Sl No 05/2020

adventz

Onsite Emergency Plan

DIRECTORATE OF FACTORIES & BOILERS ★ ORISSA, BHUBANESWAR ★
ACCEPTED
Date 13/03/20
R.No 2428 dt 19.3.2020
Director of Factories & Boilers
Odisha, Bhubaneswar

Paradeep Phosphates Limited

Plant: PPL Township, Paradeep-754145, (Odisha)

Phone: 91-6722-259600, Fax: 91-6722-229625,

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1. GENERAL INFORMATION ABOUT PPL

Company Profile:

Paradeep Phosphates Limited (PPL) is a leading fertilizer company with annual turnover close to Rs. 5,500 crores. PPL is part of Adventz Group of Companies led by the group Chairman Mr. Saroj Kumar Poddar. The Government of India holds 19.55% of shares while 80.45% shares are held by Zuari Marocco Phosphates Pvt. Ltd, a joint venture between the Adventz group company, Zuari Agro Chemicals Ltd. and Marocco Phosphore S.A., a wholly owned subsidiary of OCP, Morocco. PPL's primary focus is the production and marketing of complex phosphatic fertilizers. PPL is committed to improving agricultural productivity and for the betterment of the farming community.

Location:

PPL is located at Paradeep in Jagatsinghpur District, Orissa. It is 90 kms from Cuttack. Nearest Airport is Bhubaneswar 120KM. The site is located at 20º16'56" North Latitude and 86º38'52" East Longitude, west side of Paradeep Port. The plant encompasses 950 hectares area. Mahanadi river is 5km from the plant site and meets Bay of Bengal, which is 5.3 km away form the site. Atharbanki creek is flowing along the boundary wall of the site and is in between Paradeep Port site and the factory and Nearest Highway is 6KM from plant.

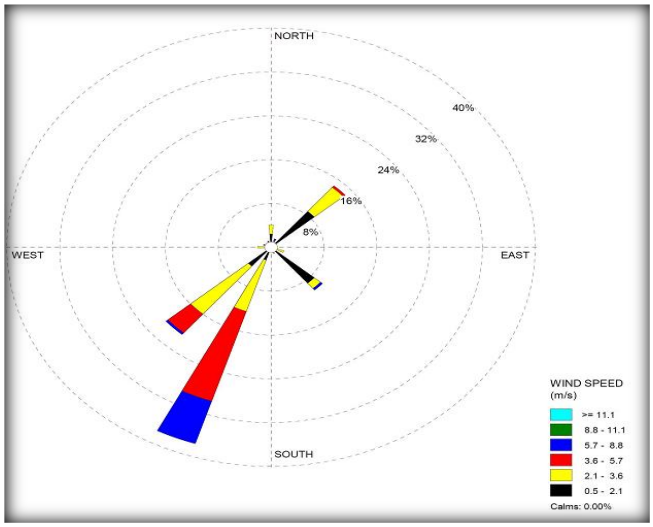
Name & Address of the Factory	Paradeep Phosphates Limited PPL Township, Paradeep Dist – Jagatsinghpur Pin Code- 754145 Tel No – 06722 – 259600 License No. - JS-33 (Serial No. 02550)
Name & Designation of Occupier	Name : Mr. Sunil Kumar Sethy Design.: Managing Director
Name & Designation of Factory Manger	Name : Mr. Ranjit Singh Chugh Design.: Chief Operating Officer Tel No : 06722-259600, Ext:-3282 Mob : 8380032424 E-mail : ranjit.chugh@adventz.com

Weather:

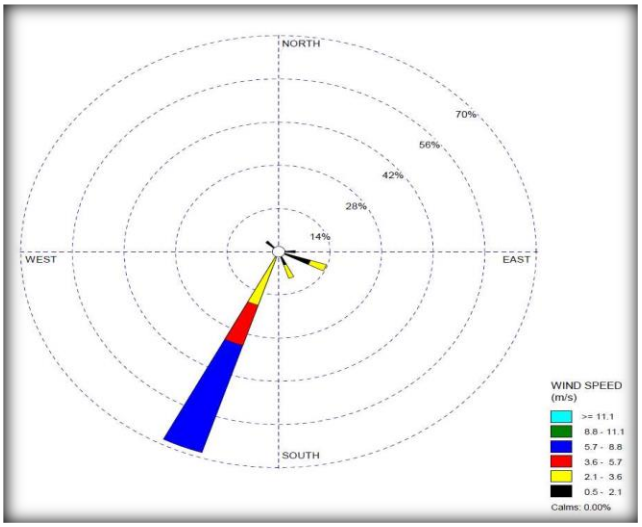
Based on the climatological table 1996-2010, India Meteorological Department, Paradeep area is windy most of the year. Average wind speed is between 6 – 13 kmph (0830 hrs – 1730hrs). Predominant wind direction is from S, SW&N, NW. Annual rainfall is 1669.40 mm most of which falls between June and September. Minimum temperature is 23ºC and maximum temperature is 30ºC. The mean relative humidity is 77% to 79% (0830 hrs – 1730hrs).

Wind Rose:

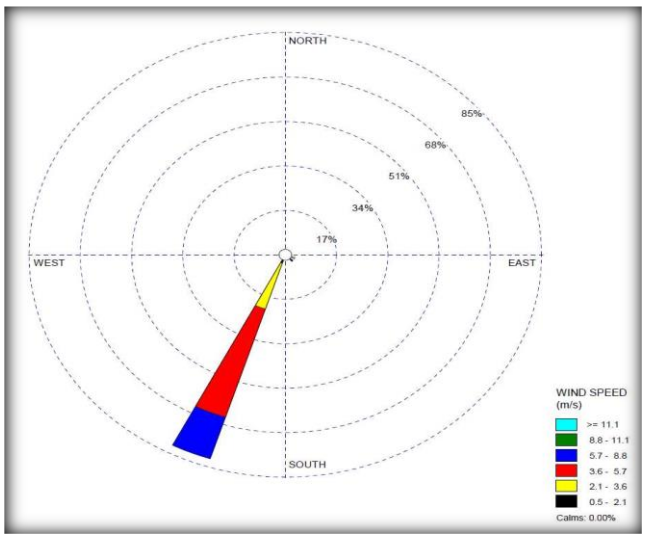
Wind Rose for all the months has been depicted in the following pages. Months 3-12 depict the average wind rose of the year.



