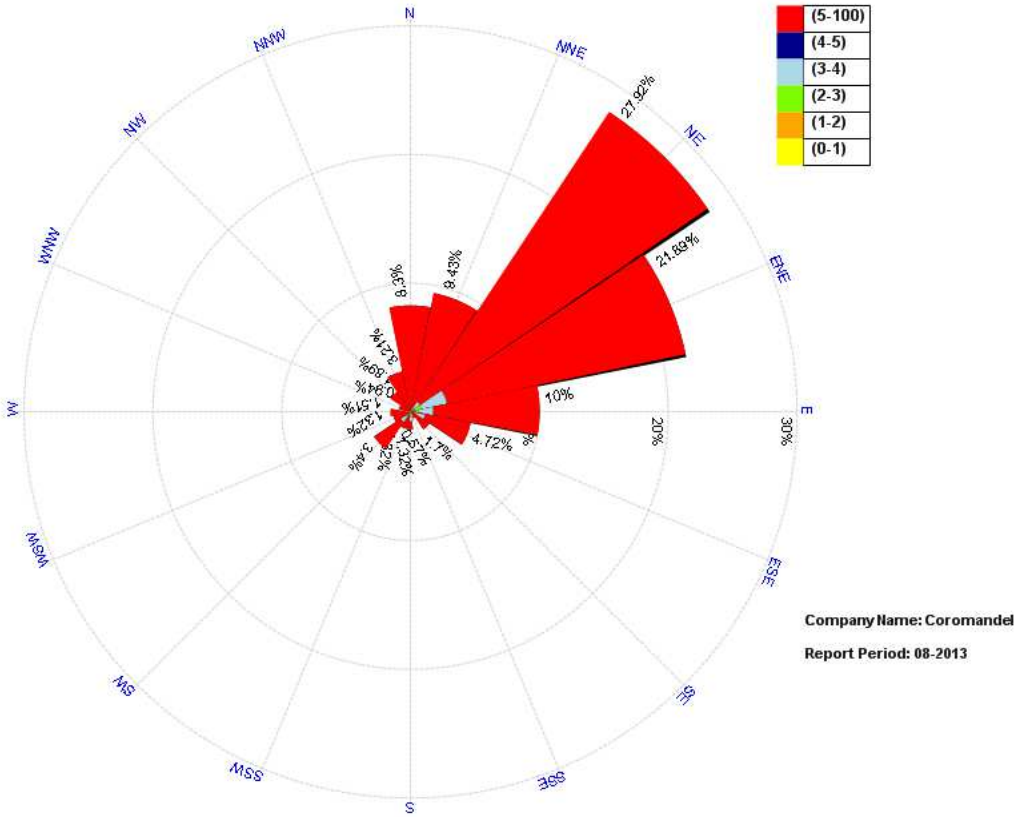


Annexure: 6.3

July’13

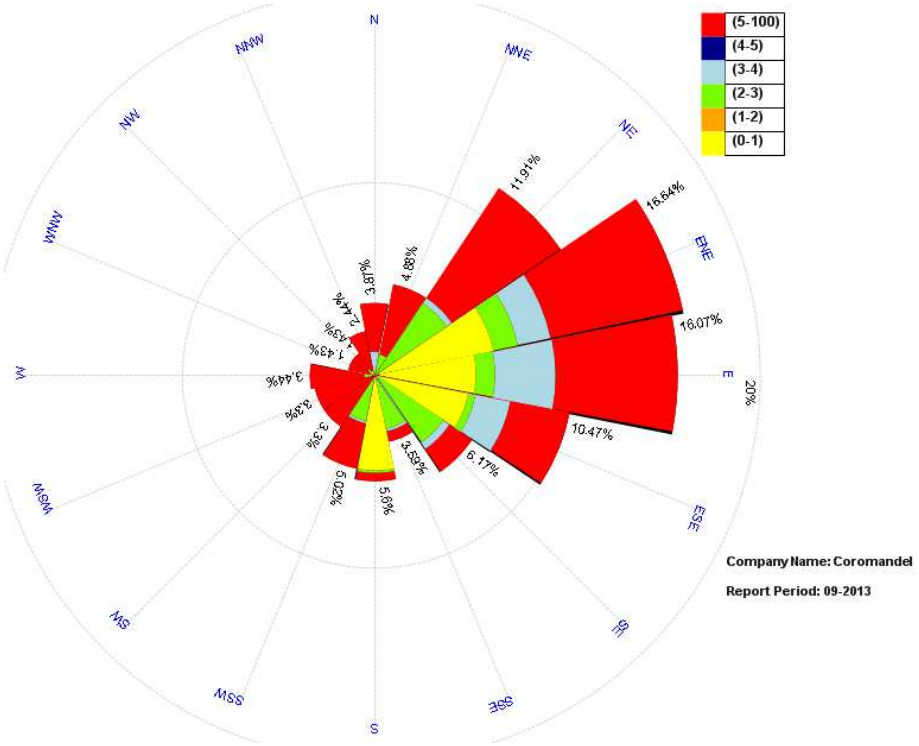


August ’13

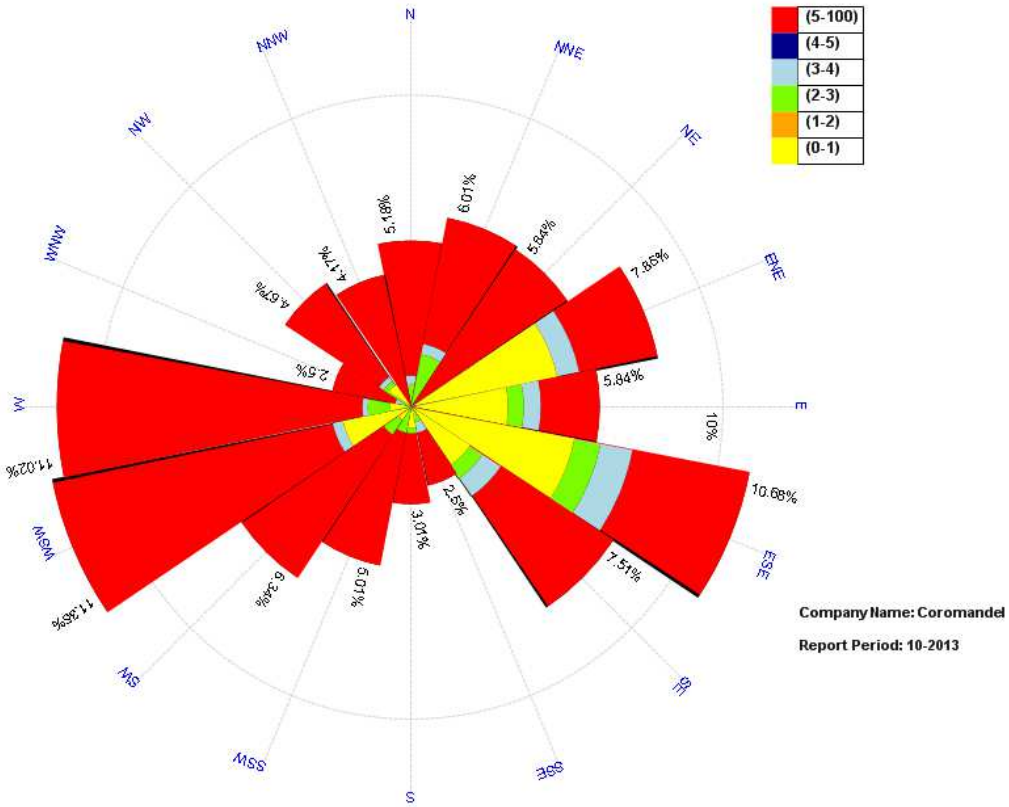


Annexure: 6.3

September'13

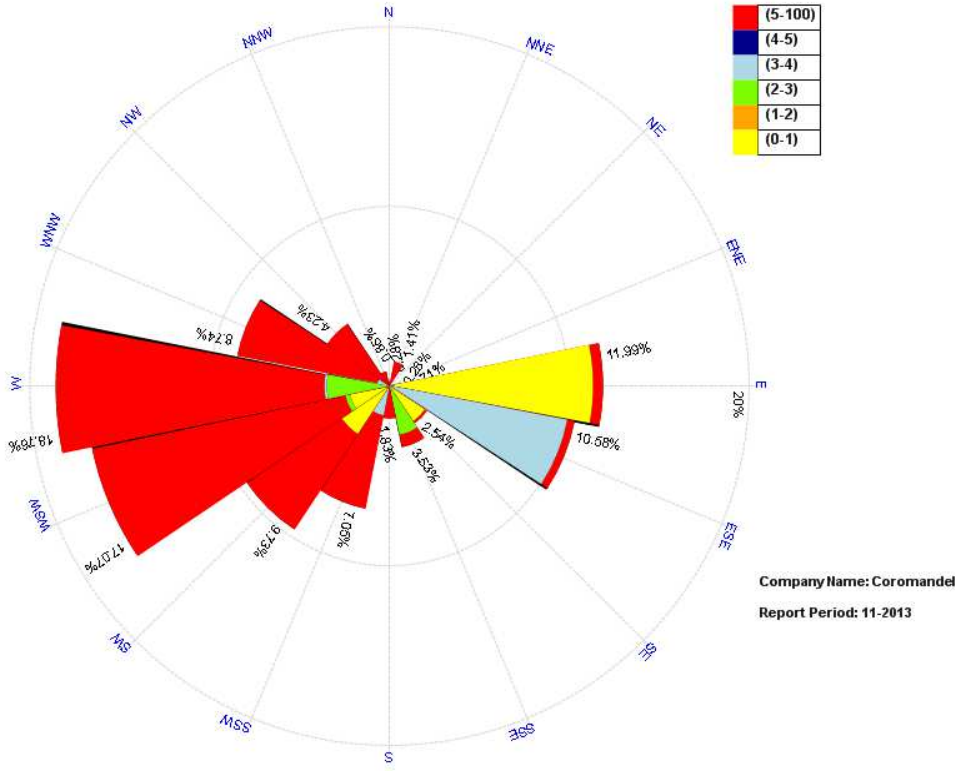


October'13



Annexure: 6.3

November'13



Annexure 6.4

Lines of Emergency Communications

(4 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 7
DATE OF ISSUE: NOVEMBER 2015

Lines of Communication

1. First responders i.e. Technician of the effected area or the concerned Shift Engineer/ Supervisor, would raise the alarm by ringing up the **Emergency Alarm Telephone "111"** or No.444 of the plant gate security office. He would give his name, location and brief details of the hazard and confirms that the message about the emergency was well received. In case the emergency phone "111" is not responding, the phone at plant gate security "444" is to be dialed and the emergency message is to be passed. Security person who receives the call intern passes the message to all the connected locations of emergency phones, by dialing * 1 of the emergency phone or by dialing P&T phone.
   In case of failure of the Emergency and P&T phones system use Walkie-talkie, Radio trunk system.

2. The call to the telephone No. 111 would be simultaneously received by the personnel at the following locations :

3.
   (a) Laboratory.
   (b) Utility & AAST Control rooms.
   (c) Plant gate security.
   (d) Telephone operator.
   (e) Fire Station.
   (f) Occupational health center (Ambulance room)

   Of the above 6 locations, whoever lifts the telephone first only will receive the emergency message. They intern should communicate the message to the other 6 places by dialing * 1 of the emergency phone and should inform by the speaker phone.

Communication to others not connected with emergency phone:

1. Laboratory:
   During shift hours / holidays and off days when telephone operator is not present, Chief Chemist / Shift Chemist would in turn communicate, about the emergency
   to all others as per priority mentioned in sheet 4 of 5 of this annexure.

2. Security Plant Gate:
   When the security person at plant gate receives the emergency message through emergency phone "111" he passes the same to other "**5 locations"** of emergency phone by **dialing * 1** of the emergency phone. If he receives the message by P&T phone "444" he passes the message to the above "**5 locations"** by **dialing * 1** of emergency phone or if it is not working through P&T phone.

   Inform duty Security Officer/ Chief Security Officer.

3. Telephone operator: (During general shift hours)

   If he receives the emergency message, he should inform the same to the other "**5 locations"** of the emergency phone by **dialing * 1** of the emergency phone. And after this he should inform the following about the hazard as per the priority as mentioned in the table at sheet 4 of 5 of this annexure.

   In case any plant telephones are found engaged or failure of the P&T system, the information should be passed through the nearby Walkie-talkie sets. A fixed Walkie-talkie set is installed in the office of the Manager – shift operations. Plant intercoms and P.A. systems can also be used for emergency communications within the plant.

4. Emergency Communication charts for normal office working hours as well as outside the office hours are given in the two following tables.