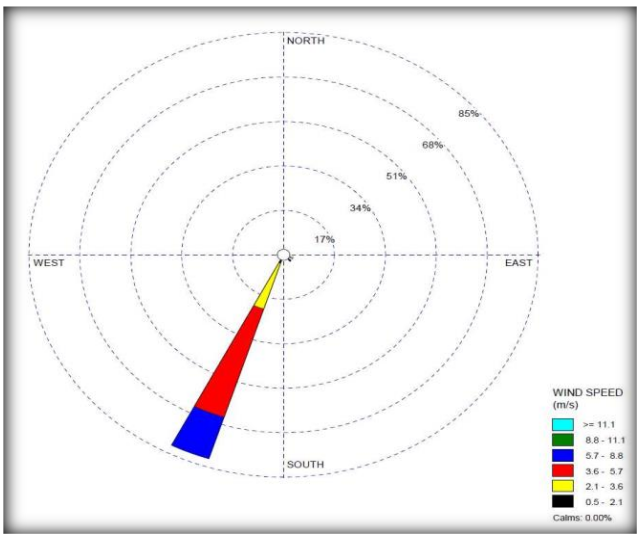
Months- 3-12



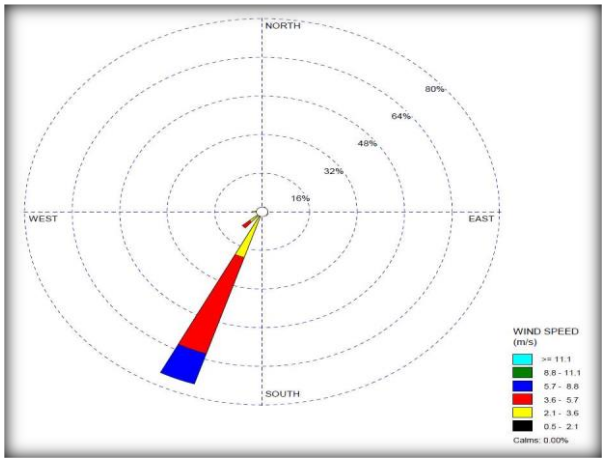
Month- 4



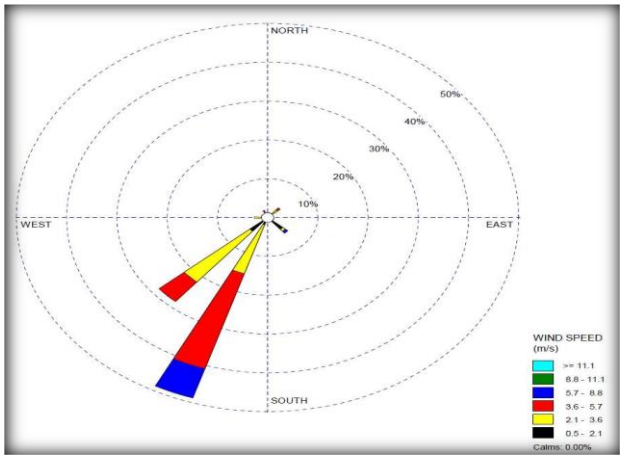
Month- 5



Month- 6



Month- 7



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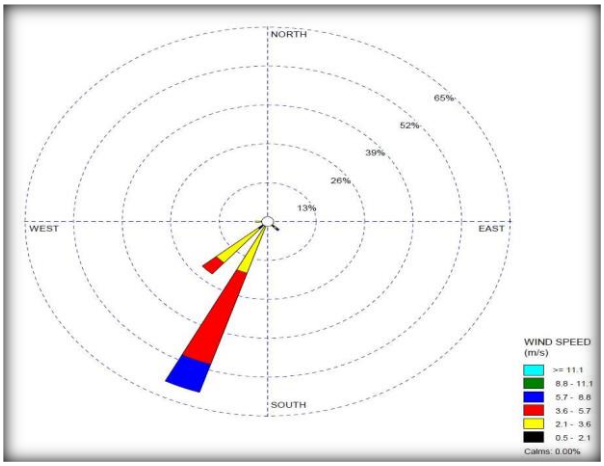
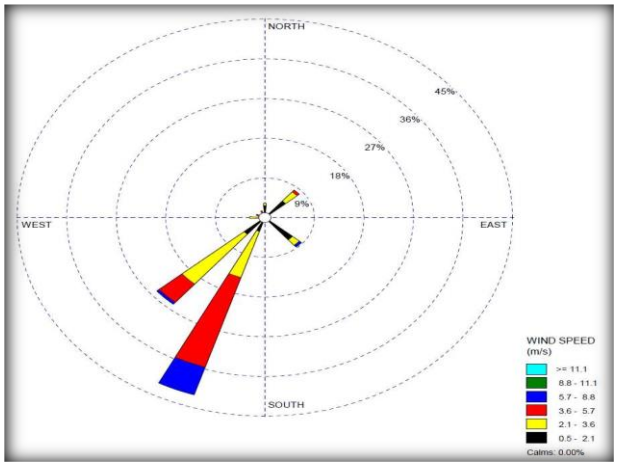
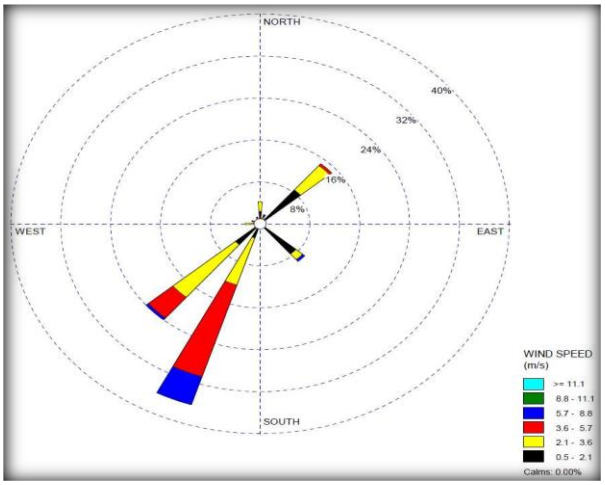


Month- 9



Month- 10



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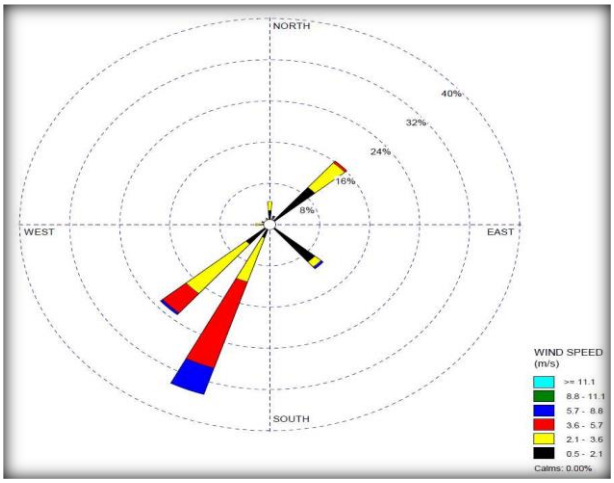


Month- 12

Approach

It is connected by highway and Express way to Cuttack. The nearest airport is Bhubaneswar. Paradeep Port Trust (PPT) is 7 km from the site.

1.1. BRIEF MANUFACTURING PROCESS.

Manufacturing Facilities:

PPL established in 1982 is a phosphatic fertilizer complex at Paradeep in Odisha state. The fertilizer complex consists of following manufacturing units.

5000 MTPD of Diammonium Phosphate Plant/ NPK Plant (4 trains)
4400 MTPD of Sulphuric Acid Plant (3 stream)
1400 MTPD of Phosphoric Acid Plant
2 X 16 MW Captive Power Plant
1 X 23 MW captive Power Plant

The fertilizer complex is using imported molten sulphur, sulphur and rock phosphate to produce sulphuric acid and phosphoric acid. Since captive production of phosphoric acid cannot cater to the four streams of DAP plant, part of the phosphoric acid requirement is made through imports. The entire ammonia requirement is met through imports.

The PPL facility covers the following areas:
Sulphur Silo
Sulphuric Acid Plant and storage
Phosphoric Acid Plant and storage
Ammonia storage
Di-Ammonia Phosphate plant
Captive Berth at PPT.
Other Auxiliary Systems include:
HSD/FO storage
LPG Cylinder Storage in Township
Captive Power Plant.

Process Description:

Sulphuric Acid plant (SAP-A&B):

Sulphuric Acid (SA) plant is based on the most modern double conversion double absorption process of M/s Lurgi GMBH, West Germany (DCDA process). It is laid in two streams, each of 1200 MTPD capacity. The raw material, elemental sulphur is transported by means of belt conveyor to the sulphur bin. Sulphur is melted in a melting pit by means of heating coils, heating media being steam. The molten sulphur is stored in a liquid sulphur storage tank after passing through filters. The molten sulphur is fed to the sulphur furnace; complete combustion takes place which gives rise to a SO_2 concentration of about 11.5%. The heat of combustion is removed by a waste heat boiler where steam (approximately 60 Ton/hr) is produced.

The gas cooled to a temperature of 420ºC is fed to a reactor having 4 catalyst beds. After third pass, the gas enters an intermediate absorber; next, gas passes through the fourth bed after getting cooled to a temperature of 170ºC in economizer. The cooled gas enters the final absorber where SO_3 is absorbed by 98.5% sulphuric acid. The remaining gas flows from the absorber through high efficiency filters and demisters, located in the upper section of the absorber to eliminate acid spray mist. The acid concentration in both the intermediate and final absorbers is maintained by the addition of process water.

(SAP-C):

Solid Sulphur is fed to a melting pit where melting is accomplished by passing of steam through stream coils immersed in the pit. For removing the impurities from sulphur, liquid sulphur is passed through a leaf or plate type filter. Filtered sulphur is stored in a storage tank. To avoid solidification of sulphur, all the pipe lines carrying liquid sulphur are steam jacketed. Liquid sulphur is pumped to a combustion chamber though 4 nos sulphur gun with high pressure to produce sulphur dioxide. Through mixing of dry air with the atomized results in a complete combustion. The secondary air feed maintains a SO_2 concentration of

about 11.5% by volume at the out let of the furnace. This corresponds to a theoretical combustion temperature of about 1131 ^{0}C.

For heating up the furnace and converter catalyst beds, the HSD is burnt. For heating purpose, a start up heat exchanger is provided at the exit of the waste heat boiler. The hot flue gas generated by the HSD oil in the furnace leaves the boiler at about 550 ^{0}C and enters the tube side of startup heat-exchanger. On the shell side of this start up heat-exchanger, cold air delivered by main air blower is heated up to approximately 440 ^{0}C. The hot air then enters the converter beds. The flue gas at the exit of start-up heat exchanger is vented to atmosphere through a flue gas stack.

The SO_2 gas leaving the sulphur combustion furnaces are cooled down to approx. 430 ^{0}C in the waste heat boiler. In this boiler, saturated steam of approx. 62 Kg / cm^2 pressure is generated, which is superheated in the super heater. SO_2 from the furnace is fed to the converter at about 11.5% concentration. The converter is an insulated, vertical cylindrical unit divided in five layers of beds, separated form each other by gas tight bottoms. The V_2O_5 catalyst required for conversion of SO_2 to SO_3 is arranged in these four beds. The gas passes through the 1st three beds and heat exchangers successively when about 95% of SO_2 gets converted to SO_3.

The SO_3 gas leaving 3rd bed at 463 ^{o}C is then cooled to approx. 269^{o}C in the tube side of Cold inter pass. The gas is then further cooled to approx 166^{o}C in Economizer-3B and then enters the steam injection chamber where LP steam from LP condensate tank was added to raise temperature upto 257 ^{o}C and then it enters HRS tower which has 2 stages, where in 1st stage it is absorbed by 99.1% H_2SO_4 acid and in 2nd stage it is absorbed by 98.5% conc. Sulphuric acid from FAT pump tank. After HRS tower, the gas is heated to approx. 430 ^{o}C by passing through the shell side of the cold inter pass and hot inter pass before entering the 4th bed. Exit gas of 4th bed of the converter goes through super heater 4B to reduce temperature to 425 ^{o}C, again it goes through 5th bed after leaving 5th bed at the temp. of 427 ^{o}C is cooled to 135 ^{o}C in economizer 5A/5C and super heater 5A before entering the final absorber where the balance SO_3 is absorbed by 98.5% H_2SO_4. The existing gas passes through high efficiency

candle filters located at the top of the absorber to eliminate acid mist in the gas which is discharged to atmosphere through a stack of height 120 mtr.