ON-SITE EMERGENCY COMMUNICATION - 1

FIRST RESPONDER

(Whoever first sees the emergency)

DIAL --- 111

(EMERGENCY PHONE NUMBER)

ALTERNATE PHONE NUMBER **444**

THE RING GOES TO THE FOLLOWING "SIX" PLACES WHERE THE EMERGENCY PHONES ARE LOCATED

- **FIRE STATION**
- **LABORATORY**
- **UTILITY & AAST**
- **SECURITY PLANT-GATE**
- **TELEPHONE OPERATOR**
- **AMBULANCE ROOM**

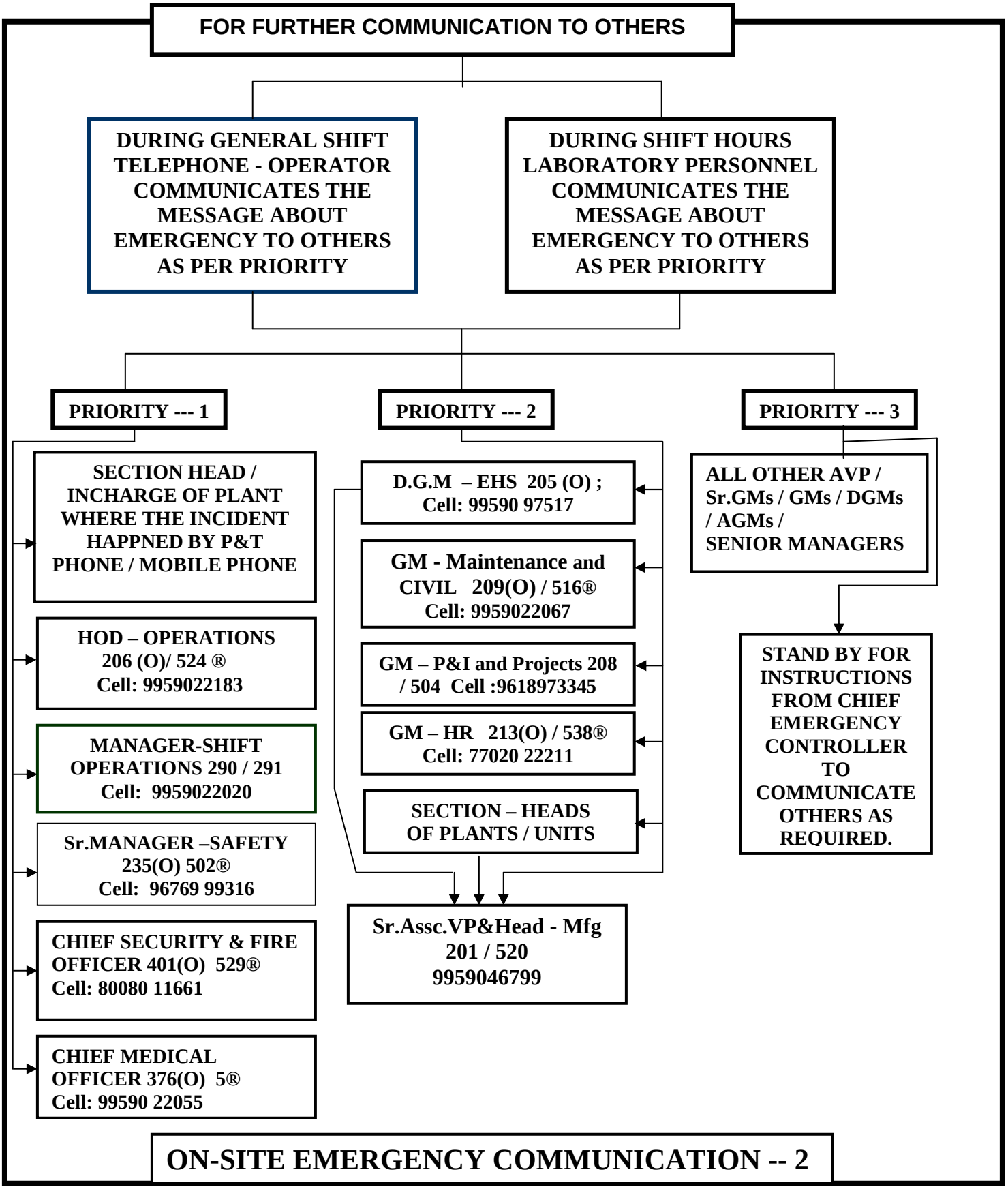
OF THESE, WHOEVER FIRST ANSWERS THE PHONE CAN ONLY HEAR THE MESSAGE. THEY, INTURN INFORMS THE OTHER "**FIVE**" BY DIALING *** 1** OF THE EMERGENCY PHONE.

FOR FURTHER COMMUNICATION TO OTHERS

DURING GENERAL SHIFT TELEPHONE - OPERATOR COMMUNICATES THE MESSAGE ABOUT EMERGENCY TO OTHERS AS PER PRIORITY

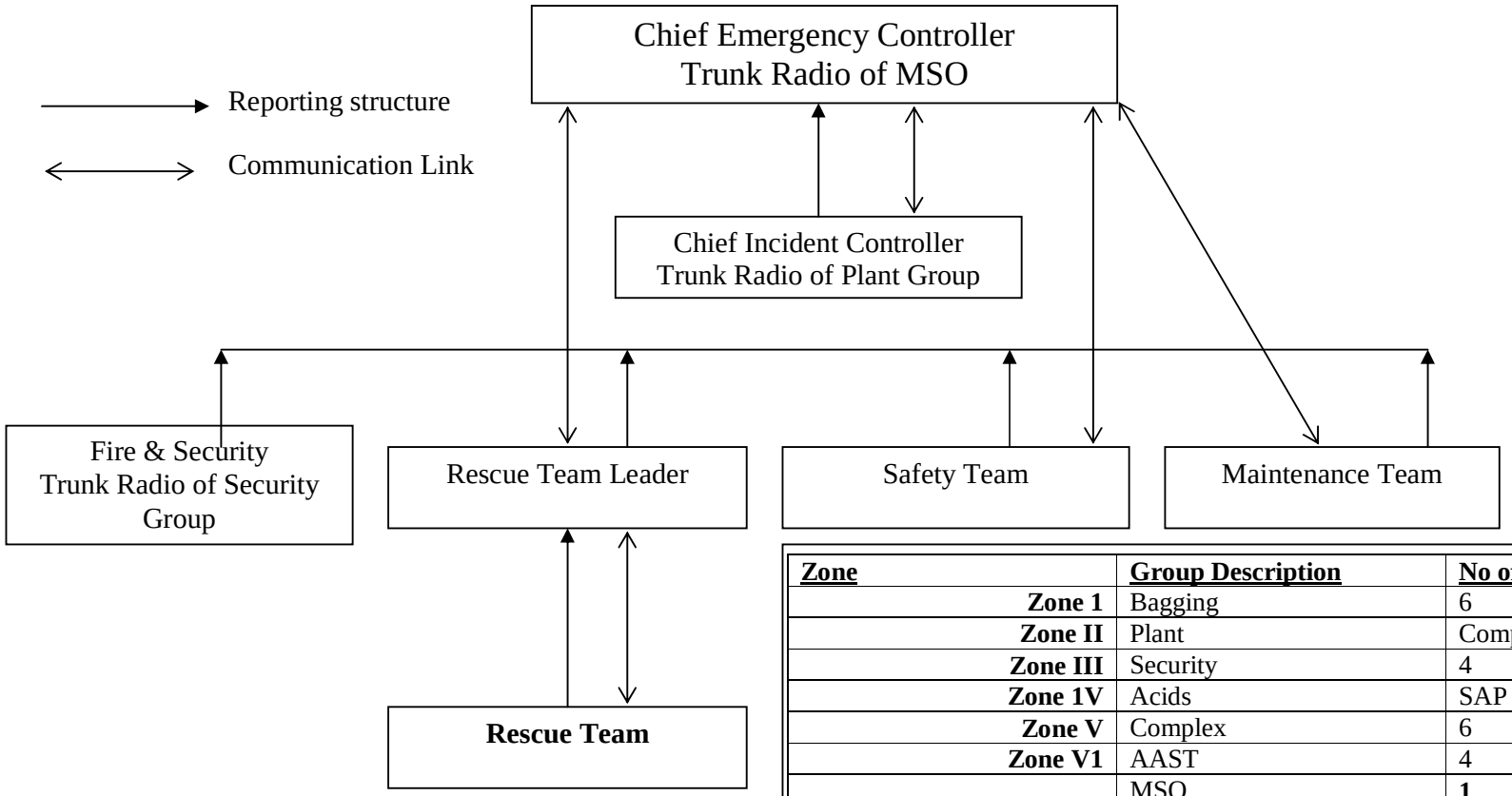
DURING SHIFT HOURS LABORATORY PERSONNEL COMMUNICATES THE MESSAGE ABOUT EMERGENCY TO OTHERS AS PER PRIORITY

COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
ANNEXURE 6.4	EMERGENCY COMMUNICATIONS	
DOC.No: E/SH/SF/WI/001	Rev. No.'8'	Effective date: 14.11.2015



COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
Annexure 6.4	**Emergency communication**	
Doc.No.E/SHE/SF/WI/001	Revn.No.'3'	Effective date: 14.11.2015

EMERGENCY CONTROL PLAN FOR REPORTING AND COMMUNICATION



Zone	Group Description	No of sets available
Zone 1	Bagging	6
Zone II	Plant	Complex 6 ;Wharf 2
Zone III	Security	4
Zone 1V	Acids	SAP 4 ; PAP 4 ; GFCL 2
Zone V	Complex	6
Zone V1	AAST	4
	MSO	**1**

NOTE:
ALL SETS SHOULD BE ON AND TUNED TO RESPECTIVE GROUP
OPEN COMMUNICATION IS DONE BY PRESSING THE " TALK BUTTON "
COMMUNICATION SHOULD BE ONLY IN PERSONAL CALL MODE DURING EMERGENCIES.

Note:
Regular CUG Mobile phones issued to Individual Functions are to be used in emergency purpose also. Auxillary communication can be done with the help of Truck Radios also

Annexure 6.5

Roles and Responsibilities of Key Personnel
(12 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 5

DATE OF ISSUE: NOVEMBER 2015

1.0 Structure of Emergency Management

Two groups shall function for mitigating and controlling of the emergency.

1.1 Emergency services group :-

This group operates from the emergency control center and Chief emergency Controller (CEC) is the leader of the group.

The following shall assume during the emergency as per their availability at the site.

1. UNIT HEAD
2. HOD – HR
3. HOD – P&I, Projects
4. HOD – Maintenance & Civil
5. HOD – SHE
6. HOD – Purchases
7. HOD – Finance
8. Shift Superintendent

The main responsibility of this group is:

1.1.1 To establish communication with the incident control group by means of Cell phones ; trunk phones, P&T phones, public address system etc and render expert advise to them if required.

1.1.2 To provide medical assistance in the ambulance room and to contact and arrange medical assistance at the near by other hospitals. To arrange for providing necessary welfare measures.

1.1.3 Arrange for transportation for shifting of the injured to outside hospitals. To ensure orderly evacuation of personnel /contract labor from other plants / units and colony area, if required.

1.1.4 To establish contact with out side agencies like District Crisis Group if the incident becomes Off-Site emergency. To provide details of emergency and taking assistance from the police, civil defense and other organizations.

1.1.5 To coordinate with outside agencies in evacuating public who are likely to get effected if the incident becomes Off-Site emergency.

1.2 <u>Incident control group</u> :-

This group operates in the field area where the incident has occurred depending on their availability.

HOD – Operations
HOD – Mainteance
HOD – Electrical, Power & Instrumentation
Section –Head (of the concerned plant where incident occurred.)
Sr. Manager – Safety
Manager – Environment
Chief Fire & Security Officer

HOD – Operations leads this group as Chief Incident Controller and supported by his team i.e. Plant DGM/AGM/ Senior Manager / Manager / Dy. Manager / Asst. Manager,

He is assisted by

1. HOD – Maintenance &Civil and his team i.e. AGM / Senior Manager / Manager / Dy. Manager - Maintenance area engineer / shift maintenance engineer.
2. HOD – Projects / Electrical / Instrumentation / Power generation and his team i.e Sr.Manager / Manager
3. Chief Security & Fire officer and Duty Security officer
4. Sr.Manager – Safety and his team – Duty Safety officer
5. Manager – Environment and his support team
6. Also assisting the group are fire fighting crew from Fire dept & Laboratory, Security personnel, Ambulance van and it's crew and the available rescue team members.
7. Maintenance technicians & electricians instrument technicians of the concerned plant as the situation requires.

<u>The main responsibilities of this group are</u>:

1.2.1 Declaration of the On-site emergency by advising the utility panel operator to blow the siren if the situation warrants so. Advising the utility plant personnel to increase the fire water header pressure.

1.2.2 Establishing contact with the emergency control group at emergency control center and act accordingly.

1.2.3 Attending on the incident preventing it from spreading to other areas and controlling it.

1.2.4 Evacuating unwanted personnel from the area and cordoning off the area from movement of vehicles and personnel other than those required.

1.2.5 Removing the injured to the medical center. To arrange for the rescue operations.

1.2.6 Provide necessary safety gear and to maintain the required stock near by incase of necessity.

1.2.7 Getting help from the neighboring industries under mutual aid scheme.

1.2.8 Declaring all-clear if the emergency is brought under control by advising the utility panel operator to blow the long siren.

1.2.9 To organize for the clean up of the contaminants / spills recovered or removed from the site of the incident.

1.2.10 To ensure replacement of used up safety equipment.

First Responders:

Any person (s), who notices the incident informs about the incident from the near by available phone by dialing "**EMERGENCY PHONE NO: 111" if the emergency phone is not responding, he alternately dials -- 444** (plant gate security). Or (if available) he communicates the message through walkie talkie to the control room from where the message is communicated through **"111"** After receiving response he shall:

- Identify himself – giving his Name, Emp. No. & Plant \ unit where he his working.
- Inform the nature of the incident i.e., whether toxic gas leak / Fire or any other major incident that is likely to cause considerable damage to property, human life, & work environment.
- Exact location of the incident.
- Repeat the message for more clarity.
- He should confirm that the message has been received properly, by questioning the receiver whether he has clearly understood the message or not.

The emergency phone is located at 6 places 1. Fire station. 2. Laboratory. 3. Security plant gate. 4. Utility & AAST. 5. Telephone operator. 6. Ambulance room.

When the No – 111 is dialed all the 6 phones at the above locations will ring. Of the 6, who ever first answer the phone can only hear the message. He is responsible for the further communication. He should inform other 5 locations, by dialing *1 of the emergency phone.

Declaration of Emergency:

After getting the information, the Chief Incident Controller (HOD-operations) will reach the place of incident as soon as possible and after assessing the situation, if required, he declares an emergency by authorizing the Utilities Technician to sound the plant siren. Prior to the arrival of the Chief Incident Controller (HOD-operations), if so warranted, the Section – Head of the Plant, Manager shift operations are also authorized to declare an emergency based on their own assessment of the situation. If none of the above mentioned persons are available and if the situation so warrants, the shift in charge of the plant where the incident occurred is also authorized, to declare an emergency based on his own assessment of the situation.

R3

Alerting of personnel at administrative building and at other places of work:

As it is possible that some of the plant \ units personnel may not be aware of the emergency due to inaudibility of the emergency siren because of the changing wind directions and plant sounds. Chief emergency controller shall entrust one of the assisting team members to check (if not inform) all the units \ plants whether they are aware of the emergency.

Chief emergency controller will also decide whether to alert the personnel at administrative block. If he so decides to alert them, he will initiate sounding of siren provided in the administrative building, for which, the switch is provided at the Emergency control center (central control room.). As per the information available from the incident site and assessing the wind direction and consequences Chief emergency controller will decide whether to evacuate people working at other areas or not. If it is required to do so, he advises the emergency group team member to inform the same to the unit heads of the concerned plants.