The concentration of acid is maintained at 98.5% in drying tower and final absorption tower by controlling the quantity of water to be mixed with the acid, and acid circulation in HRS 1st stage is maintained at 99.1% by addition of feed water in HRS diluter. The circulating acid from the HRS tower was passes through HRS boiler where LP steam was generated with 10.5 Kg / cm^2 then acid goes to Drying tower and Final absorption tower through heater and preheater. Final absorber bottom comes back to final absorber pump tank and then pumped through water-cooled shell and tube acid coolers to DT pump tank. The final product from DT pump tank goes through water cooled plate type heat exchanger to offsite.

The basic reaction steps in the production of Sulphuric Acid are outlined below:-

$$S + O_2 \longrightarrow SO_2 + \text{heat}$$

$$SO_2 + 1/2O_2 \longrightarrow SO_3 + \text{heat}$$

$$SO_3 + H_2O \longrightarrow H_2SO_4 + \text{heat}$$

The acid concentration in both the intermediate and final absorber is maintained by the addition of process water/DM water.

Phosphoric Acid Plant (PAP):

The 1400 MTPD single stream Phosphoric Acid (PA) Plant is based on Dorocco Di Hydrate Process of M/s Jacob International Inc. of Florida along with Hindustan Dorr Oliver Ltd. Bombay. Wet grinding process is adopted where rock phosphate is fed to ball mill through extractor weigher where wet grinding slurry of 67-69% solids is prepared. In the ground rock hopper, a dust scrubber is provided to entrap the dust coming out of the dust hopper.

From the ball mill, the rock slurry is pumped to the product tank. The slurry containing 67-69% solids from product tank is fed to the reactor at first and third agitator point. Concentrated sulphuric acid having 98.4% concentration and recycle phosphoric acid are fed to the reactor. The reaction slurry proceeds through reaction section and underflows into the vacuum cooler feed compartment where degassing takes place and the slurry is then pumped to the vacuum cooler. Defoamer is added to the reactor to inhibit the formation of foam/froth.

The slurry is cooled down in the vacuum cooler by maintaining a vacuum of 150-300mm Hg absolute by evaporation of water. A barometric condenser and vacuum jet system remove the vapours. The slurry from the vacuum cooler flows down the reactor to filter feed tank through a vertical seal by a vacuum cooler tank. Filter feed is distributed on a horizontal filter through feed box, where phosphoric acid is separated from gypsum. The cake in the filter is given four successive washes by a filtrate of 12% P2O5, heated pond water and a final wash. The de- watered cake after fourth wash is removed, slurried and pumped to the gypsum pond. Air that passes through the cake is disengaged from the filtrates in the filtrate recovery system and passes through the filter condenser where gas is cooled and vapours condensed. The pond water used in the filter condenser is discharged through the pond water tank.

The scrubbing system provides a preliminary pond water quench to cool the vent gases. The gases are then scrubbed in the first stage in a cross flow packed bed scrubber using cold pond water. The gases then pass through a second packed bed, which reduces the emission below 0.0058 kg flourine per tonne of acid. A mist eliminator eliminates droplet entrainment. Acid from filter is pumped to a clarifier. The clarifier overflow goes either to a product acid tank or to the evaporator as required. The sludge from the clarifier is either recycled to the clarifier or to the reactor or transferred to the DAP plant. Concentration of the acid, whenever necessary is carried out in the evaporators. The concentrated acid overflows from the flash chamber through a barometric condenser. The non-condensable are removed by a vacuum jet system in condenser operating for the cooling water system.

Di -Ammonium Phosphate/NPK Plant (DAP/NPK):

DAP and NPK plant is based on Dorocco Granulation Process consisting of four identical streams and has a capacity to produce 5000 MT per day. The main raw materials are phosphoric acid, ammonia, sand (as filler) and Defoamer (procured from Fertibon). Phosphoric acid (42/54%) and anhydrous ammonia are pumped from storage tanks to pre-neutralizers (PN Reactor) reaction takes place as a result of which DAP and mono-ammonium phosphates are formed. The slurry contains 80% solids and is pumped to rotary granulators where further ammonia is fed to convert mono-ammonium phosphate to di-ammonium phosphate in a mole ratio of 1.8.

The recycle material along with the filler mixed in the fines conveyors are fed to the granulators. Wet DAP granules flow by gravity to rotary dryers where they are dried in a co-current stream of hot air. The dried granules are screened for size separation in double deck vibrating screens where oversized and undersized material are sent back to the system by means of fine conveyors. The product falls into the product compartment of the screen hopper and is withdrawn through product coolers and dispatched to product storage (50000 MT capacity) or direct to the Bagging Plant as required.

The wet process system consists of scrubbing and reaction sections. Scrubbers, which are venturi cyclone type, handle the ammonia and dust bearing fumes and gases evolved from the pre-neutralizer, granulator, drier and dust systems. The scrubbing medium for the three scrubbers is recirculated phosphoric acid solution. The fumes and gases from dryer and fume scrubbers are forced by respective fans to a tail gas scrubber whereas gases and fumes from pre neutralizer granulators, and coolers are scrubbed and exhausted to atmosphere through the fume stack.

Zypmite:

Handling, Storage and proportion of raw materials : Different raw materials (like phospogypsum ,Dolomite or Iron slag ,micronutrients all in solid form) are taken from raw material storage using pay loader and are stored in different silos .A fixed quantity of each raw material is drawn from the silo through a dynamic weigh belt feeder and is fed to a paddle mixer.

Mixing of raw materials: Designed quantities of different raw materials are fed to a paddle mixer wherein they are thoroughly mixed. Mixed Raw materials along with recycle material are fed to a Rotary Drum Type Granulator by Bucket elevator.

Granulation: Adequate quantity of water is sprayed in the drum. Due to moistening and rolling action of the material in the drum, granules are formed . The granule size depends upon the speed and size of the granulator, amount of water sprayed and the residence time of granules.

Drying :

In the drier, the granules are lifted to the top of the drum by means of lifters and then they fall to the bottom by gravity . A transverse current of hot mixture of air and flue gases flow continuously from one end of the other end and takes away the moisture from the falling granules . The hot current of the air and flue gas mixture is generated by an oil fired furnace and a blower. The hot and dried granules coming out of the drier are fed to cooler.

Cooling : The out let material of drying section is at high temperature and it cools down by rotary cooler and is cooled by blowing of air .

Segregation and Recycling: Two screen wherein undersize and oversize granules are separated and recycled to the Granulation Drum for reprocessing. (Oversize granules are crushed using Chain Mill). The granules in the size range of 1mm to 4mm are passed on for packing.

PACKAGE BOILER WATER SOFTENING

- Charge process water to cation exchange softener (any one) and allow the water to pass down wards through the resin column.
- Output of the softener is allowed through a flow meter to Deareator installed at a height of 10m. for Deareation purpose before feeding the soft water to boiler drum.
- When Deareator is filled with 80% water open the deareator outlet valve and allow the soft water to come to the boiler feed water common suction header.
- Open suction and discharge feed check valves for any one of the feed pump and allow the water to go to the drum by gravity / running the feed pump.
- Fill up the boiler drum up to 75%, fill up the log sheets at regular intervals.
- HSD day tank is to be filled up with HSD (up to 80%) before start up by running the HSD transfer pump (No. 1) available for package boiler in HSD handling system.
- Charge the HSD to the HSD feed pump suction header by opening day tank outlet valves and common valve located in suction header.
- Open the air vent valve to release the air in the pipelines and close the valve when oil comes.
- Allow the oil to pass through the suction strainers to one of the F.O. injection pump suction pipe.
- Open both the suction and discharge valve of the injection pump.
- Fill up the log sheet at regular intervals.

[SAME PROCEDURE IS TO BE FOLLOWED UP FOR F.O.]

PACKAGE BOILER SOFTENER REGENERATION:

The unit is isolated for regeneration when it has delivered it's specified output or the treated water quality is not satisfactory.

Ensure 540 liters of 30% (V/V) brine solution is prepared in a brine tank.

(A) **BAKE WASH**

- Open backwash outlet valve (V4) fully.
- Open and adjust back wash inlet valve (V3) so as to maintain level of water at

WASH marker as the orifice board in the drain sump.

- Continue back washing for 5 minutes or till the effluent is clear.
- Close V3 and V4 valves.

(B) **BRINE INJECTION:**

- Open rinse outlet valve V5 fully.
- Open brine inlet valve V6.
- Adjust ejector water flow in such a way that flow should be 1.62 m3 / hrs.
- Open and adjust ejector suction valve to maintain level at BRINE marker on the orifice board in the drain sump.
- Required quantity of brine solution will be ejected in 20 minutes.
- Then close ejector suction valve and after 1 or 2 minutes close brine inlet valve V6.

(C) **FINAL RINSE**

- Open inlet valve V1 and adjust rinse outlet valve V5 to get 3.54 m3 / hrs.
- And check level of water in the sump at RINSE marker on the orifice board.
- Continue rinsing for about 1 hrs.
- If quality is satisfactory close rinse outlet valve V5 and open softener outlet valve V2 as required.

PACKAGE BOILER START UP:

- Flue gas damper of the boiler is to be opened first.
- Blow down valves, stop valve, flue gas outlet damper of stand by boiler are to be closed.
- Switch on the supply of control panel.
- Check the boiler inter locks, control on burner and boiler safety.
- Run the F.D. fan and purge the furnace for 5 minutes at least to expel out any unwanted gases prior to boiler light up.
- Start the fuel injection pump and keep it under circulation (1st with HSD) and maintain the required oil pressure and temp (15 kg / cm2) and maintain pressure for furnace oil at 20 kg / cm2 and temperature 850C (min.)

- Switch on the ignition spark, firing will take place and ignition spark will go off.
- For initial firing run the boiler on low-firing to raise steam pressure to 50 psig. in 2 hrs. time stop for one hour with air vent bleeding till steam come out. Then run boiler on HIGH firing after 100 psig and raise pressure to 150 psig in 4 hrs.
- After the pressure is built up open stop valve of boiler slowly. Main steam valve is to be opened gradually to warm up steam line.
- Then connect boiler to process steam load.
- First charge steam to deareator and F.O. storage / day tanks, to get the required temp (1050C & 600 c respectively).
- When required temp of F.O. achieved change over in fuel firing is to be done (i.e., HSD to F.O.) and boiler is to be kept in continuous firing with F.O. net with HSD.
- Dose Na2SO3 / Hydrazine and phosphate chemicals for boiler water treatment as per required.
- Fill up the log sheet at regular intervals

HRS BOILER:

STARTING OF HRS BOILER:

- Verify that the HRS boiler level controller (5LIC – 1839) is in service, and set to control at 0 mm (approximately 50% of gauge glass).
- Close the block valve to the blowdown sample cooler upstream of the continuous blowdown valve.
- Verify that there is cooling water flowing through the boiler blowdown sample cooler.
- Verify that both bottom drain (intermittent blowdown) valves are open.
- Open the block valve and cross-over valve from the bottom drain line to route flow through the boiler blowdown sample cooler.
- Close the inlet flow control valve to the HRS boiler blowdown flash tank.
- Verify that the automatic boiler drain valve (5XV – 1842) is closed.
- Open the sample cooler outlet flow control valve.

- Verify that there is now a flow through the sample cooler.
- Verify that the conductivity indicator (5CI – 843) is in service.
- Take a sample of the water flowing out of the sample cooler, and have the lab confirm the conductivity shown on the indicator (5CI-1843).
- Verify that the steam outlet valve from the steam separator is open and the back pressure controller (5PIC – 1835) is in manual and closed.
- Open the steam separator steam vent valves (5HIC – 1838 and the manual valve).

HRS Boiler Operation:

The HRS boiler is a kettle boiler with ZeCor-310MT U-tubes, carbon steel shell, and separate steam purifier vessel. The acid flows through the tubes with water/steam on the sheliside. Normal operating pressure in the boiler is 10.55 kg/cm2g. The acid enters the boiler at about 227°C (5Ti—1830) and leaves at 200 °C (5Ti-1831). Both these points have high and high-high temperature alarms. A high-high alarm condition on either of these temperature indicators will activate interlocks I-81, which stops dilution water flow to the HRS diluter and opens the water bleed valve; I-90, which shuts down the steam injection system; I-91, which stops strong acid crossflow; and I-92, which stops sparge air flow to the HRS diluter and opens the air bieed valve.

Back pressure controller 5PIC-1835 controls the steam pressure in the HRS boiler. The normal set point for 5PlC-1835 is 10.5 kg/cm2g. A small portion (approximately 10-20%) of the HRS steam is used by the acid plant's Sulphur system. The balance of the steam generated in the HRS boiler flows to Owner's
10 kg/cm2g header.

5HlC-1838 and Interlock l-84 operate a steam vent valve (5HV-1838), located downstream of the boiler outlet block valve at the exit of the steam purifier. During normal operations, this valve is kept closed. It is only opened during startup, shutdown, and emergency procedures. 5HV-1838 is opened and the back pressure control valve (5PV-1835) is closed by interlock I-84. Another vent valve parallel to 5HV-1838 is provided to supplement flow to atmosphere during startup.

The boiler water level should be maintained slightly above the top of the tubes. Unlike fire tube boilers in a typical high pressure steam system, no thermal damage will occur to the HRS boiler if the tubes run dry on the steam side. However, it is highly desirable to maintain the boiler at the normal level to minimize fouling and maintain good steam purity and heat transfer. 5LlC-1839 automatically controls the boiler level. The normal set point for 5LlC-1839 is approximately +100 mm above the kettle centerline or 0 mm as indicated on the DCS. Visual confirmation of the level is observed with a gauge glass, which should be at approximately 50% level. 5LlC-1839 is provided with high, low, and low-low alarms. High level is alarmed by 5LAHH-1840. Low-low level in the boiler will activate interlocks l-81, which stops dilution water flow to the HRS diluter and opens the water bleed valve; l-90, which shuts down the steam injection system; l-91, which stops acid crossflow; and l—92, which stops sparge air flow to the HRS diluter and opens the air bleed valve. Stopping dilution water flow will decrease the heat build-up in the acid system. When this occurs, the plant operators must quickly restore boiler level or shut clown the plant.

Reducing the heat generation in the tower will reduce HRS steam production in a controlled manner. This is accomplished by decreasing plant rate. HRS boiler outlet steam flow is indicated by 5Fl-1837.

In the event of an emergency when it is desired to quickly stop the production of HRS steam, the HRS circulating pump can be stopped, but this will trip the main compressor (Interlock l-1), shutting down the plant. If an acid leak is suspected in the boiler, the emergency trip button (5HS—1820 A or B) can be engaged.

Boiler water quality should be checked once per shift. Chemical additions and blowdown rates should be adjusted to meet the water quality specified by the Owner's water treatment specialists. The chloride level in the boiler blowdown must not exceed 10 ppm Cl as high chloride levels cause stress corrosion cracking in stainless steel.

The continuous blowdown valve on the boiler should be set to maintain the desired water quality. A side stream from the continuous blowdown lines is routed to an HRS

boiler blowdown sample cooler, and the conductivity of the blowdown leaving the cooler is indicated (5Cl-1843) with a high alarm.

The boiier should be manually blown down at least once per day or as directed by plant supervision. The boiler is blown down by slowly opening the manual block valve ahead of the emergency blowdown valve (5XV-1842). The boiler can be blown down until the low level alarm (5LICL-1839) is activated.

An HRS atmospheric boiler blowdown tank and blowdown valve (5XV-1842) are provided to rapidly evacuate contaminated water from the boiler shell in the event of an emergency (activation of l-87). Under normal operations, this system receives the continuous and intermittent blowdown from the HRS boiler. The emergency blowdown system can be initiated in the following three ways:

- Operator pushes emergency trip button (5HS-1820 A or B).
- Low-Iow acid concentration to the first stage (5ASLL-1815A/B).
- Acid temperature increase or water outlet temperature higher than acid inlet temperature across the HHS boiler or heater.

Operation of High Pressure Steam System during the Initial Heat-up:
Open the outlet block valve at the high-pressure superheater 1C. Set the superheater outlet steam temperature controller (3TIC-1401) to control at 482deg.C.

Verify that the waste heat boiler level controller (3LIC-1370) is in service, and set to control at the normal operating level. Verify that the boiler low-low level interlock is in service (3LSLL-1371).

Close the waste heat boiler non-return and steam drum steam outlet block valve. Fully open the steam drum vent valve. Open the bypass valve around the battery limits block valve in the superheated steam import/export line to equalize the pressure on both sides of the block valve. Then open the block valve and close its bypass valve.

During the initial start, when the steam drum pressure (3PI-1376) increases to about 3kg/cm2 g and a strong steam plume is visible at the vent, the boil-out procedure can

be started. Perform boil-out procedure per the boiler vendor's instructions and/or the Owen's water treatment representative's instructions.

After the boil-out and flush are complete, refill the boiler. Restart the fuel fire in the Sulphur burner, and raise the boiler pressure to about 3kg/cm2 g. Then close the steam drum vent valve and open the non-return and the outlet block valves. Continue the heat-up schedule.

General

The high pressure steam system consists of economizers, superheaters, a waste heat boiler, and a steam drum. Process heat is recovered into boiler feed water and high pressure steam. The nominal steam conditions at the export header are 63.2 kg/cm2g and 482°C.

The temperature of the S02 gas from the sulfur burner is higher than the required temperature for optimum conversion. The gas is cooled in the waste heat boiler which recovers the surplus heat as high pressure (HP) saturated steam. The gas temperature out of the boiler is controlled by a gas side bypass. The boiler steam temperature is a function of the boiler steam pressure.

In the converter, the conversion reaction produces heat, and the gas temperature rises across the catalyst bed. The gases must be cooled to improve the yield of the sulfur dioxide oxidation in the next catalyst pass. Gases leaving the first converter pass flow to superheater 1C where they are cooled by heating the HP export steam leaving superheater 4B. The Pass 2 inlet gas temperature is controlled in the proper range by bypassing a portion of the steam flow around superheater 1C.