Emergency Operations:

As a general rule, Plant Persons of the effected area are responsible for the emergency operations. They will be supported by the Manager-shift operations or the concerned Plant Manager, the Fire Tender/ Fire crew, Laboratory technicians strengthened as required by personnel from Complex, Bagging and the Maintenance group, under instructions from the Chief Incident Controller.

No one else should go to the scene of emergency automatically.

The Manager (shift operations) will be in charge of the emergency operations until the arrival of the concerned Plant Manager. On his arrival, the HOD - Operations will take overall charge of the emergency operations.

Emergency Coordination:

Chief Emergency Controller has many roles to play once he arrives at the central control room and takes charge of the Emergency Control. He will oversee and coordinate the activities of (i) the Incident Control Group and (ii) the Emergency Control Group.
Incident control group lead by the HOD – Operations will coordinate all activities required for effective containment of the hazard and if required resort to safe shut down of the affected sections/ units.

Communication Team which is closely linked to the Chief Emergency Controller will have the HOD - SHE for communications with all statutory authorities and HOD –HR, who will communicate as necessary with the Public, Press and relatives of the injured Employees.

Advisory Team, which will render advisory services to the Chief Emergency Controller, consists of the General Manager, all DGMs and Sr. Managers not directly involved in the Emergency Organisation and the In charge -Environment.

All Clear :- After the Emergency has been brought under control, Chief incident Controller will authorize Utilities unit to give an "All Clear Signal". Manager shift operations and Section – Head of the plant are also authorized to give "All clear signal". He also communicates about all clear to the emergency control center. If an Off-site Emergency had earlier been declared, Chief emergency controller communicates about the all clear to the external authorities like the district crisis group.

2.0 Roles and Responsibilities of Key Personnel

2.1 First Responder: (Plant Operator / Technician or whoever first observes the incident)

2.1.1 Initiates action to control emergency
2.1.2 Reports emergency to the Shift- in – charge
2.1.3 Reports emergency by dialing emergency phone "111" or by dialing "444" in case the emergency phone is not responding, or informs about the emergency to his control room by walkie –talkie, if the P&T phone is not near by, for onward communication through emergency phone.

2.2 Shift-in-charge (Of the area/plant where the incident occurred):

2.2.1 Raises alarm by dialing the emergency telephone No.111 or 444 if the first responder has not already dialed it.

2.2.2 Takes necessary action to handle the emergency.

2.2.3 Informs Manager- Shift operations and Plant Manager.

2.2.4 Informs other plants/ units likely to be effected by the emergency.

2.2.5 Stops plant or section as necessary to control the hazard**.**

R3

2.2.6 Authorized to declares emergency when Chief incident controller is not available at the site of incident.

2.3 Telephone operator:

2.3.1 On receiving the emergency phone call, communicates the information to all concerned as per the Emergency Communication chart and as per the priority.

2.3.2 Give priority to in-coming and out-going calls pertaining to the Emergency.

2.4 Security Guard – Plant Gate:

2.4.1 Informs the duty security officer and chief security officer immediately on receiving the emergency phone call.

2.4.2 Stays at post and awaits further instructions.

2.5 Shift Chemist/ Chief Chemist:

2.5.1 On receiving the emergency phone call send all Lab Techs and the sample collection Jeep to scene of emergency, to assist unit shift-in-charge in fighting the emergency.

2.5.2 Contact Manager-shift operations and inform about the emergency.

2.5.3 Informs about the emergency to the key personnel as listed in the Emergency Communication chart as per priority during shift hours when the telephone operator is not present.

2.6 Manager-shift operations:

2.6.1 Immediately on receiving information, proceeds to the scene of emergency and assess the situation.

2.6.2 Assumes the role of incident Controller, till HOD – Operations / delegate arrives on the scene. He shall co-ordinate with Officer in-charge of Fire , Security Officer, Safety Officer, Ambulance Room Assistants, Maint. Shift Supervisor etc to handle the emergency and to mobilize more emergency combat equipment, to provide first aid, to evacuate of people if necessary, including contract labor and all other related functions. Upon the arrival of the Chief Incident Controller, post him with the developing situation and assist him as directed

2.6.3 Take necessary steps to handle the emergency and authorizes stoppage of plants/ section if necessary to contain the hazard

2.7 Section – Head -- (Of the area/plant where the incident occurred):

2.7.1 On arrival at site, takes control of all emergency operation within his area and ensure that all systems effected or likely to be effected are safely isolated or shut down, if not already done by the Shift Engineer.

2.7.2 Declares On site emergency by authorizing ACT panel operator to sound the emergency siren, if not already not done by Manager shift operations or Chief incident controller (HOD – ops) or in their absence.

2.7.3 In emergencies involving more than one operating area, carries out instructions of DGM (operations)

2.7.4 Coordinate the efforts of operating and maintenance personnel to contain or eliminate the hazard.

2.7.5 Order stoppage of all work permits.

2.7.6 Ensure adequate availability of safety and fire fighting equipment. Supplement as necessary with the help of Safety officers.

2.7.7 Account for all staff in his area and coordinate with safety & security officers to ensure all trapped person in the effected area are rescued and brought to safety.

2.8 Section – Head / Shift In charge – Utilities:

2.8.1 Ensures adequate supply of Utilities like Fire/ Process / BF waters, Steam, Plant Air / Inst Air and other utilities required for emergency operations.

2.8.2 Establish communication with OSBL operators if they are in the field during the emergency and ensure that they are equipped with necessary safety gear for personal safety and walkie talkie for proper communication

2.8.3 Coordinate with Shift Engineer-Electrical for electrical isolation of equipment in effected plants as may be required for emergency operations.

2.9 <u>Chief Emergency Controller</u> (CEC): Unit Head / Delegate as mentioned at 1.1 above)

2.9.1 Takes command as Chief Emergency Controller and if the situation so requires, monitors and control all emergency functions from Emergency Control Center –1 or emergency control center – 2 depending on the wind direction.

2.9.2 Ensures that various groups/ teams as envisaged in the On-site Emergency Plan are functioning and ensures proper coordination between them including the Emergency Operations and Emergency Services Groups

2.9.3 Ensures that all persons, company employees and others, in the Factory are accounted for and order initiation of rescue operations.

2.9.4 Based on assessment of the risk, declare evacuation and advise escape routes and the assembly points to be reached, which will be determined based on the prevailing wind direction.

2.9.5 Handles all communications with higher Management, Press & Public in coordination with HOD – HR.

2.9.6 If the hazard is likely to go beyond Factory boundary limits, he will contact the Off-site Emergency Coordinator (the District Collector) and communicates with all other Statutory Agencies involved in the Off-site Emergency Plan.

2.10 <u>Chief incident Controller:</u> (HOD-operations / Delegate as mentioned at 1.2 above)

2.10.1 Assess the situation and declares On-site Emergency as required, if not already declared by Manager-shift operations.

2.10.2 Takes overall control of the emergency operations in the plant and coordinates the activities of the Managers of all operating units, the Maintenance services, Sr.Manger-Safety and Shift security & Fire Officer

2.10.3 For emergencies confined to one particular operating unit, advises the concerned unit Manger on controlling the emergency

2.10.4 Instructs operating units/ sections to be shut down or tripped based on assessment of the hazard

2.10.5 Instructs Maintenance personnel to attend to emergency repairs or replacements if any required for arresting the leaks etc.

2.10.6 Coordinates with Safety and Fire fighting crew in providing Safety and Fire Fighting equipment to the plant personnel engaged in emergency operations and arranges for safety equipment to be made available to the operating and maintenance personnel

2.10.7 Coordinates with the Emergency Services Group for safe rescue and safe evacuation of personnel from effected areas

2.10.8 Ensures that the handling of emergency is going on safely and gets in touch with Chief Emergency Coordinator to review progress.

R3

2.10.9 HOD – Ops shall also acts as Chief incident Controller in case of necessity as mentioned at 1.1 above, in such case one of the delegates mentioned at 1.2 above shall takes the responsibility of Chief incident controller.

2.11 HOD- (HR)

2.11.1 Gets in touch with the Chief Emergency Controller to assess the magnitude of the emergency and review the service requirements

2.11.2 Coordinates the activities of Teams involved in First Aid/ Medical services, Rescue, Evacuation/ transportation, Security/ Traffic control and Welfare supplies, as required by Emergency Operations Group

2.11.3 Instructs Dy. Manager-Garage to arrange for emergency transportation required for evacuation of personnel and additional requirements of Ambulance services if any

2.11.4 Instructs Chief Medical Officer regarding first aid & treatment, requirement of medical help from outside agencies

2.11.5 Gets in touch with Chief Emergency Controller for review of progress.

2.11.6 Acts as Chief incident Controller in case of necessity as mentioned at 1.1 above.

2.11.7 Communicates as necessary with public, press / media, and relatives of the injured employee(s).

2.12 HOD (SHE) :-

2.12.1 Ensures that the Manager-Safety, Sr.Manager – Environment , Shift security & Fire Officer and the Chief Medical Officer report to Emergency Operations and Emergency Services Groups as per the on-site organisation chart to provide assistance as required

2.12.2 Joins the Advisory Team to advise and assist the Chief Emergency Coordinator in discharge of his functions and matters relating to Safety and Environmental impact

2.12.3 Communicates with Statutory Authorities as directed by CEC

2.12.4 Instructs In-Charge of Environment department to advise possible environmental effects and remedial measures if any.

2.13 Safety Officers:

2.13.1 Assists the Emergency Operations Group in fighting the emergency

2.13.2 Provide adequate personnel protective and safety equipment to the personnel involved in handling the emergency, from other areas if needed and replace used canisters, masks etc

2.13.3 Will invalidate all safety permits in the effected and surrounding areas

2.13.4 Will ensure that preventive safety measures are initiated in neighbouring areas which are likely to get effected by the situation in the effected area

2.13.5 Will control Ambulance and other vehicles for transporting the injured for First Aid in Ambulance Room.

2.14 Area Maintenance Engineers/ Electrical & Inst Engineers:

2.14.1 Reach the scene of emergency and report to the Chief incident controller for any assistance in handling the emergency

2.14.2 Mobilize concerned Technicians as required by the incident control group for handling the emergency

2.15 Chief Security & Fire Officer:

2.15.1 Reach the scene of emergency and report to the Chief Incident Controller for any assistance in handling the emergency, immediately on receiving information from security guard at plant gate.

2.15.2 Control by-standers not involved in the emergency control operations

2.15.3 Ensure that the security at the entry gates is controlled to keep out all persons other than Coromandel employees.

2.15.4 Allow the Fire brigades and others coming from outside to help emergency and rescue operations inside and guide them to the required location as advised by the Chief Emergency controller

2.15.5 Send as many security guards as possible to the site of emergency after taking care of the assigned responsibilities.

2.15.6 Get information on number of employees/persons working in the plant including contract workmen and account for visitors inside the plant and report the number to Chief Emergency Controller at Emergency Control Center.

R3

2.15.7 Co ordinates and advises the fire fighting team in combating the incident.

2.16 Chief Medical Officer:

2.16.1 Will render necessary treatment at the First Aid center.

2.16.2 Arrange for hospitalisation and treatment at outside hospitals/ nursing homes as necessary

2.16.3 Mobilise extra medical help as necessary

2.16.4 Keep adequate supply of medicines to treat plant related emergencies

2.17 Dy.Manager – HR & Admin (Welfare Officer) :

2.17.1 Assists Chief Medical Officers with first aid to the injured and arrange further medical supplies required by him

2.17.2 Arrange and ensure availability of welfare supplies including food and beverages for all those involved in the emergency

2.18 HOD - Maintenance:

2.18.1 Report to the Chief Emergency controller at emergency control center.

2.18.2 Arranges for the maintenance requirements if any at the site of incident.

2.18.3 Mobilises all required transport vehicles for emergency evacuation of the trapped person in the effected area.

2.18.4 Engages additional vehicles to take care of the emergency requirements as indicated by the Chief Emergency controller.

2.18.5 Acts as Chief Emergency Controller in case of necessity as mentioned at 1.1 above.

2.19 HOD –Acid group:

2.19.1 Report to Chief Emergency Controller for rendering any necessary help / advise.

2.19.2 Acts as Chief Emergency Controller / Chief incident controller in case of necessity as mentioned at 1.1 / 1.2 above.

2.20 In charge -Stores:

2.20.1 Keep the warehouse open and standby at the telephone at the warehouse, ready to issue any emergency safety and fire fighting equipment supplies.

2.21 All other persons not involved in emergency control operations:

2.21.1 All Managers, Senior Managers & DGMs not given any specific role should report to the Chief Emergency Controller for consultations and rendering any advice concerning the Emergency Control. All Managers, Dy. Managers of the other plants / sections (other than the plant / unit where the emergency occurred) should be present at their respective plants / sections and wait for any instructions from the emergency control center and to act accordingly.

2.21.2 All the other employees like the Technicians from other operating units/ areas (except Bagging and Complex), office staff, General labor force, Distribution staff and contract employees including the Cafeteria staff, may stay at their places of work, till they obtain necessary instructions to proceed to the designated Assembly Points. The assembly points will be selected based on the prevailing wind direction at the time of the incident.

2.22 Rescue team:

2.22.1 Rescue team members those are available in the shift should report at the place of incident and the rescue team co ordinator should report to the Chief incident controller for further action as directed by the Chief incident controller.

EMERGENCY RESPONSE PLAN

EMERGENCY CONTROLLERS:

Chief emergency controller: Unit – Head

Chief incident controller: Head-Operations. (During shifts/holidays MSO/Plant In-Charge till Head - Operations arrives on site)

Control centers : Main control center - Shift Superintendent room.

: Alternate Main control center- Garage area

Assembly points:

1) Main Plant Gate
2) Other assembly points are: i) Contract workman entry gate. ii). Dock road entry gate No.5 iii) Gypsum pond entry gate no.4 iv) Wharf Engineers room opposite V) At Wharf new Silo area – 8th security gate

ASSEMBLY points are to be selected based on the wind direction.

SIREN: Declaration authority-- shift in-charge as per the availability. Siren will be activated immediately receiving the emergency message. Phone communication also will be simultaneously carried out.