Hot gases leaving the third pass of the converter are cooled by sending them through the cold interpass heat exchanger and economizer 3B. The gas temperature from economizer 38 can be adjusted, by bypassing HP boiler feed water around the economizer, to prevent drip acid formation that is normally associated with variable hydrocarbon content in sulfur feed.

The gas stream leaving the fourth pass of the converter is cooled in superheater 4B by superheating steam from superheater 5A. Superheater 4B gas outlet temperature is automatically controlled by the steam bypass.

The gas stream leaving the fifth pass of the converter is cooled in the combination superheater /economizer. The first section is superheater 5A where the gas is cooled by superheating steam from the waste heat boiler. The gas then flows to economizer 5C and economizer 5A where it is cooled by HP boiler feed water. The gas temperature from economizer 5A can be adjusted to prevent drip acid formation normally associated with variable hydrocarbon content in sulfur feed.

Gas leaving economizer 5A enters the final absorbing tower.

The economizers operate in series (economizer 5A, economizer 3B, and economizer 5C), and the hot BFW is routed to the steam drum.

The superheaters operate in series (superheater 5A, superheater 4B, and superheater 1C).

A small portion of the high pressure steam exiting the superheaters is used in the turbine drives of the IP and HP boiler feedwater pumps, and the balance of the superheated HP steam is exported to the Owner.

Temperature Control

(1) Economizers

Manual water side bypasses are provided on economizer 5A and on economizer 3B to control the outlet gas temperature from each economizer. There is no water bypass around economizer 5C. The temperature of the gas leaving economizer 3B is indicated by 5TI—1800 and shouId be about 166°C. The temperature of the gas leaving economizer 5A is indicated by 4TI-107O and shouId be about 135°C. The bypasses should be adjusted to prevent overcooIing of the process gases and formation of drip acid in the economizers. If drip acid is forming In the economizers, increase the outIet gas temperatures by opening the water side bypass valves.

The normal temperature profile in the economizers is expected to be:

	Gas Side °C	Water Side °C
Economizer	236 In	106 In
Section 5A	135 Out	146 Out
Economizer	269 In	146 In
Section 3B	166 Out	197 Out
Economizer	355 In	197 In
Section 5C	236 Out	241 -242 Out

Care must be exercised to maintain the temperature in these ranges at all times and all production rates. The boiler feedwater inlet to economizer 5A must be kept above 105°C by the deaerator operation. The outlet gas temperature from economizer SB must be kept above 165°C to prevent the formation of drip acid. Routinely open the gas side drains to determine if any drip acid is being formed.

Under normal conditions at rated capacity, the water side bypass should be closed or nearly closed. At turndown conditions, approximately 30-60% of the boiler feedwater flowing to economizers 5A and 3B will be bypassed. When manipulating the water bypass of the economizers, slowly open the valve to avoid large changes in water flow around the economizers.

At turndown conditions, boiling can occur in the tubes and can eventually lead to equipment damage due to steam hammer or severe scaling. Particular attention to the temperature profiles should be taken in these situations, and the possibility of steaming should constantly be watched. See
Appendix 2 for troubleshooting guidelines around the economizers.

(2) Waste Heat Boiler

The pressure of the steam drum sets the temperature of the steam leaving the boiler steam drum. See Section 11.3.3 for details on pressure control.

The control of the gas temperature leaving the waste heat boiler to the Pass 1 of the converter is described in Section 8.

(3) Super heaters

The steam temperature of the export steam is automatically controlled by 3TlC-1401, which regulates valve 3TV—1401 in the steam bypass line around superheater 5A.

During start-up, low rate, or off—strength operations, the heat balance in the plant can shift, putting more heat to the steam passing through the superheater. The following steps can be taken to keep the steam temperature in the 482°C design range.

- Reduce Pass 1 inlet gas temperature. This may lower overall conversion.
- Raise Pass 2 inlet gas temperature. This may lower overall conversion.
- Raise gas strength, if below the design value of 11.5% S02. This will generate more steam flow.
- Lower the economizer gas outlet temperatures, if possible. This will generate more steam flow.

Pressure Control

(1) HP Steam Header

The normal operating pressure in the waste heat boiler is 66.7 kg/cm2 g. The boiler pressure is indicated on the DCS with a high alarm (3PI-1376). Two safety relief valves are provided on the boiler. Each of the three superheaters is provided with a safety relief valve.

Steam pressure to the Owner's header, downstream of superheater1C, is automatically controlled by 3PIC-1403, which regulates 3PV-1403A in the steam line to the Owner's header, and if needed, 3PV-1403B in the vent line to the atmosphere.

Waste Heat Boiler Steam Drum Level

The waste heat boiler level is automatically controlled (3LlC-1370) by the cascade flow control of boiler feedwater through flow valve (3FV—1356) in the boiler feed water line to economizer 5A. This is a three-element controller and the controller also receives signals of the steam flow from the boiler and the water flow to economizer 5A. The level controller is provided with high-high, high, low, and low-low level alarms.

if the water level drops too low, the boiler tubes could run dry and severe damage could result. On low-low level, the sulfur burner feed pumps will trip and the plant will be shut down while there is still enough water in the steam drum to keep the tubes submerged while the plant cools.

An electrode column level indicator is also provided on the waste heat boiler (3Ll-1371), with redundant high-high, high, low, and low-low level alarms. The electrode column has the same interlock trips as the level controller. An interlock bypass switch (3LHS-1371) is provided in the field for use when blowing down the column. Be sure that the bypass switch has reset after the blowdown is complete.

To avoid entrainment of water from the boiler into the steam lines, it is important that the water level in the boiler be maintained at a point close to the normal operation level (usually the center line of the gauge glass). See the vendor's operating instructions for the level set points in the steam drum.

CAUTIONS

- When manually adding water to a hot steam drum, proceed cautiously as the water will swell as it heats and may raise the level above the high level.
- Never add water to the steam drum if the water level has dropped below the gauge glass. Cool the plant down before refilling the boiler.

Deaerator

The deaerator is a direct contact deaerating boiler feed water heater. Design is based on an inlet water temperature of 40 °C. Low pressure 1 kg/cm2g steam is used for heating. Outlet water temperature is 105 °C. The boiler chemical feed system provides water treatment chemicals to the deaerator, and to the high and intermediate pressure boiler feedwater pumps.

The pressure in the deaerator is automatically controlled by pressure controller 3PIC-1307 controlling valve 3PV-1307. The valve controls the steam addition to the deaerator.

The water level in the deaerator is automatically controlled by level controller 3LIC-1300 and operating level valve 3LV-1300. The valve controls the amount of demineralized water added to the deaerator.

Boiler Feedwater Pumps:

The HP boiler feed water pumps supply water from the deaerator to the waste heat boiler, through economizers 5A, 3B, and 5C. The IP (HRS) boiler feed water pumps supply water from the deaerator to the HRS boiler through the HRS heater, and also to the HRS diiuter and LP flash tank.

The plant is equipped with two HP boiler feed water pumps and two IP boiler feed water pumps. One of each is operating, and the other is on standby. The normally operating pumps are driven by a steam turbine. The standby pumps are driven by an electric motor. The standby pumps should only be used when the main pump fails. Boiler feed water flow is normally regulated by water demand (level control) in the boilers.

The discharge pressure instrumentation of the each boiler feed water pump system includes a low pressure switch (3PSL-1324 for the HP pumps, 3PSL-1334 for the IP pumps). On low discharge pressure, the standby pump is interlocked to automatically start so that water flow to the boiler is not interrupted.

Steam Purity

The steam produced in this plant is used by Owner. The steam should contain less than 0.05 ppm total dissolved solids. Steam purity should be monitored on weekly or monthly schedule.

A system is provided for determining the purity of the steam at the exit of the waste heat boiler. The operation of the steam sample cooler is essentially the same as that for boiler water.

Manual Blowdown

The boiler should be blown down manually at least once per day at times specified by

the Supervisor.

Two seat-and-disc type blowdown valves are installed in the blowdown line. When manually blowing down the boiler, the valve nearest the boiler should be opened first and closed last. With the valve closest to the boiler fully open, slowly open the outer valve. The valve farthest from the boiler should be opened as much as possible without blowing down more than specified by the Supervisor. When finished, close the outer valve and then the inner valve.

These blowdown valves may be opened rapidly, but they should be closed gradually to avoid possible water hammer if closed too rapidly. Care must be taken to close these valves tightly, as even a small amount of leakage may upset the boiler water analysis and will quickly ruin (erode) the valve.

The electrode and the gauge glass water columns and its gauge glass should be blown down each day. These should not be given a hard blowdown. The gauge glass water column should be blown down before the gauge glass in order to prevent etching of the glass. Before blowing down the electrode water column, bypass lnterlocks I-1 and I-5 (3LHS—1371). Be sure to reset the bypass switch (3LHS—1371) after the blowdown is complete. Several plants have destroyed their boilers when these interlocks were bypassed and not reset properly.

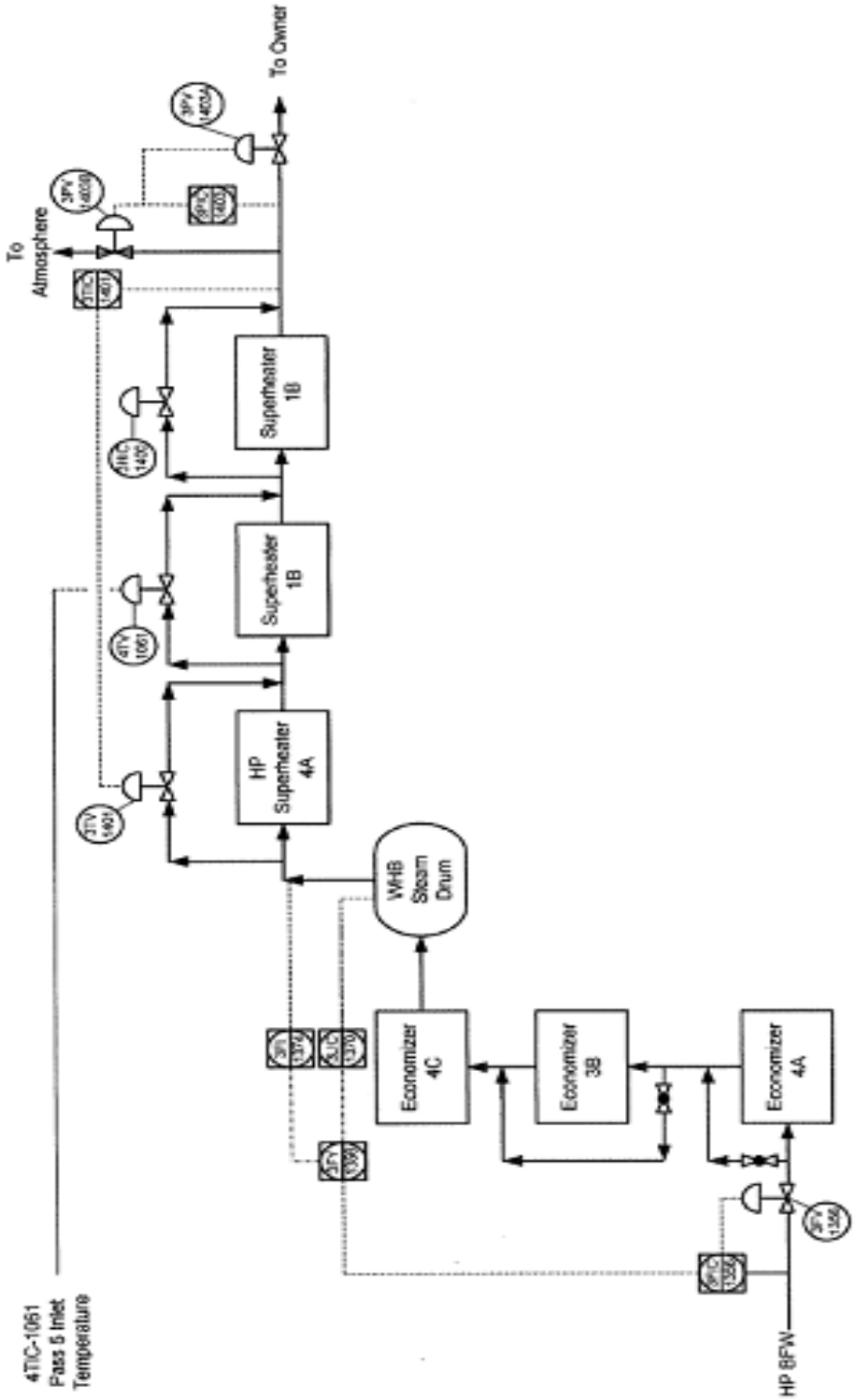
Continuous Blowdown

The continuous blowdown valve must be regulated to hold the total solids in the boiler water within the specified limits. When solids content in the boiler water is high, the continuous blowdown valve should be opened a little so that the next test will be within prescribed limits. When the total solids are low, the continuous blowdown valve should be closed a little.

The continuous blowdown is routed to the pressurized blowdown flash tank. The flash steam is sent to the deaerator. The remaining blowdown from the pressurized tank and the manual blowdown can be discharged to the atmospheric blowdown flash tank. The flash steam from the atmospheric blowdown tank vents to atmosphere and the

excess blowdown water flows to the Owner's trench at grade level.

Steam System Control Loops:



Captive Power Plant:

Captive power plant with two units of 16 MW capacities has been installed as a standby arrangement supplied by M/s BHEL. This plant runs on furnace oil. DM Water Plant has been installed to meet the boiler feed water requirement of CPP boilers as well as sulphuric acid plant boiler.

Two Storage tanks (HSD/FO) of capacity 56 KL and 230 KL are located at CPP and one HSD storage tank of capacity 300 KL is located at 5 MW DG Set.

Captive Berth at PPT:

PPL has a private berth facility at Paradeep Port. It is Equipped with 14 m draft capable of bringing in Panamax sized vessels carrying 50,000-60,000 MT. Two automatic ship unloaders - one capable of unloading 1000 MT and the other 600 MT of solid cargo and 500 MT of liquid cargo per hour.

There is a marine unloading arm for ammonia and hose facility for unloading phosphoric acid and sulphuric acid through pipeline from port to plant site. In addition the system incorporates a 3.1 km length cross-country conveyor of 2000 MTPH capacity for receiving rock phosphates and sulphur at plant site.

Other Storages:

Chlorine Storage:

Chlorine is stored in tonners at Water Treatment Plant. The factory stores a maximum of 9nos tonners at a time. One tonner is equivalent to 930 kg. This chlorine is in liquid form and is being used to treat the water. The empty cylinders replaced by the filled ones on regular basis.

Sulphur Storage:

The sulphur is stored in solid state to the extent of 45000 MT. It is stored in an enclosed shed called silo. Sulphur is being transported from jetty through the conveyors. The storage shed approximate dimensions are 150 m x 41.5 m x 10 m. The

stored sulphur is transported through conveyors to SAP.

LPG Storage:

LPG cylinders are stored in a Godown. There are total 102 cylinders for industrial use and 153 cylinders for domestic use. Godown has approximate dimensions of 12 m x 8 m x 4 m.

Process Water:

Two process water tanks are installed to cater to the needs of process water from the plant as well as supply of firewater. In the process water pump-bay a jockey pump is installed to keep fire hydrant pressure. There are one diesel driven and two motor driven fire water pumps. Pumps are kept connected so that they could be started immediately whenever necessary. Firewater inlet to the pumps is at a lower level than the process water intake. Process water clarifier is provided which takes water from a huge water reservoir, before pumping.

1.3. Process Flow Diagram of PPL

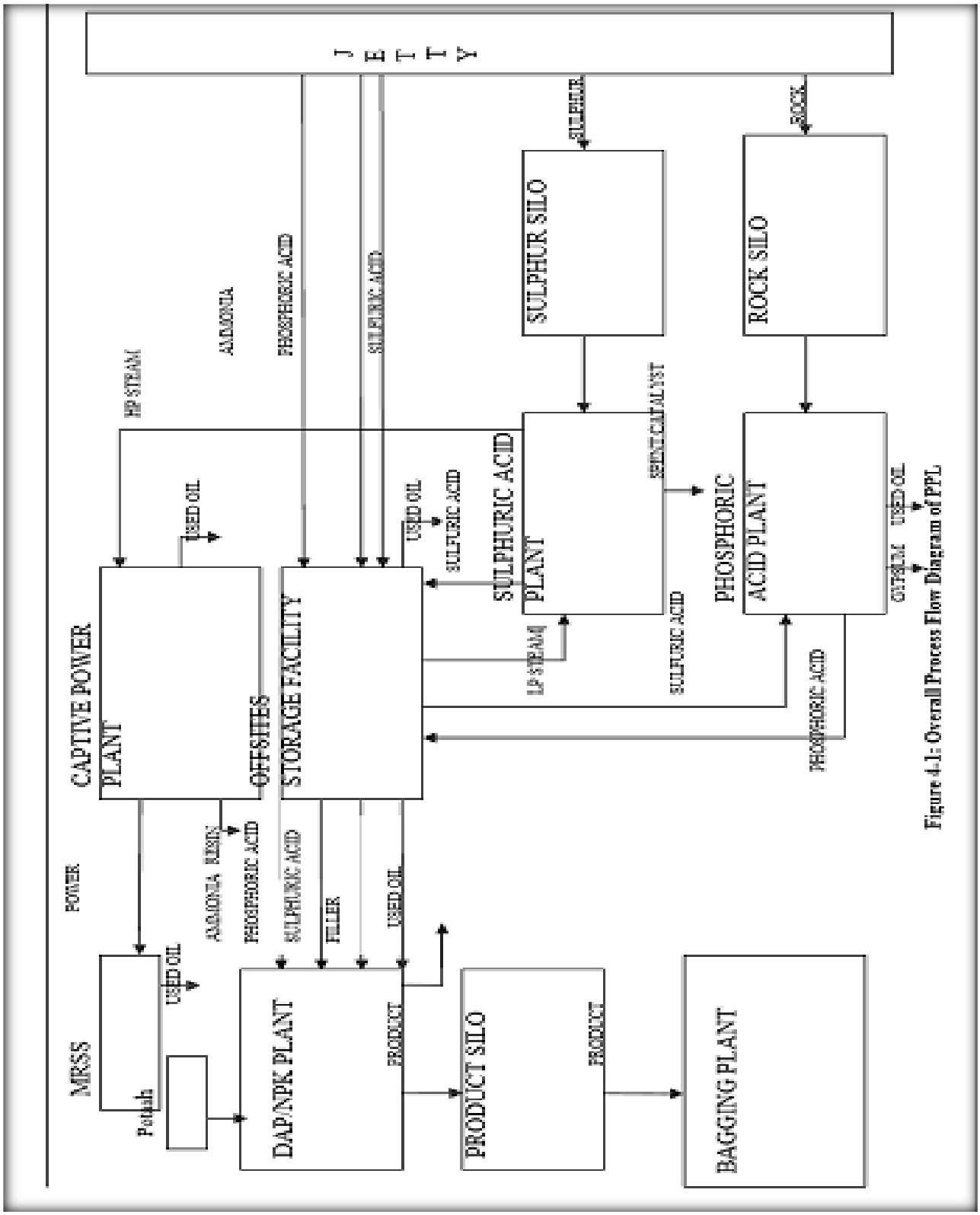


Figure 4.1: Overall Process Flow Diagram of PPL

2. Organizational Setup:

The Chairman of the Company, Shri Saroj Ku Podar, heads the organization. His office is located in Delhi.