SIREN CODE: a) ONE MINUTE WAILING SOUND (On and OFF) for on- site emergency declaration.

b) ONE AND HALF MINUTE CONTINUOUS SIREN for "All clear signal".

EMERGENCY COMMUNICATION:

Emergency phone no: 111 If it is not responding dial 444 or communicate thru walkie- talkie.

Emergency phone located at 6 places.

1) Fire station, 2) Laboratory 3) Security plant gate, 4) Utility & AAST 5) Telephone operator, 6) Ambulance room.

Of the above 6 locations, who ever lifts the phone first only will receive the emergency message who in turn should communicate the emergency message to the other 5 places by dialing *1 of the emergency phone and should inform by the speakerphone.

<u>Chief Emergency Controller</u> (CEC): Unit Head / Delegate

1. On receiving the telephonic message/ hearing siren he will rush immediately to the Emergency Control Centre-1 – or 2, depending on the wind direction.
2. Takes command as Chief Emergency Controller and start emergency functions from Emergency Control Center.
3. Directing Emergency Control Group comprising of HOD-HR ; HOD-SHE ; HOD-Purchase ; HOD- Finance ; HOD – Maintenance ; HOD- Power & Instrument
4. Communicating with Chief Incident Controller and enquiring about the seriousness of the emergency situation, control measures taken, condition of the victims affected, availability of ambulance services, concentration of toxic gases etc., any requirement of nearby industries' fire tender to assist our emergency crew and availability of protective equipment etc.
5. Advising HOD - H.R on declaration of evacuation and if required, providing guidance on making necessary arrangements for bringing people to the assembly points and for arrangement of vehicles and on provision of emergency medical help through contacting nearby hospitals and nursing homes.
6. Advising HOD – HR on handling Press & Public as required
7. Consulting HOD- SHE regarding calling of help from District Crisis Group under mutual aid agreement from nearby industries for controlling the emergency situation and for liaison with factory inspectorate and Pollution control board.
8. Seeking assistance from HOD – Purchase for emergency procurement of materials
9. Seeking assistance from HOD - Finance for arranging money for any emergency equipment procurement.
10. If the emergency is likely to spread beyond the Factory premises, advises HOD-SHE to contact the Off-site Emergency Coordinator (The District Collector & Chairman of the District Crisis Group) and communicates with all other Statutory Agencies involved in the Off-site Emergency Plan.

Chief incident Controller: (HOD-operations / Delegate)

1) On hearing the siren / receiving the telephonic message, he will rush to the emergency control centre and reports to the chief emergency controller. After consulting him about handling emergency, he will proceed to the plant where emergency occurred.
2) Establishing communication with Chief emergency Controller and Takes overall control of the emergency operations in the plant and co-ordinates the activities of the Managers of all operating units, the Maintenance services, Manger-Safety and Chief Fire Officer.
3) Instructs operating units / sections to be shut down or tripped based on assessment of the hazard.
4) Instructs Maintenance personnel to attend to emergency repairs or replacements if any required for arresting the leaks etc.
5) Coordinates with Safety and Fire fighting crew in providing Safety and Fire Fighting equipment to the plant personnel engaged in emergency operations and arranges for safety equipment to be made available to the operating and maintenance personnel.
6) Instructs Chief security officer on barricading the area to prevent entry of people into the incident area.
7) Co-ordinates with ambulance and rescue group to move the affected victims for / to immediate medical help / Occupational health center.
8) Appraising the emergency action in the incident area to the Chief emergency controller in controlling the emergency situation.
9) Directing for safe rescue and safe evacuation of personnel from effected areas
10) Ensures that the handling of emergency is going on safely and gets in touch with Chief Emergency Controller to review progress from time to time.
11) Ensuring the emergency situation is fully controlled and the area free from any emergency such as gas leak or fire.
12) Obtaining clearance from Chief emergency controller for all clear signal

Shift-in-charge (Of the area/plant where the incident occurred):

1) Inform to AAST to raise emergency siren and also dialing the emergency telephone No.111 or 444 if the first responder has not already dialed it.

2) Informs. Manager- shift operations and Plant Manager

3) Takes necessary action to handle the emergency till the plant Manager arrives.

4) Co-ordinate with maintenance crew and safety crew in controlling the emergency.

5) Communicating with CEC and appraising of the situation till plant manager arrives.

6) Informs other plants/ units likely to be affected by the emergency.

7) Stops plant or section as necessary to control the hazard

Shift In charge – AAST

1) After getting to know about the emergency situation in the plant, declares Emergency by blowing the Emergency Siren from AAST.

2) Ensures adequate supply of Utilities like Fire/ Process / BF waters, Steam, Plant Air / Inst Air and other utilities required for emergency operations.

3) Establish communication with OSBL operators if they are in the field during the emergency and ensure that they are equipped with necessary safety gadgets and personal safety and walky-talky for proper communication

Manager-shift operations:

1) On hearing the emergency siren/ telephonic message he will rush to the emergency control centre.

2) Immediately on receiving information, he will pass on the message to Unit – Head, HOD –Operations, HOD- SHE, and HOD – HR & Admin.

3) Coordinating and communicating with emergency services group and emergency controlling group, till chief emergency controller arrives to the emergency control centre.

4) On assuming charge by the Chief Emergency Controller (CEC), based on CEC's instructions, he will proceed accordingly.

HOD- (HR)

1) On hearing the emergency siren, telephonic message he will proceed to the emergency control centre and for assisting the Chief Emergency Controller to assess the magnitude of the emergency and review the service requirements .

2) Coordinates the activities of Teams involved in First Aid/ Medical services, Rescue, Evacuation/ transportation, Security/ Traffic control and Welfare supplies, as required by Emergency Operations Group

3) Assisting CEC by directing Security officer /HR Manager to arrange for emergency transportation required for evacuation of personnel and additional requirements of Ambulance services, if any.

4) Assisting CEC by directing Chief Medical Officer regarding first aid & treatment, requirement of medical help from outside agencies.

5) Communicates as necessary with public, press / media, and relatives of the injured employee(s).

HOD (SHE):

1) On hearing the emergency siren /telephonic message he will rush to the emergency control centre and assists Chief Emergency Controller.

2) Ensures that the Manager-Safety, Senior Fire Officer and the Chief Medical Officer report to Emergency Operations and Emergency Services Groups as per the on-site organization chart to provide assistance as required.

3) Joins the Advisory Team to advise and assist the Chief Emergency Co-Ordinator in discharge of his functions and matters relating to safety and environmental impact.

4) Communicates with Statutory Authorities as directed by CEC.

5) Communicating with Manager – Safety regarding control measures taken, first aid services, concentration level of ammonia in the area, and availability of protective equipment.

6) Instructs Manager - Environment to advise possible environmental effects and remedial measures, if any.

Sr.Manager-Safety:

1) On hearing the emergency siren/telephonic message he will rush to the emergency control centre and inform the Chief Emergency Controller and then proceed to incident site.

2) Assists the Emergency Operations Group (Incident Controller) in fighting the emergency

3) Provide adequate personnel protective and safety equipment to the personnel involved in handling the emergency, from other areas if needed and replace used canisters, masks etc.

4) Will invalidate all safety permits in the effected and surrounding areas

5) Will ensure that preventive safety measures are initiated in neighboring areas which are likely to get affected by the situation in the effected area.

6) Will coordinate Ambulance and other vehicles for transporting the injured for First Aid in Occupational health center.

Area Maintenance Engineers/ Electrical & Inst Engineers:

1) On hearing the emergency siren/telephonic message confirm the area of the incident with utilities/AAST and reach the scene of emergency and report to the Chief incident controller for any assistance in handling the emergency.

2) Mobilize concerned Technicians as required by the incident control group for handling the emergency

Chief Security Officer / Chief Fire Officer:

1) On hearing the emergency siren/telephonic message reach the scene of emergency along with fire tender and report to the Chief Incident Controller for any assistance in handling the emergency and start controlling operation.

2) He will direct security staff in providing barricades surrounding the affected area so that entry of unauthorized persons is restricted.

3) He will direct the security staff at the entry gates to keep out all persons other than Coromandel employees.

4) Allow the Fire brigades and others coming from outside to help emergency and rescue operations inside and guide them to the required location as advised by the Chief Emergency controller.

5) Sending as many Fire and Security guards as possible to the site of emergency after taking care of the assigned responsibilities.

6) Get information on head count of number of employees/persons working in the plant including contract workmen and account for visitors inside the plant and report the number to HOD- HR at Emergency Control Center.

7) Co-ordinates and advises the fire-fighting team in combating the incident.

8) He will direct staff at security gate also to blow siren to enable administrative building staff and bagging plant staff to know about the emergency.

Chief Medical Officer:

1) Will render necessary treatment at the First Aid center.
2) Arrange for hospitalization and treatment at outside hospitals/ nursing homes as necessary
3) Mobilize extra medical help as necessary
4) Keep adequate supply of medicines to treat plant related emergencies.
5) Co-ordinates moving of affected victims out of the site to occupational health center, and further, to outside hospitals if necessary along with rescue group.

Welfare Officer:

1) Assists Chief Medical Officer with first aid to the injured and arrange further medical supplies required by him.

2) Arrange and ensure availability of welfare supplies including food and beverages for all those involved in the emergency

3) Arranging vehicles for rescue operation

HOD - Maintenance:

1) On hearing the emergency siren /telephonic message, report to the Chief Emergency controller at emergency control center.

2) Arranges for the maintenance requirements if any at the site of incident.

3) Mobilizes all required transport vehicles for emergency evacuation of the trapped person in the effected area.

4) Arranging cranes for rescue operation.

5) Coordinating with ware house Manager for arranging maintenance equipment.

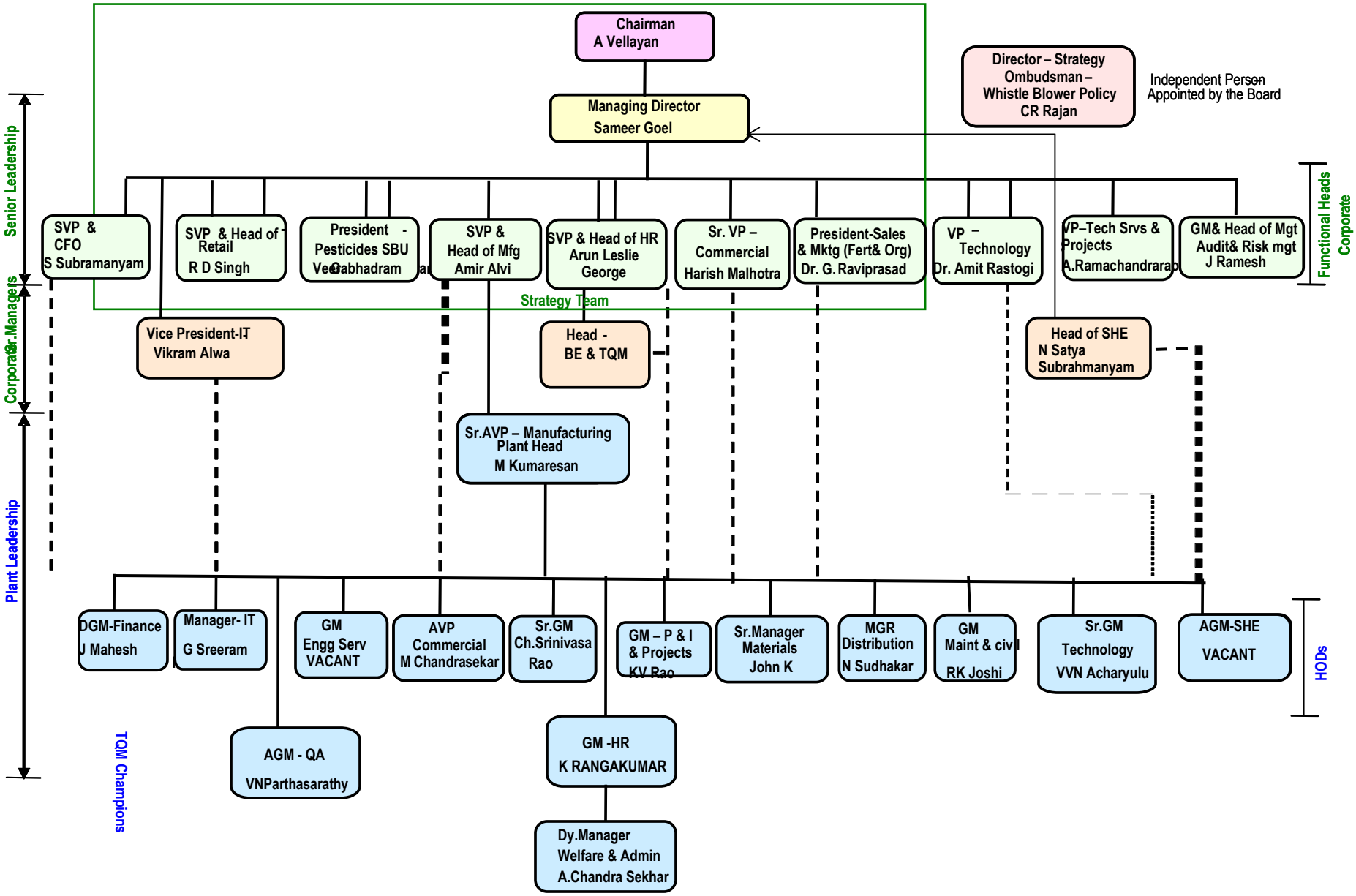
In charge -Stores:

On hearing the emergency siren/telephonic message he will proceed to the warehouse and keep the warehouse open and standby at the telephone at the warehouse, ready to issue any emergency safety Maintenance and fire fighting equipment supplies

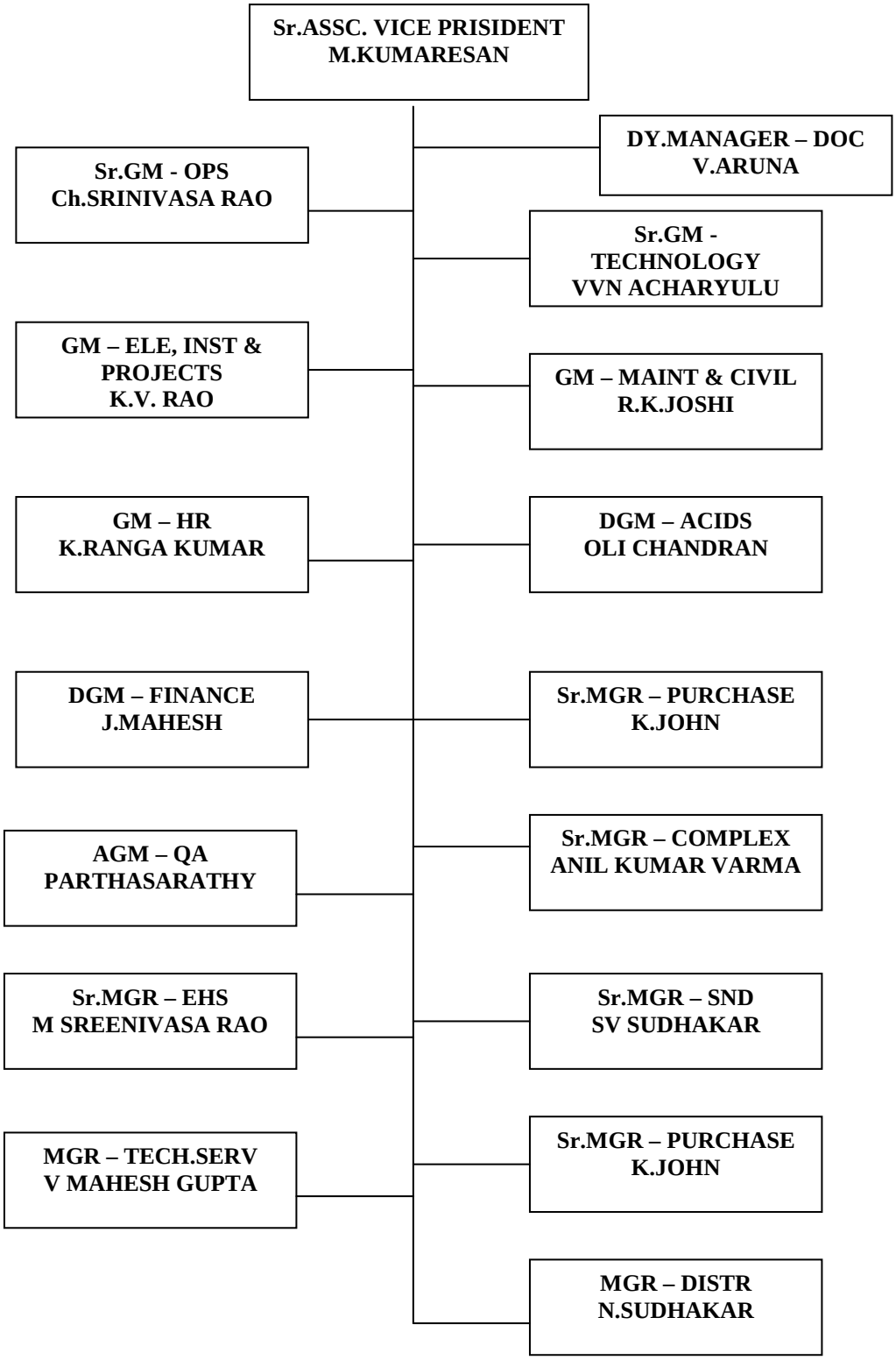
DGM–(Operations)

On hearing the emergency siren /telephonic message Report to Chief Emergency Controller for rendering any necessary help

ORGANISATION CHART- COROMANDEL



ORG.CHART – VISAK UNIT



EMERGENCY CONTROL GROUP WORKS FROM
EMERGENCY CONTROL ROOM – 1
OR
EMERGENCY CONTROL ROOM – 2
(LOCATED AT GARAGE)

GROUP LED BY UNIT HEAD / DESIGNATE AS
"THE CHIEF EMERGENCY CONTROLLER"

IN THE ABSENCE OF ABOVE AND DURING SHIFTS, MSO - TAKES RESPONSIBILITY, UNTILL THE ARRIVAL OF THE ABOVE PERSONS.

THE GROUP IS ASSISTED BY :

- HOD'S & INCHARGES OF –
  - HR
  - SHE
  - MAINTENANCE
  - POWER & INSTRUMENTATION
  - Finance
  - Purchases

INCIDENT CONTROL GROUP WORKS FROM
THE FIELD

THE AREA OF EMERGENCY

GROUP LEAD BY HOD – OPERATIONS / PLANT / UNIT - INCHARGE
AS
"THE CHIEF INCIDENT CONTROLLER"

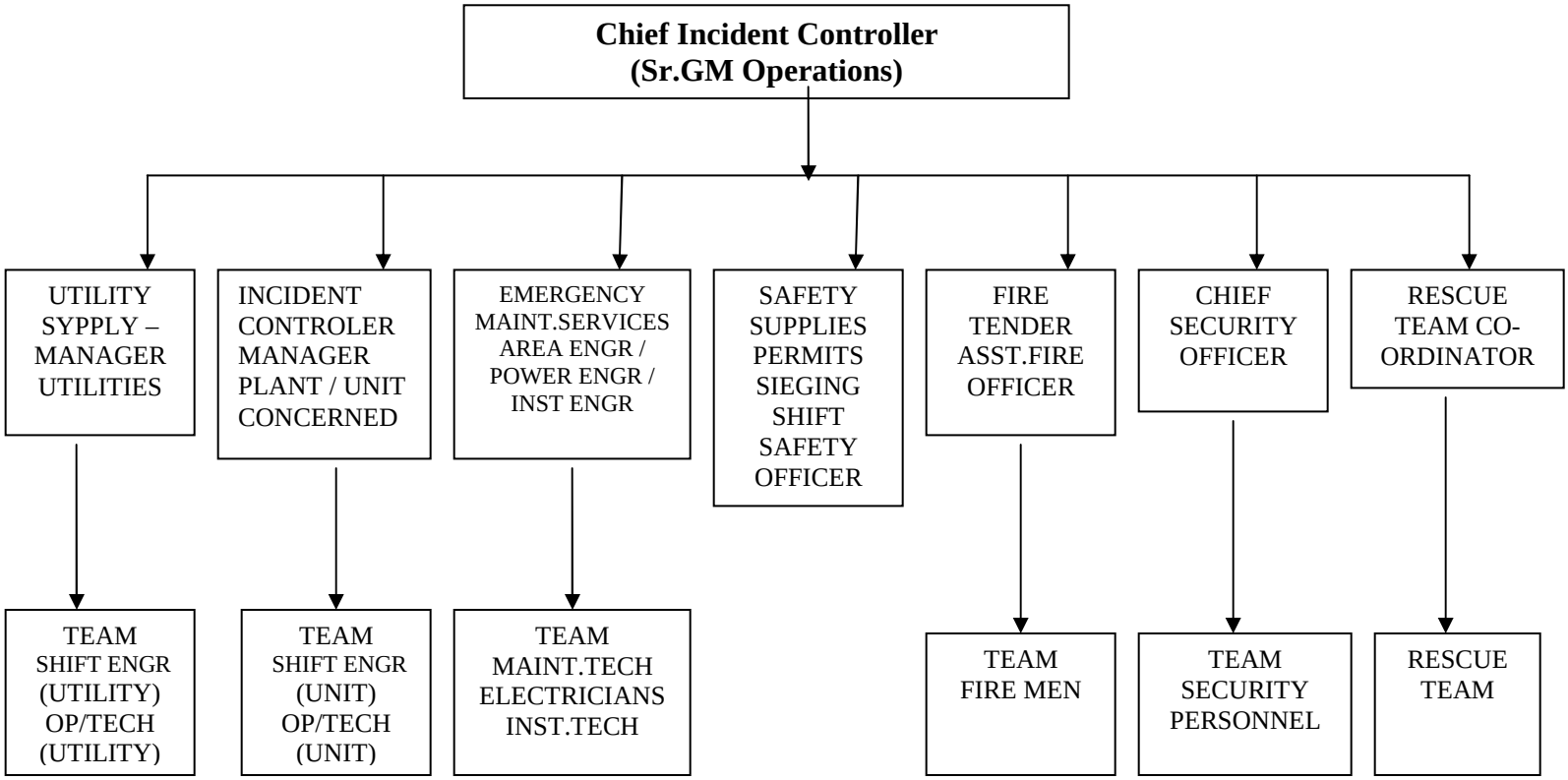
IN THE ABSENCE OF ABOVE AND DURING SHIFTS, MSO - TAKES RESPONSIBILITY, UNTIL THE ARRIVAL OF THE ABOVE PERSONS (WHEN HE HAS NOT TAKEN CHARGE AS "THE CHIEF EMERGENCY CONTROLLER")

THIS GROUP IS ASSISTED BY :

- PLANT / UNIT – INCHARGE &
- THE PLANT / UNIT STAFF
- INCHARGE OF FIRE DEPT &
- THE FIRE OFFICER & CREW
- MAINTENANCE AREA ENGINEER &
- MAINTENANCE TECHNICIANS OF THE UNIT
- SAFETY OFFICER
- RESCUE TEAM
- ANY OTHER ASSIGNED TEAM FOR MITIGATING THE EMERGENCY
- ANY OTHER MUTUAL AID FROM OTHER INDUSTRIES AS REQUESTED

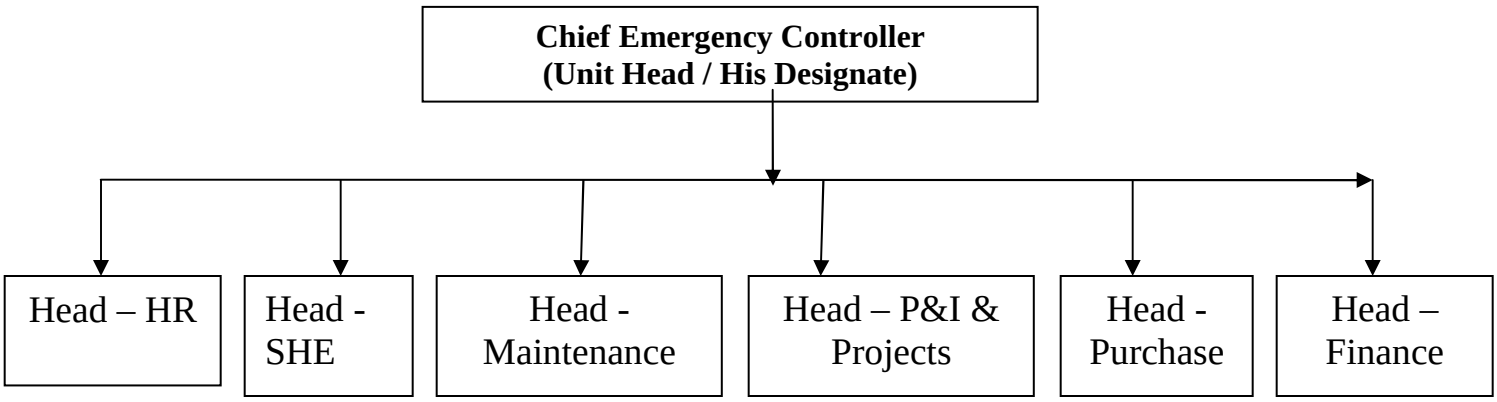
COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
ANNEXURE: 6.6	**Coromandel ORGANISATION CHART sheet 3 of 5**	
DOC.No: E/SH/SF/WI/001	Rev. No.'3'	Effective date: 14.11.2015

EMERGENCY TEAM ON FIELD



EMERGENCY OPERATIONS

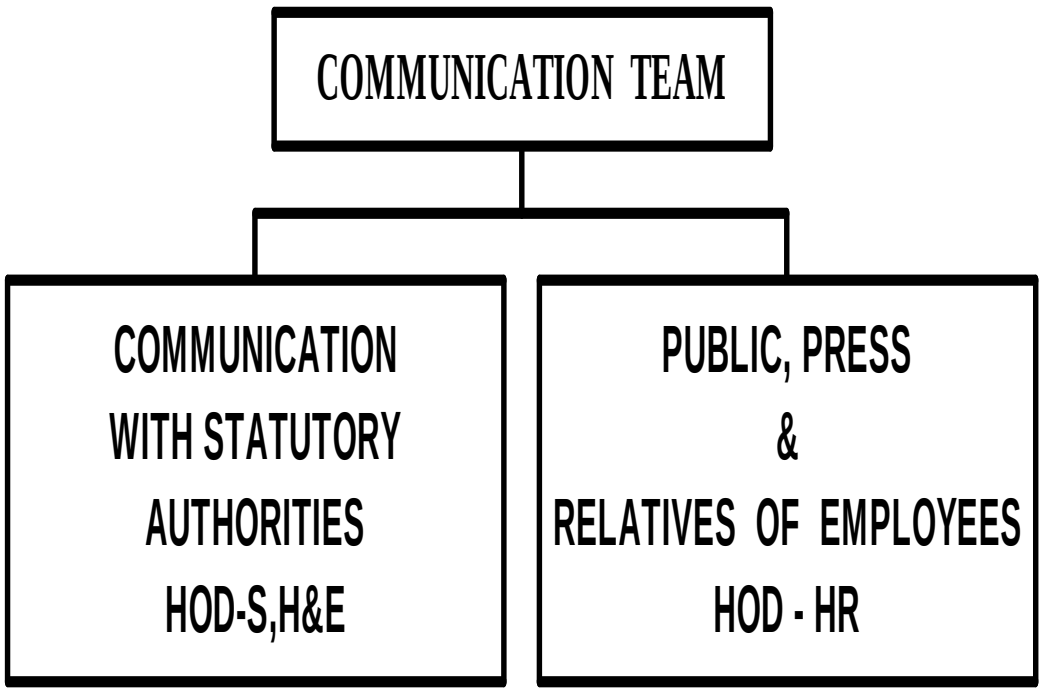
COROMANDEL INTERNATIONAL LIMITED VISAKHAPATNAM		
ANNEXURE: 6.6	**Coromandel ORGANISATION CHART sheet 3 of 5**	
DOC.No: E/SH/SF/WI/001	Rev. No.'5'	Effective date: 14.11.2015



EMERGENCY TEAM AT EMERGENCY CONTROLL CENTER

ADVISORY TEAM

- **Sec in Charge (SHE)**
- **All AVP/ GMs /DGMs / AGMs Sr. Mgrs not involved in the Emergency plan**



Annexure 6.7

General Code of Conduct during Emergency
(1 Sheet)

DOC NO: E/SH/SF/WI/001 REV NO: 2
DATE OF ISSUE: NOVEMBER 2015

1.0 Regular Coromandel employees and possibly others are likely to be present both within the plant area and the wharf during any typical working hour. In order to effectively deal with any emergency, the on-site emergency plan has been prepared with specific roles and responsibilities assigned to the designated employees in the plant.