Group, Managing Director, Shri. Sunil Sethy is next to in the hierarchy and he is the Occupier of the company. His office is located in Delhi.

At the site, Shri Ranjit Singh Chugh, Chief Operating Officer, site heads the facility and Factory Manager of the company. His office is located at Plant, site Paradeep

The organizational chart is shown in Figure 2.1.

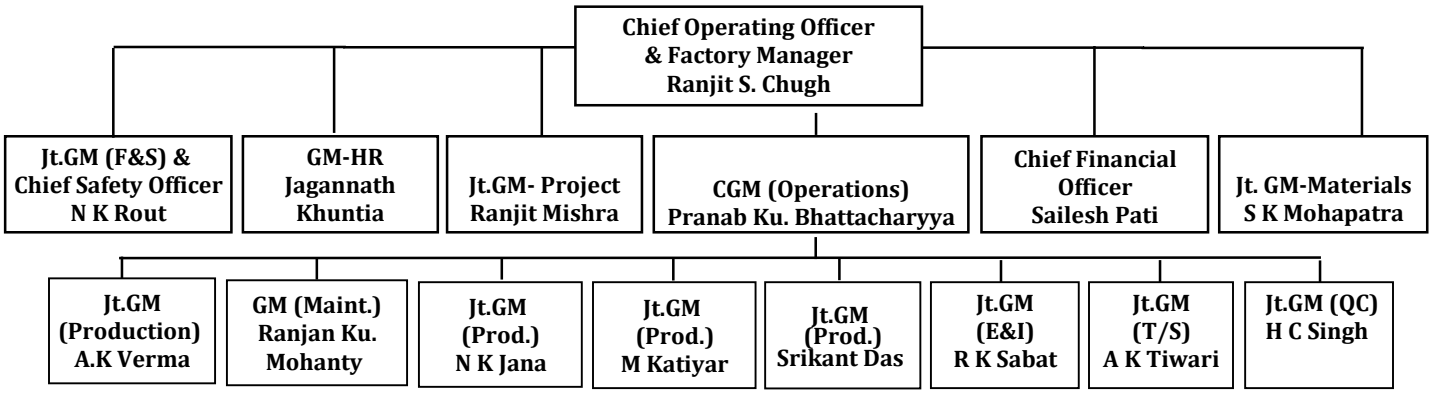
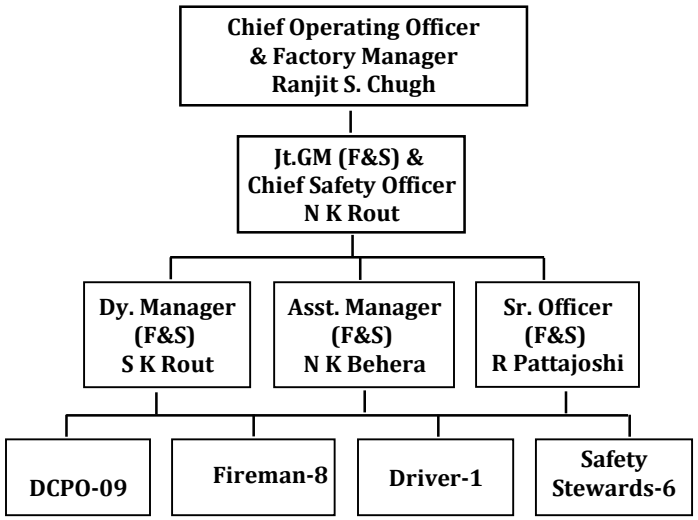


Figure 2.1

Organizational Setup of Fire & Safety Section:



3. Man-power break up: (Shift wise):

Manpower as per license is 3500 and shift wise distribution of employees and contact worker is as follows:

SHIFT	PERIOD	NUMBER OF EMPLOYEE	
		PPL EMPLOYEE	CONTRACT WORKER
A	6AM to 2PM	147	257
B	2PM to 10PM	132	192
C	10PM to 6AM	118	132
GENERAL & OFFICE	8.30AM to 6.00PM	249	687
OFF & LEAVE		94	-
Total - 2008		**740**	**1268**

4. Product & by-product:

Sl. No.	**Product**	**Quantity/Annum**	**Storage Type**
1	DAP and NPK	13,00,000 MTPA	Above the ground
2	Sulphuric Acid	13,80,000 MTPA	Above the ground
3	Phosphoric Acid	3,00,000 MTPA	Above the ground
4	Captive Power	47258.75 KW	-
Sl. No.	**By-Product**	**Quantity/Annum**	**Storage Type**
1	Phospo Gypsum	16,00,000 MTPA	Above the ground

5. Raw materials quantity & type of storage:

Sr. No	Name of the Substance	Maximum Storage Capacity	Storage Description	Height (Mtr) , Dia Ø (Mtr)
1	Ammonia	50,000 MT	Liquid ammonia is stored in 5 atmospheric storage tanks (above the ground), each having a capacity of 10,000 MT totaling to 50,000 MT. Of this, 8000MT (safe operating volume) is allow to kept in a tank.	H - 19 D -34.6
2	Phosphoric Acid	60,000 MT	There are six rubber lined conical steel tanks of 10,000MT capacity each. (above the ground)	H-10.5 D- 2.8
3	Sulphuric Acid	45,000 MT	There are five numbers of sulphuric acid storage tanks four of each 10,000 MT capacity and one of 5000 MT capacity. (above the ground)	H- 10.5 D- 28
4	Chlorine	8370 KG	The factory stores a maximum of 6 out of 9 tonners at a time of 930 kg capacity each.	Kept in Toners
5	High Speed Diesel	457 KL	The factory stores a maximum of 274KL, taking 60% of the total capacity of 6 tanks. (above the ground)	1).H - 4.5 D - 4.5 2) H – 2.9 D- 8.05
6	Furnace Oil	3830KL	There are two heavy fuel oil (FO) storage tanks each having a capacity of 1800KL. The factory stores a maximum of 2298 KL (taking 60% of the total capacity of 2 tanks). (above the ground)	H- 10 D- 16
7	Sulphur	45,000MT	Storage Silo	L - 150 W - 41.5
8	Rock Phosphate.	90,000 MT	Storage Silo	L - 205 W - 41.5
10	RMS (Sand Storage)	10,000MT	Storage Silo	L - 129.6 W - 30

6. Hazardous substances used as raw material showing their tank/container capacity and mode of storage:

Name	Number of Tanks	Type of storage	Shape	Height in Meter	Length in Meter	Dia.in Meter	Volumetric capacity in M^3	Maximum storage Capacity		Maximum one time inventory	
								MT	KL	MT	KL
Ammonia tank	5	Above the ground	Cylindrical	18		33	15395 M^3	10000 MT/Unit		8000 MT /Unit	
Phosphoric Acid Tank	6	Above the ground	Cylindrical	10.5		28	6144.52 M^3	10,000		9,000	
Sulphuric Acid tank	4	Above the ground	Cylindrical	10.5		28	6002.474 M^3	10,000 MT/Unit		9,000 MT/Unit	
Sulphuric Acid tank	1	Above the ground	Cylindrical	9		30	2740 M^3	5,000 MT		5,000 MT	
Chlorine tonners	5	Above the ground	Cylindrical		2.085	0.76	0.943 M^3	1MT/Unit		0.93 MT / Unit	
HSD Storage Tank (Offsite)	1	Above the ground	Cylindrical		5.35	1.99	16.631 M^3		15 KL		15 KL
HSD Storage Tank (SAP)	1	Above the ground	Cylindrical		8.05	2.9	53.144 M^3		50 KL		50 KL
HSD Storage Tank (CPP)	1	Above the ground	Cylindrical	7.5		7.5	331.17 M^3		300 KL		300 KL
HSD Storage Tank (CPP)	1	Above the ground	Cylindrical	4.5		4.5	71 M^3		56 KL		56 KL
HSD Storage Tank (Store)	1	Underground	Cylindrical		4.576	1.98	14.08 M^3		14 KL		14 KL
HSD Storage Tank (Store)	1	Underground	Cylindrical		6.25	2.11	21.88 M^3		22 KL		22 KL
FO Tank (Offsites)	2	Above the ground	Cylindrical	10		16	2009 M^3		1800 KL		1500 KL
FO Tank (CPP)	1	Above the ground	Cylindrical	6.5		7.5	287 M^3		230 KL		230 KL