A general code of conduct has been drawn for the rest of the employees not directly involved in the emergency organization to avoid unnecessary panic and to ensure smooth functioning of the on-site emergency plan.

2.0 On hearing the siren and declaration of emergency, the staff of the affected area and other staff who are assigned specific duties shall use necessary safety appliances and take steps to meet emergency conditions as per the instructions of chief emergency controller.

Siren code at Coromandel:

a) For On-site emergency declaration: one minute wailing sound.
b) For "All clear signal" one and half-minute continuous siren.

3.0 The employees, who are not assigned any specific duty, shall stay at their place of work or take an escape route and assemble at one of the assembly points, as directed by the chief emergency controller.

4.0 Staff of non-affected area shall take a safe shut down of the plant as directed and reach the Assembly point following safe escape depending on the wind direction.

5.0 Following is a general code of conduct for all personnel in the plant.

- Do not rush to the affected area without any specific duty
- Do not panic and prevent panic in others
- **Do not spread rumors**
- Do not issue statements to public / media
- Act as per the advice of the Chief Emergency Controller or the concerned emergency officer and perform duties allotted by them.
- Guide, as directed, the personnel from mutual aid and other agencies, who come to attend the emergency, to the required location as directed by the emergency control officer.

6.0 List of key personnel with residential addresses and telephone numbers attached.

Annexure 6.8

Emergency Action Code
(2 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 2
DATE OF ISSUE: NOVEMBER 2015

EMERGENCY ACTION CODE

The Emergency Action code (EAC or HAZCHEM CODE) is a useful device to enable one to know immediately what action is necessary in case of fire, spillage of leakage. EAC uses numerals 1,2,3 or 4 in combination with certain letters. The numeral indicates what agent should be used for fighting a fire involving the particular hazardous substance. For example EAC for Ammonia is 2PE – where 2 indicates that water can be used , P shows that it is violently or explosively reactive and full body protection with BA is needed, and the word DILUTE means water can be used to control the liquid ammonia spills or leaks. 'E' indicates the surrounding area of 200 m may be evacuated (and in the direction of wind even a longer radius). Thus EAC code is useful for fire fighters and knowledge persons to organise fire fighting and evacuation of personnel and containment of spillage.

Emergency Action Code Scale
For Fire or Spillage
1.Jets 2.FOG 3.Foam 4.Dry Agent

P	V	FULL	**DILUTE**
R			
S	v	BA	
S		BA for Fire only	
T		BA	
T		BA for Fire only	
W	V	FULL	**CONTAIN**
X			
Y	v	BA	
Y		BA for Fire only	
Z		BA	
Z		BA for Fire only	
E	**Consider Evacuation**		

Note for guidance:

FOG: In the absence of fog equipment a fine spray may be used.

Dry Agent : Water must not be allowed to come into contact with the substances at risk.

V: can be violently or even explosively reactive.

FULL: Full body protective clothing with BA.

BA: Breathing apparatus plus protective gloves.

DILUTE: May be washed to drain with large quantities of water.

CONTAIN: Prevent, by any means available, the spillage from entering drains or watercourse.

SUBSTANCE	UN Number	UN HAZARD Classification	EAC (HAZCHEM Code)
AMMONIA (Liquified)	1005	2, 3, 4.1	2PE
LPG	1075	2,3	2WE
SULPHUR	1350	4.1	2Z
Sulfuric acid	1830	8	2P
Phosphoric acid	1805	8	2R

Annexure 6.9

Mutual Aid Schemes
(3 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 4
DATE OF ISSUE: NOVEMBER 2015

(UPDATED AS PER LATEST MOU OF MUTUAL AID SCHEME)

1.0 Major industries nearer to Coromandel International Ltd are

- Hindustan Petroleum Corporation Limited (HPCL)
- Andhra Petrochemicals Limited (APL)

2.0 Coromandel, HPCL and APL have entered into a mutual aid scheme to strengthen the fire fighting forces through mutual assistance in case of emergencies. Under the mutual aid scheme a section of the trained men and a portion of the fire equipment and appliances will be made available to the distressed organization to combat the fire emergency.

3.0 The approximate distance between the member organizations by the shortest route is given below:

Coromandel to HPCL	2 km
Coromandel to APL	4 km
APL to HPCL	3 km

4.0 Coordination and Communication:

Following are the contact numbers of the mutual aid partners.

4.1 <u>HPCL Contact persons and their phone numbers:</u> to be contacted in case of emergency:

- **Chief Manager (Fire & Safety)****: 0891-2740183(off) 0891-2781091 (Res)

- **Manager (Refinery shift):** 0891-2894444,0891- 2577397
- **DGM (Operations):** **0891-2894401, 0891-2709662,9491198642**
- **Fire & safety officer shift** **0891-2894849,2894851,2894848,2577592**
- **:**

4.2 <u>APL Contact persons and their phone numbers</u> in case of emergency

- **Shift – in – charge **:** 0891-2010056,2891414,2891427,2891333
- **Fire Station** **0891-2891222,2891482,2891481:**
- AGM(Safety) 0891-28914819(O), 0891-**2575201(Res), 9490133192**

- DGM(Operations) 0891-28912412(o) , 0891-2564451(Res)
- **VP(O & TS):** 0891-2577740,2891411(O), 0891-2540081(Res)

**** Note: <u>These persons are available round the clock</u>**

5.0 Following equipment is available and can be spared by the mutual aid partners during an emergency.

5.1 List of equipment available with HPCL for mutual aid:

<u>Sl.No.</u>	**<u>Description</u>**	**<u>Quantity</u>**
1.	Foam Tender	1 No.
2.	63 mm Hoses	10 Nos.

3.	63 mm Nozzles	4 Nos.
4.	Foam Branches	6 Nos.
5.	BA sets	2 Nos.
6.	Foam Compound	5000 ltrsl
7.	Fire Suite	2 Nos.
8.	Ambulance	1 No.

5.2 List of equipment available with APL for mutual aid:

Sl.No.	Description	Quantity
1.	Foam Tender (3 kl water capacity and 500 l of Foam tank)	1 No
2.	63 mm Fire Hoses	10 Nos.
3.	Fire Hose branch pipes (63 mm)	4 Nos.
4.	Foam Compound AGFFF	5000 ltrs l.
5.	Fog Nozzles	2 Nos.
6.	Foam Making Branches	2 Nos.
7.	Fire Suite	2 Nos.
8.	BA seta	2 Nos.
9.	Ambulance	1 No.

6. 0 Call and Turn out Procedure for Mutual Aid:

6.1 The call for assistance shall clearly indicate:
a) Place of fire
b) Type of fire
c) Type of equipment required
d) Any additional equipment required

6.2 On receipt of the assistance call, the number unit will dispatch the fire tender accompanied by at least three-trained personnel.

6.3 When assistance is required, the concerned security officials are to be informed for allowing the five tender for entry without delay. They will also guide the assisting fire services to the exact location of fire.

6.4 The in-charge of assisting fire services shall report to the fire officer in-charge of affected unit and shall act as per his instructions. The assisting fire service shall not leave the place of occurrence unless so instructed by the fire chief of the affected unit.

6.5 The member units shall practice mock drills once in two months, each time in a different unit to make the members of the fire station familiar with topography and action expected of them during actual operation.

A record of these exercises will be maintained by each organization.

Annexure 6.10

List and Location of

Safety Equipment, Safety Showers & Wind Sacs
(5 Sheets)

LIST OF RESPIRATORY PERSONAL PROTECTIVE EQUIPMENT

S.No.	Plant / unit	Location	Air line respirator /Trolley mounted or Long duration	SCBA sets	ELBA sets (for emergency escape)	3M canister mask/ cartridge
1	Sulfuric acid	MCC room	Nil	Nil	Nil	Nil
		DCS room	Nil	3 Sets	2 Nos	10 sets
2	PAP	Control room	Nil / Nil	1 Set	2 Sets	2 sets
3	Utility& AAST plant	Utility Control Room	NA	2 sets	Nil	1 set
		Manager's room	NA	1 Set	NA	Nil
		AAST control panel room	NA/1	4 Sets	2 Sets	8 sets
		Compressor Shed	1/ Nil	Nil	Nil	Nil
4	Complex plant "C" train	Control room	1 / Nil	2 sets	2 Sets	4 sets
5	Complex plant A&B trains	Control room	2 / Nil	2 sets	2 sets	4 sets
		Ammonia Station	Nil	Nil	Nil	2 sets
6	Security / 5 gate	Record room	Nil	Nil	1 set	2 sets
7	Ambulance room	Reception room	Nil	Nil	Nil	4 sets
8	Fire Station	Fire tender	Nil	2 sets	2 sets	12 sets
9	Manager shift -ops	ECC-1	Nil	2 sets	2 sets	6 sets
10	Garage	ECC-2	Nil	6 sets	2 sets	8 sets
11	Laboratory	Outside lab (emergency cup board)	Nil	1 set	Nil	2 sets

S.No.	Plant / unit	Location	Air line respirator /Trolley mounted or Long duration	SCBA sets	ELBA sets (for emergency escape)	3M canister mask / cartridge
12	Wharf	Safety equipment room	Nil	5 sets	4 Sets	3 sets + 2 nos cartridges
		On berth	2 sets are provided (4 cylinders of 6 M^3 each)			
13	DG/TG	Control room	Nil	1 set	NA	2 Sets + 1 set
14	Instrument Shop	Shop	NA	Nil	Nil	1 set
15	New ETP	Control Room	NA	Nil	1 set	Nil
16	SND	Maint. Engineer Room	NA	Nil	Nil	2 sets
17	FPP	Control Room	NA	1 set	2 sets	3sets
18	G Sulphur	Control Room	NA	1 set	1set	2sets
19	Yard Office	Yard Office	NA	Nil	Nil	1+1 set

- Note: Apart from the above the following PPE are also available.
  - At ware house 8 nos. of filled cylinders, 2 SCBA Sets & 15 nos. of 3M canister mask / cartridge are available at emergency safety cabin.
  - 10 SCBA set cylinders & 20 nos. of 3M canister mask / cartridge are available at ware house.
  - In safety department's room 2 nos. of Airline respirators, 2+2 nos. - 3M canister mask / cartridge are available.
  - MSA protection suit from liquid Ammonia 1 no is available at Wharf safety equipment room, 1 no at AAST Control Room & 1 no at AAST/Utility Manager Room
  - The regular personal protective equipment like PVC suits, gloves, face shields, asbestos gloves, cotton face masks etc are available at all the control room as per requirement.

- About 12nos. of fire suits are available at the following locations.

Location of Fire Suits:

o Utilities	Control Room -- 1No,
o Wharf	Molten Sulfur Storage area – 2 Nos.
o General	Emergency cabin at Lab – 1 no.
o Fire tender	2 No's.

Safety Showers and Eye Washers:

Phos Acid	**Ground floor: Near Dilution coolers & AB Evaporators area. Reactor top, Phos Acid Storage tanks area (east and west sides). PAN Filter North - West corner. FRU at issue pumps area & Middle floor. 30% "C" tank splitter box (Eye washer only), belt filter ground floor & 2nd floor**
Sulfuric Acid	**Acid issue pumps North, Acid trucks loading platform, A storage tank North West corner & D storage tank North East. Storage tanks top walk way platform, near stack, SAP 2 alkali scrubber area, product acid pumps area.**
Utilities	**Caustic lye & Sulphuric acid tank area.**
Complex A & B **Complex C train**	**Near A – Tr. Sulphuric acid tank, near B-Tr. Scrubber area staircase, A –Tr. Scrubber area (reactor top floor), B-Tr. Scrubber area (Reactor top floor), Ammonia station.** **At the north side of C train control room, FA-804(Sulfuric acid tank) North East at ground floor.**
AAST	**1. Near control room entrance** **2. Ammonia transfer pump area both I & II tanks** **3. Ammonia truck tanker loading area,**
WHARF	**1. At MOV on Fertilizer berth** **2. At the entrance of the Fertilizer berth** **3. At the boiler house.**
Molten Sulfur storage tanks	**1. Near Truck loading area** **2. Near transfer pumps**
SND	**1. Sulphur pits area.**
PAP Pilot plant	**1. Control Room Entrance area**
FPP	**1. Ground floor sulphuric acid tank area.**
New ETP	**1. Drain pit 2 area** **2. Chemical dosing pumps area**
QA lab	**1. Inside Lab (only eye wash)** **2. Near entrance door**

Location of Wind Sacs

1. Admin Building – 1 No.
2. Complex plant "C" train top – 1 No.
3. Phosphoric acid plant top – 1 No.
4. Atmospheric Ammonia Tank-2 – 1 No.
5. SAP2 IAT Tower – 1 No.
6. Wharf Area - On inclined Conveyor structure(JD 1304) -1 no.
7. Wharf area - Molten Sulfur storage tanks. 1 No.
8. Rock grinding plant top – 1No.
9. Product handling unit top –1No.

Annexure 6.11

List of Trained First Aiders
And
Rescue Teams

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LIST OF TRAINED FIRSRT-AIDERS

S.No	Emp.No.	Name	Department	Certificate
1	11004583	L Narasimha Rao	Utilities	First Aid Training
2	11004590	M Nagaraju	Utilities	First Aid Training
3	10005531	T Ramachandra Rao	Security & Fire	First Aid Training
4	8000145	Laxman Bhandari	Safety, Health & Environm	First Aid Training
5	10004461	Tatikonda Arjuna Rao	Phosphoric Acid	First Aid Training
6	10004559	Doolam Santhosh Kumar	Complex	First Aid Training
7	10003664	Vurumu Rajesh	Complex	First Aid Training
8	10003670	Dadi Srinivas Kumar	Complex	First Aid Training
9	11004762	E Ramakrishna	Utilities	First Aid Training
10	10003662	Mandharapu Dinakar	Pilot Plants	First Aid Training
11	10001974	B V Nookesh Kumar	Electrical	**First Aid Training /Power medicine**
12	11004461	K Govinda Raju	Bagging & Product Handlin	First Aid Training
13	10004108	B Chanakya Varma	Electrical	**First Aid Training /Power medicine**
14	10003672	M V Siva Sankara Satish	Electrical	**First Aid Training /Power medicine**
15	10001972	B Govinda	Electrical	**First Aid Training /Power medicine**
16	10002099	N Sreenivasa Rao	Instrumentation	**First Aid Training /Power medicine**
17	10009966	S. Satyanarayana	Instrumentation	**First Aid Training /Power medicine**
18	11004666	M Chinnappa	DG/TG	**First Aid Training /Power medicine**
19	10005733	Paluri Ramesh	Electrical	**First Aid Training /Power medicine**
20	11004227	S Venkateswarlu	Electrical	**First Aid Training /Power medicine**
21	10005965	Pitta Suresh	Electrical	**First Aid Training /Power medicine**
22	10005386	Kedarisetti Venkatesh	Electrical	**First Aid Training /Power medicine**
23	11004541	R Koteswara Rao	Bagging & Product Handlin	First Aid Training
24	10005388	Bugata Appala Raju	Instrumentation	**First Aid Training /Power medicine**
25	10004560	R Kumar Naidu	SND	First Aid Training
26	10005341	Kodati Pavan Kumar	SND	First Aid Training

27	11004438	M G Rama Rao	Phosphoric Acid	First Aid Training
28	11004444	K Janardhana Rao	Sulfuric Acid	First Aid Training
29	11004798	S Maheswara Rao	Phosphoric Acid	First Aid Training
30	10003553	Parimi Venkata Rao	Quality Control & Laborat	First Aid Training
31	11004898	V Sree Rama Sudhir	Instrumentation	**First Aid Training /Power medicine**
32	10004180	Kandregula Krishna	Utilities	First Aid Training
33	10005338	Lotla Appa Rao	Utilities	First Aid Training
34	10006534	Gondesi Yaswanth	Complex	First Aid Training
35	10005339	Bevara Gowrisankar	Complex	First Aid Training
36	10005170	U Kiran Kumar	Complex	First Aid Training
37	11004876	Khaleel Ahmad	Complex	First Aid Training
38	10002718	Phaneendra Rongali	Sulfuric Acid	First Aid Training
39	10005282	Mohd. Azmath Ali	SND	First Aid Training
40	10006047	Nagubilli Venkata Rao	Security & Fire	First Aid Training
41	11004548	D Appala Raju	Bagging & Product Handlin	First Aid Training
42	11004551	B K Venkata Rao	Bagging & Product Handlin	First Aid Training
43	10003720	Pappu Sudarshana Rao	Instrumentation	**First Aid Training /Power medicine**
44	10006806	Naralasetti Sreedhar	Electrical	**First Aid Training /Power medicine**
45	10004107	J Naga Ramesh	Electrical	**First Aid Training /Power medicine**
46	10010027	S Srinivas	Electrical	**First Aid Training /Power medicine**
47	10001971	J Devanand	Electrical	**First Aid Training /Power medicine**
48	CONTRACT	A.SRINIVASA RAO	HR-AMBULANCE	First Aid Training
49	CONTRACT	B.SRINIVASA RAO	HR-AMBULANCE	First Aid Training
50	CONTRACT	R.PYDI RAJU	HR-AMBULANCE	First Aid Training
51	CONTRACT	SK.DARIYA	HR-AMBULANCE	First Aid Training
52	CONTRACT	D.SRI RAMA MURTHY	MNT-BAGGING	First Aid Training
53	CONTRACT	S.SRINIVASA RAO	MNT-COMPLEX	First Aid Training

LIST OF TRAINED RESCUE TEAM

S.No	E.Code	Employee Name	Department
1	10005699	D Sandeep Kumar	Shops
2	11004744	B Durga Prasad	Wharf
3	11004490	A Satyam	Garage
4	11004766	G Ravi Kumar	Utility
5	10004485	Malisetti Venkata Gurunadha Rao	Security & Fire
6	10003553	Parimi Venkata Rao	QA Lab
7	10003384	R Dasu	Complex
8	10005341	Kodati Pavan Kumar	SND
9	11004876	Khaleel Ahmad	Complex
10	10003664	Vurumu Rajesh	Complex
11	11004695	Ch Prabhakara Rao	Bagging & Product H
12	11004461	K Govinda Raju	Bagging & Product H
13	11004406	B V V S N Murthy	Wharf
14	11004541	R Koteswara Rao	Bagging & Product H
15	8000145	Laxman Bhandari	Safety, Health & En
16	10006991	Bandi Srikanth	Electrical
17	11004762	E Ramakrishna	Utilities
18	11004795	A Rama Raju	Assembly
19	10004802	Kopanathi Srinivasa Rao	Materials - Stores
20	10005338	L Appa Rao	Utility
21	10002217	R Ramesh	Utility

Annexure 6.12

Evacuation and Emergency procedures

(2 sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 2
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1.0 Evacuation:

When Emergency is declared by the Chief Emergency Coordinator, the plant personnel will come to know about the same through the message received from the emergency control center and respective plant \ unit managers.

If the emergency is arising out of large scale release of Toxic gas like Ammonia, or sulfur dioxide, assessment should be made as to the effected areas and if it is safe for the plant personnel to continue working in these areas. In such an event all persons who are not required for emergency duties should be instructed to leave their place of work and go to the nearest Assembly point or a protected room.

The first important precaution to be taken in case of Toxic gas release is to protect the Control Rooms by shutting off the air conditioners and ensuring that all doors and windows are closed to prevent toxic gas entry.

The escape routes towards the Assembly points will depend upon the prevailing wind direction. Escape routes for two predominant wind directions are shown in Annex 6.1. The announcement regarding the exact route to be followed could be made through the telephones, plant/ area PA system etc.

2.0 Rescue Operations:

During such emergencies involving Toxic Gas release, it may so happen that some persons can get trapped in the gas leakage area and may be unable to come out of the toxic plume path. Special teams for rescue operations will be formed whose members will be trained in rescue and relief operations during emergencies and will be evenly distributed in all the shifts. The special protective equipment by these teams will be kept in all plant Control Rooms, Emergency Control Center, close to the Assembly points and other strategic locations.

3.0 Accounting of Personnel:

Accounting of N.M staff: Electronic identity card swiping system has been developed and data processing gets the information of the number of persons entered or left the plant giving account of the personnel present inside. This information from data processing is given to the security for head count.

Accounting of M.Staff: Computerized attendance marking system has been developed which is also connected to the data processing, from which, the account of M.staff present inside is given by the data processing to the security.

Accounting of Contract work men: Security takes account of contract workmen entering and leaving the factory premises at plant gate.

Accounting of Visitors: Security takes account of visitors entering and leaving the factory premises at plant gate. However Visitors shall not be allowed inside the plant during emergency and those who are already inside are accounted and will be evacuated from the factory premises by the security personnel.

Accounting of Apprentices \ Trainees: Shift in-charges of Individual plants \ units, where trainees and apprentices are reporting directly for work has to give the account of those personnel with them to security. Training department has to account for the trainees \ apprentices reporting directly to them and to give their account to the security.

Security department at plant gate shall take account of all the above personnel and maintains the total strength of personnel present inside the factory at any given time and furnishes information to the Chief Emergency Controller during emergency.

4.0 Emergency Medical Aid:

It is of utmost importance that injured personnel are given prompt medical attention as soon as possible. Arrangements will be made for vehicles including ambulances for taking the injured to the Hospitals nearby. Chief Medical Officer and Welfare officer will take care of this function during the emergency.

5.0 Plant/ Sectional Shut Down:

During the emergency it may be necessary to shut down a few or all of the Plants/ sections as the situation demands. The Chief emergency Coordinator and Emergency Operations Controller will take decisions in this regard and coordinate the shut down activity.
In case of ammonia gas leak in Complex or the Ammonia storages, the individual plants where the leak occurred will be shut down and if considered safe the Ammonia plant may be kept running.

If the leak is major and near the wharf, ammonia unloading activity will be suspended immediately and the line isolated at both ends.

Annexure 6.13

Material Safety Data Sheets

DOC NO: E/SH/SF/WI/001 REV NO: 3

DATE OF ISSUE: NOVEMBER 2015

AMMONIA

Physical properties of Ammonia.

1. Anhydrous ammonia is present both in the gaseous and liquid form.
   under atmospheric pressure and temperature conditions it is present in the gaseous form.

2. Ammonia readily dissolves in the water forming aqueous ammonia with liberation of heat.

3. Ammonia vapor is colorless, has pungent odour which serves as it's own warning agent.

4. Ammonia is lighter than air and in the open atmosphere it will disperse by virtue of its own buoyancy. However ammonia vapors produced from cold liquid may term ammonia – air mixtures heavier than air, which may stay close to the ground for some time.

5. The threshold limit value (TLV) of ammonia is 25ppm by volume. Its presence is detectable due to its own odour at 25 ppm.

6. The main physical characteristics of ammonia are given below:

a) Normal boiling point	-- 33^0C
b) Critical temperature	132.40^0C
c) Critical pressure	114. 25 bar.
d) Freezing point	-- 77.7^0C.
e) Latent heat of vapourisation at 1 atma and --33^0C	1370.76 Kj / Kg
f) Explosive limits	16 to 25% v/v
g) Auto-Ignition temperature	651^0C

Toxic Effect of Ammonia

1. In general, Ammonia gas under high concentration may cause irritation to eyes and respiratory tract.
2. Skin contact of liquid ammonia as well as strong aqueous ammonia may cause burns.
3. Its concentration – wise general effects are given below:

Vapor concentration (ppm by v/v)	General toxic Effect	Exposure period
25	Odour detectable by most persons	For eight hours
50	No adverse effect	
100	No adverse effect for the average worker	Deliberate exposure for long periods is not advisable
400	Immediate nose and throat irritation	No serious effect from 30 to 60 minutes.
700	Immediate eye irritation	-do-
1700	Convulsive coughing. Severe eye, nose, throat irritation.	Could be fatal after 30 minutes.
2000 - 5000	-do-	Could be fatal after 15 minutes.
5000 - 10000	Respiration problem. Rapid asphyxia	Fatal with in minutes.

Fire and Explosive Hazards of Ammonia

1. Ammonia forms flammable and explosive mixtures with air in the range of 16 to 25% concentration by volume. It's auto ignition temperature is 651^0C. Since such concentrations are seldom encountered in practice, the chances of fire and explosive hazards due to ammonia are relatively remote.

2. The presence of oil in ammonia or mixtures of ammonia with other combustible materials will increase the fire hazard.

3. The explosive range of ammonia is broadened by :

    1. Admixture with oxygen replacing air.
    2. Temperature and pressure higher than atmospheric conditions.
    3. Presence of chlorine with rich ammonia reacts readily. When chlorine is in excess a violently explosive compound, NCl_3 is formed.

Behavior of leaking ammonia:

It is important to understand, to start with, the behavior that may be expected of leaking ammonia. The source of leaking ammonia may be in the vapor or in the liquid form. Incase liquid ammonia

leaks, there will be splashing of liquid ammonia giving rise to ammonia vapor the amount of which depends upon its temperature. A higher temperature will cause a large quantity of vapor release.

Whenever major release of ammonia vapor takes place a large thick white snow like cloud is formed immediately at the point of leakage. The cloud soon begins to roll along the ground in the direction of the wind. The rate of dispersal of this cloud depends on the wind velocity and the extent of leak. With a higher wind velocity the movement and dispersal of clouds will be quicker, while at lower wind velocities the gas cloud moves slowly and gets diluted and dispersed gradually.

It is therefore evident from above that wind direction and velocity play a crucial role in determining the magnitude of hazard that may be caused by an ammonia leakage. It would be of practical importance that the plant personnel are aware of normal wind direction at different times of the day so that they can immediately move up wind from the pollution of the ammonia leakage.

Personal Safety Protective Equipment:

The following safety appliances properly used would considerably reduce the extent of injury when a person is exposed to ammonia release.

Personal Safety protective equipment	Applicability
1.Respiratory protection	
a) Ammonia canister mask	For small leak concentration less than 2% And for 10 to 20 minutes.
b) Self contained breathing apparatus	For any ammonia concentration suitable for about 20 minutes at a time.
c) Air line mask with compressed air supply	For continuous work.
d) Wet cotton pad.	For temporary relief.
2. Body protection.	
a) Rubber / PVC suit with Gumboot.	For body protection against liquid ammonia.
b) Cotton overall.	For body protection against vapor ammonia.
c) Safety shower.	For body protection after exposure.
3. Eye Protection.	
a) Face shield.	For liquid ammonia.
b) Panorama goggles.	For vapor ammonia.
c) Eye wash fountain.	For eye protection immediately after exposure.

A Few Safety Hints on Ammonia:

a) Ammonia gas being lighter than air moves along with air in the direction of the wind hence one should move away from the wind direction in order to escape from ammonia exposure.
b) Ammonia being highly soluble in water, a pad of wet cloth held against nose will give, some relief while escaping from the region contaminated with ammonia gas.
c) When it is noticed that atmosphere is getting contaminated with ammonia gas beyond endurable limits, immediately run away from the area holding the breath and if breathing becomes unavoidable try to have short and shallow breaths. Take care not to inhale long and deep breaths of ammonia contaminated air.
d) Ammonia vapor clouds can be contained to a certain extent by spraying water through fog nozzles. However the direction of the spray should be carefully chosen depending on the wind direction and velocity. This can be attempted after the primary actions such as safe shut downs of systems have been done.
e) If there is a liquid ammonia spill do not spray water directly on the spillage, as it will result in a release of large clouds of vapors. To contain the release of vapor due to ambient heat the spilled ammonia may be covered with suitable foam to reduce the rate of evaporation.
f) If there is a fire in the area adjacent to ammonia storage vessels, pumps or transfer pipe lines, it is essential to keep the surface of such equipments cool by spraying water on them.

First aid treatment:

Any one effected by exposure to ammonia should be moved as fast as possible to an uncontaminated place. In the mean time arrange for the ambulance to transport the patient to the first aid center. The following first aid treatment is recommended for administration to the patient.

1. Cause: Inhalation of concentrated ammonia vapor.
   Effect: Irritation of respiratory tract.

First Aid Treatment:

a) Loosen his clothing and make him to lie down with face down position and observe breathing.
b) If breathing stops apply artificial respiration.
c) Do not attempt to give any thing orally to patient if he is unconscious.
d) Consult the doctor for further treatment.

2. Cause: contact of concentrated ammonia vapor with eyes.
   Effect: Irritation of eyes.

First Aid Treatment:

a) Flood the eyes thoroughly with eye lids slightly open, with large quantities of water from water tap, water spray, fountain hose or by inserting the head in a water container, and repeatedly opening and closing the eyes for at least 10 mints.
b) Consult the doctor for proper medication.

3. Cause: Contact of cold liquid ammonia with skin.
   Effect: Skin burns.

First aid treatment:

a) Remove all clothing soaked in ammonia taking care that they do not come in contact with skin.
b) Flood the reacted area thoroughly with large quantities of gently running water for at least 10 mints.
c) Consult the doctor for further medication.

4. Cause: swallowing of liquid ammonia.
   Effect: Acute pain and vomiting sensation.

First Aid Treatment:

a) If the patient is conscious, he should drink large quantities of water. If he is unconscious or under shock or in pain, does not induce vomiting.
b) If the patient begins to vomit keep his head down below his hips to prevent the vomit entering the lungs.
c) Consult the doctor immediately.

SULFURIC ACID :-

Manufacturer's Name :- M/S Coromandel fertilisers limited.

Trade Name :- Acid sulfurique, Battery Acid ,Oil of Vitriol, Electrolyte Acid, Fertiliser Acid, spirit of sulphur and Hydrogen sulfate.

Product use :- For the manufacture of Phosphoric Acid.

Hazardous ingredients of the material :-

Hazardous ingredients :- Corrosive liquid. Approximate concentration – 98%

C.A.S.No.or U.N.No. -- CAS No.—7664-93-9. UN No. – 1830.

LD 50 (Specify species route) --- 2.14 gm / Kg. (oral – route).

LC 50 (Specify species & route) --- 510 mg / m^3 / 2hrs.(inhl –route).

Physical Data for Material:--

Physical state – Liquid. Odour less , colour less only liquid.

Odour threshold (ppm) --- > 1 mg / m^3 Specific gravity --- 1.84.

Vapour pressure:-- 0.001 mm Hg. At 20^0c. Vapour density -- N.A (air = 1)

Evaporation rate --- Extremely low. Boiling point ---- 270^0c. Freezing point – 3^0c

Solubility in water --- Soluble in all proportions. pH – 0.3. in sol. Density -- 1.84 g /ml

Coefficient of water/oil distribution -- N.A.

Flammability (Yes/ No) --- NO Means of extinction --- N.A.

Special procedures: It does not burn but is highly reactive / contact with many combustible material.

Avoid using water sine it generates heat & splattering.

Flash point and method --- N.A.

Lower explosive limit --- N.A. Upper explosive limit – N.A

Auto Ignition temp.. N.A. TDG flammability classification – 8.0.

Hazardous products of combustion – sulfur dioxide, sulfur trioxide & sulfuric acid fumes.

Explosion data sensitivity to chemical impact --- Sensitivity to static discharge.

Reactivity data :---

Chemical stability (yes /No) -- Yes. Stable under normal conditions.

Incompatibility to other substances (Yes /NO) -- Yes. Reacts violently with organic & inorganic materials including water, alcohol carbides, chlorates, picrates, nitrates.

Reactivity under what conditions --- concentrated acid reacts violently with water, generating heat and causing splattering.

Hazardous products of decomposition :-- SO_2 ,& SO_3

Material name and identity :-- Dense white fumes of SO_2 ,& SO_3

Toxicological properties of material :-- Route of entry --- Skin contact. Eye contact. Inhalation. & Ingestion.

Effects of acute exposure to material :-- Irritation or damage to the mouth, nose, throat, lungs &skin.
Effects of chronic exposure to material :-- Prolonged exposure to mists and vapour can cause erosion and discolouration of the teeth, irritation to eyes and inflammation.

Exposure limits :-- TLV – TWA --- 1mg / m^3 Irritancy of the material – Irritant to eyes, skin, nose, throat and lungs.

Sensitivity of the material –N.A. Carcinogenisity, adverse reproductive effects, Terstogenicity, Mutagenicity :-- N.A.

Synergistic materials (materials which would worsen the adverse effects) :-- N.A.

Preventive Measures :-- Personal protective equipments :--

Gloves(specify) ;--- Rubber. Respiratory (specify) :-- Canister masks (acid).
Eyes(specify) ;-- Chemical safety goggles and face shield.
Foot wear(specify) :-- Rubber gum boots. Clothing(specify) :-- Acid proof apron /Suit.
Others(specify) :-- NIL

Annexure 6.14

List of
Internal and External Telephones
(6 Sheets)

DOC NO: E/SH/SF/WI/001 REV NO: 10
DATE OF ISSUE: NOVEMBER 2015

EMERGENCY RESPONSE CENTER - VISAK: 2791766. Radio Trunk: 700342 / 700 346.

NAME OF THE DEPARTMENT	TELEPHONE NO	TELEPHONE NO:
District Collector	2754106 (off)	2526 999 (Res.)
Jt. Chief inspector of Factories	2550294 (off)	9000905700 ©
Inspector of Factories	2550294 (Off)	8978394276 ©
Asst. Director (Dock Safety)	2563857 (off)	2705957 (Res.)
Regional Officer (APPCB) Zonal Officer (APPCB)	2755356 (off) 2719380 (Fax) 2719480	9866776722 © 9866776719 ©
Police	2577392 (Malkapuram)	2517071 / 2517033 (Gajuwaka)
Commissioner of Police	2562763 ; 2562709 (O)	2525500 ®
Civil Defense Control Room	2709602	9849903822
Dy. Chief inspector of boilers	6681384 (O)	
Neighboring Industries	2577592 (HPCL) 2577606 (APL) 2518401 (VSP) 2577502 – (Ship yard) 2577356, 2744409, 9492792155	2517301- 309 (Hindustan Zinc) 2564841 (VPT) 2577077 (ALU FLOURIDE) 2517341 (BHPV)
AP Transco – Gajuwaka Substation	ADE - 2517279	Operator - 2517450

NAME OF THE DEPARTMENT	TELEPHONE NO	TELEPHONE NO:
Fire Services: Fire station – Peda Gantyada. Fire station – Kancharapalem. Fire station – Suryabagh. Fire station – Suryabagh. Fire station–NAD Kotha Road. Fire station–Gajuwaka Fire station–Steel Plant Fire station–BHPV Regional Fire officer. Divisional Fire officer.	101/ 2787818 2517780 - 9963728664 22558470. 2563582 2558470 – 9963729367 2558151 2515232 2518401/2519541 2517381 2563582.(O & R) 9949991059© 2568905 (O) 9963728301©	2569411 / 2552178 (VPT – Control Fire station) 2577297 (VPT -OIL WHARF)

NAME OF THE DEPARTMENT	TELEPHONE NO	TELEPHONE NO:
Navy exchange. M.O.C	2577885 2577240	Navy – NBCD office – 2812928 & 2812544
Chief controller of Explosives (Nagpur).	0712 – 2510577 (telefax)	
Joint Chief controller of Explosives (Chennai)	044 – 851 5464. Fax: 851 4848.	Joint. Commissioner of labour – vizag - 2748 760 (O), 9492555150©
Asst.Commisioner of labour (central – Vizag)	9492555003©	Regional labour commissioner (Hyderabad) – 27612531 &27612538
E S I Corporation.	2747 364 (O)	

GOVT. & OTHER HOSPITALS.			
NAME OF THE HOSPITAL	**TELEPHONE NO:**	**NAME OF THE HOSPITAL**	**TELEPHONE NO:**
ESI – Hospital	2577195	District Medical & Health office – Vizag.	2550840.
St Ann's Hospital –	2577830	R.K.Hospital	2517 081; 2517 599;
INHS Kalyani –	2577264	CARE Hospital	2714014; 2522622 3041055;3041444
INDUS Hospital	2508881	NRI Hospital	2535063; 2535752.
Port Hospital –	2873540	LATHA Hospital	2736116.
Amrutha Nursing home	2517345.	CDR (Ram Nagar)	2560882
Annapurna Nursing home.	2755 875	Apollo hospital	2529619 / 2712727
KGH	2564891; 2564892; 2564893	Apollo hospital - Emergency	2727272/2529618
Hymavati Nursing home.	2577232 (5 lines)	Sujatha Hospital	6577115
Kala Hospital	2764748	Seven Hills	2705791
Krishna Eye Hospital	2517727	Seven hills - Emergency	2708090

PRESS & MEDIA:			
NAME OF THE PRESS	**TELEPHONE NO:**	**NAME OF THE MEDIA**	**TELEPHONE NO:**
EENADU-	2552211/12/13/14	DECCAN CHRONICLE –	2701376; 2553806.
ANDHRA BHOOMI –	2552333; 2553807.	THE HINDU –	2537285 / 86 / 2537386
ANDHRA PRABHA –	2556055; 2556133.	INDIAN EXPRESS –	2556055; 2552910
ANDHRA JYOTHI	2516933/2516923	HINDUSTAN TIMES	2537276
VAARTHA -	2706784 – 85. 2706622	ALL INDIA RADIO	2523022

Internal Telephone Numbers of Key Persons of Coromandel international Ltd. (To be contacted during Emergency)

FACTORY GENERAL TELEPHONE NO ----- (0891) 2578400 TO 2578419.

S. NO.	NAME & DESIGNATION	RESIDENTIAL ADDRESS	TEL.NO.
1.	M Kumaresan UNIT HEAD	10B - COROMANDEL PARK SRIHARIPURAM. MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400- EXT (o) 201 ® 520 © 9959616003
2.	Dr. K.V.Ramana Rao Chief Medical Officer	17B - COROMANDEL PARK SRIHARIPURAM. MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT (O) 376 ®534 © 99590 22055
3.	K.Ranga Kumar GM – HR	19B - COROMANDEL PARK SRIHARIPURAM. MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT (O) 213 ® 538 © 9959022048
4.	N Satya Subrahmanyam HOD– E.H.S.	Plot No- 170 D No: 1-86-18, Sector IV.MVP Colony VISAKHAPATNAM	2578400 EXT 242 (O) ©9959097517
	R K Joshi. GM – Maintenance & Civil	8 B ,COROMANDEL PARK, SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT 209 ® 516 9959022067
5.	K V Rao GM-P & I, PROJECTS	2 B,COROMANDEL PARK, SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT (O) 208 ®503 © 9618973345
6.	J.Mahesh DGM-FINANCE	4A,COROMANDEL PARK, SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 Extn.217 ®523 ©9949656149
7.	Ch Srinivasa Rao Sr.GM – OPERATIONS	12B,COROMANDEL PARK, SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT 206 ® 524 9959022183
8.	M.Sreenivasa Rao Sr.Manager - EHS	1B, COROMANDEL PARK SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT (O) 235 ®502 © 9676999316

S. NO.	NAME & DESIGNATION	RESIDENTIAL ADDRESS	TEL.NO.
9.	S.VIJAY KRISHNA CHIEF SECURITY & FIRE OFFICER.	15 A– COROMANDEL PARK SRIHARIPURAM. VISAKHAPATNAM	2578400 EXT(O) 401 / ® 529 © 8008011661
10	MANAGER.(Shift-Ops) .(SHIFT-SUPDT)	CENTRAL CONTROL ROOM.	2578400 EXT (O) 290 / 291 9959022020
11	Oli Chandran DGM- Acids	16B,COROMANDEL PARK SRIHARIPURAM, VISAKHAPATNAM	2578400 EXT(O) 303 / ® 532 © 8978527272
12	ANIL KUMAR VARNA Sr.MANAGER – COMPLEX PLANT.	4B, COROMANDEL PARK SRIHARIPURAM, VISAKHAPATNAM-	2578400 EXT (O) 316 ® 99590 22065
13	N.PHANI KIRAN MANAGER – SULFURIC ACID PLANT	8 A, COROMANDEL PARK SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT 302 (O) ® 515 ©8008127023
14	B.Ramesh Babu. AGM – Wharf , Maint Complex, Bagging&PH Utility&AAST, SND,	9B, COROMANDEL PARK SRIHARIPURAM, MALKAPURAM P.O., VISAKHAPATNAM-530 011	2578400 EXT 356 (O) ® 518 © 99590 22569
15	M.SATYA RAO AGM (CIVIL PROJECTS)	D. No: 33 - 14 – 123, ALLIPURAM MAIN ROAD VISAKHAPATNAM – 530 004	2578400 EXT(O)292 ® 2724780 9959022076
16	S Subbaraju AGM-Bagging	15-6-3/2 ; Plot no:202 Sea hill residency; Krishna nagar ; Visakhapatnam-02	2578400 EXT (O) 326 9959022043
17	M.PAVAN KUMAR Manager – Environment	MIG 2A-23 ; Gulla Palem village; Shriharipuram; Malkapuram post - 530011	2578400 EXT (O) 235 8790191187
18	K.Kotaih MANAGER - WHARF	14B,COROMANDEL PARK SRIHARIPURAM, VISAKHAPATNAM	2578400 EXT(O)352 Res:528 99590 98028
19	S.Syam Prasad Reddy Sr.Manager – Maint.Acids	12A,COROMANDEL PARK SRIHARIPURAM, VISAKHAPATNAM	2578400 EXT(O)35 Res:523 99590

S. NO.	NAME & DESIGNATION	RESIDENTIAL ADDRESS	TEL.NO.
20	A.Chandra Sekhar Dy.Manager – Welfare Officer	C/o K.Radha Krishna Plot No: MIG-1-145 Vuda Colony, Opp. Coromandel gate Sriharipuram Malkapuram post VISAKHAPATNAM	2578400 EXT(O)384 ® 523 ©9550611499

CELL PHONE FACILITY:

SHIFT SUPERINTENDENT	9959022020
COMPLEX PLANT	9959022013
WHARF	9959022016
UTILITIES	9959022015
BAGGING	9959022014
TG/DG SHIFT ENGINEER	9959022019

TRUNK RADIO FACILITY:

AAST	: 710362,710370 & 710353
WHARF	: 700834 & 700835
SECURITY	: 700842, 700843&700844
FIRE	: 700845