7. Hazardous Substances generated:

Sl. No.	Hazardous waste	UNIT	Permissible disposal method	2018-19
1	Sulphur Muck	MT	Engineering Landfill	279635
2	Spent Catalyst	M3	Engineering Landfill /disposed to registered recyclers	73
3	Used Oil	Kl	To authorized recycler	13.74
4	Oily Cotton (WASTE CONTAINING OIL)	Kg	Incineration in HW incinerator	12
5	Oily Sluge.	Kg	Incineration in HW incinerator	0
6	Drain & ETP sludge	MT	Engineering Landfill	2531.4
7	Spent Resin from DM Plant	Kl	Engineering Landfill	7.2
8	Acid residue obtained during cleaning of storage tanks	MT	Engineering Landfill	244557.4
9	PAP Reactor Scales	m3	Engineering Landfill	39
10	Discarded containers or barrels	Nos	Kept under shed and disposed to authorized dealers	579
11	Sludge from Waste Water Treatment plant /Effluent Collection tank sludge	M3	Engineering Landfill	0
12	Cooling tower sludge	M3	Engineering Landfill	0

8. Identification of hazards:

This facility stores and handles ammonia and chlorine, which are highly toxic in nature. Also, it stores and handles Sulphuric acid, Phosphoric acid, Sulphur and combustible materials like HSD and FO. Also we have seven numbers of Boilers (Four numbers waste heat Boilers & two numbers package Boilers).

9. Identification of Most Credible Hazards:

The following Elements or Events that can lead to a Major Accident

Accidental Release of Ammonia	**1**. a	due to over pressurization of atmospheric ammonia storage tank
	b	during shipment of Ammonia from Jetty to Plant
	c	during Ammonia loading in Tanker & while being transported on road
	d	due to leakage in Ammonia pipe line
Accidental Release of Chlorine	**2**. a	due to catastrophic failure of chlorine tonner
	b	due to leakage in chlorine tonner nozzle
	c	due to leakage from distribution header / pipe line
Fire/explosion in HSD/Fuel oil tank	**3**	due to HSD / Fuel oil storage tank failure followed by fire in dyke
Boiler	**4**	due to explosion of Boiler

The selection of maximum credible Accident scenarios is generally done on basis of engineering judgment and expertise in the field of Risk Analysis.

Consequence Analysis:

Software PHAST can do effective calculations and give the distance up to which radiation, overpressure and toxic dispersion effects would be experienced. These models are designed by scientific research and field experiments to portray the dispersion pattern of escaped fluids and the effects produced by them on catching fire or getting exploded. Such models are used by different industries to find out approximately the probable damage consequences due to release of toxic/flammable fluids or at least to depict the possible intensity of overpressure and radiation effects on the surroundings.

Modeling offers multiple advantages in assessing the magnitude and consequences of such accidents. The following aspects are important for the mathematical treatment of release cases and the resulting accident scenarios:

- Release condition
- Dispersion effects
- Fire and explosion effects

The thermal radiation would be maximum at the centre of the fire and starts falling down as one move away from the seat of fire. Effect of this on human and environment should be known to us to understand the damages that can be caused by fires in the storage and handling system.

Impact distances for small, medium and large leaks and catastrophic rupture cases have been incorporated in this study as per the frequency contribution and wherever the damage distances are significant as compared to other leak sizes.

Toxic Hazards:

The following Table 8-1 explains about the distances of the toxicity level (in fraction).

Toxic Lethality Distances (in meters) for Toxic Hazards

S.N.	Area	Material	Event	Toxic Lethality Level (in fraction)			
				1	0.1	0.01	0.001
1	SAP	SO2	25 mm Leak from Converter_SO2	*	28.3	36.3	41.5
2	Jetty	Ammonia	25 mm Leak from Unload Arm_NH3	50	270	450	650
3	Storage Tank	Ammonia	25 mm Leak from Tank NH3	60	360	600	860
4	Storage Tank	Ammonia	Rupture of Tank _NH3	*	1480	1850	2270
5	Pipeline	Ammonia	25 mm Leak from Pipe Line from Tank to Pump_NH3	40	320	520	720
6	Pipeline	Ammonia	25 mm Leak from Pipeline from Pump to DAP_NH3	*	380	480	650
7	Pipeline	Ammonia	25 mm Leak from Pipeline from feed line to PN Reactor_NH3	*	360	450	600
8	Tonner	Chlorine	8 mm Leak from Tonner Cl2	*	170	270	370
9	Tonner	Chlorine	Rupture of Tonner Cl2	*	340	440	550
10	Storage Tank	Sulphuric Acid	Rupture T2 H2SO4	21.5	22	22	22

* The following values are not shown as the contours are not visible due to their Negligible values.

DESCRIPTION OF HAZARDOUS CHEMICALS AT PLANT SITE (PUT IN SEPARATE APPENDIX)

- **Chemicals (Quantities and Toxicological Data):** Please see Annexure 2 for MSDS of chemicals stored and handled.
- **Transformation, if any, which may occur:** No transformation could occur for the chemicals concerned.
- **Purity of hazardous Chemicals:**

S.N.	Substance	Transformation	Purity
1	Chlorine	Stable	99.99%
2	Ammonia	Stable under normal conditions. Releases nitrogen and moisture on burning.	99.99%
3	Fuel Oil	Releases CO_2 and water vapor on burning.	Commercial
4	Sulphuric Acid	Vapors from hot acid causes moderate irritation of eyes and respiratory system.	98%
5	Phosphoric Acid	Toxic fumes of oxides of phosphorus are the hazardous combustion products.	52%

HAZARDOUS PROPERTIES OF MAJOR CHEMICALS:

S. N.	Name of Chemical	Hazardous Properties
1	Ammonia	Both Toxic and Explosive Toxic: Fatal Conc. = 5000 - 10000 ppm IDLH = 300 ppm STEL = 35 ppm TLV = 25 ppm Explosive: LEL= 16% UEL= 25%
2	Chlorine	Toxic/poisonous gas Fatal Conc. = 1000 ppm after a few breaths. IDLH = 10 ppm STEL = 3 ppm TLV = 1 ppm
3	LPG	Flammable and explosive LEL= 1.9% LEL= 9.8%

4	MS/FO/HSD etc.	Flammable/Explosive LFL/LEL = 0.6 – 1.3 % UFL/UEL = 6 – 7.5 %
5	Phosphoric Acid /Sulphuric Acid	Corrosive

LIKELY TO BE DANGEROUS TO THE PLANT

- The ammonia release may not adversely affect the plant structures and equipment.
- Chlorine release may result in corrosion of equipment and piping which could get exposed to leaking chlorine.
- Fires in the fuel oil tank may affect nearby equipment due to high radiation. However, major damages are not expected.

DETAILS THE EFFECTS ON STORAGE OF HAZARDOUS SUBSTANCE

Stress and strain caused during normal operation: installation of all equipment in the entire complex has been done as per good engineering practices. The plant operations are subjected to continuous monitoring in the form of surveillance and checks in the control room and locally in the form of hourly inspection tours through the plants to check for the normalcy in working conditions.

The instrument department checks alarms and trip settings of instruments. Critical equipment are checked during every start up. Complete logic system is tested by simulation during shut down.

Preventive maintenance schedule is drawn based on predictive maintenance technique. The predictive maintenance schedule includes vibration monitoring of rotary equipment, condition monitoring of anti-friction bearings, thickness measurement of equipment and piping.

The pressure vessels are inspected and tested to meet the statutory requirements. The pressure safety valves are also tested.

All care has been exercised in design of equipment since corrosive and toxic materials are handled. The process equipment has been designed according to relevant international codes and standards.

Material of construction has been selected based on the nature of chemicals handled and other parameters like temperature.

Well trained and experienced persons carry out maintenance and repair work in accordance with relevant codes and standards.

No adverse effect is envisaged due to stress and strain caused during normal operation considering all the above factors.

- **Fire and Explosion inside the plant and effect, if any, fire and explosion outside**

S.N.	Area	Material	Event	Radiation Distances (m)		
				37.5 kW/m²	12.5 kW/m²	4 kW/m²
1	Sulphur Silo	Sulphur	A3_Fire from Sulphur Silo_Sulphur	*	*	55
2	Pipeline	Fuel Oil	G1_Rupture of Unloading Pipeline to FO Tank_FO	169	215	331
3	Storage Tank	Fuel Oil	G2_Rupture of T2 FO Tank_FO	*	260	450
4	Storage Tank	LPG	D1_100 mm Leak from Cylinder Storage_LPG	238	178	142
5	LPG Godown	LPG	D2_Fire in Godown Cylinder Storage_ LPG	249	130	30
6	Storage Tank	HSD	H4_Tank on fire at SAP_HSD	*	*	24
7	Storage Tank	HSD	H5_25 mm Leak from T2 at SAP_HSD	13	25	35
8	Steam Header	Steam	I1_Rupture of Header_Steam	125	160	210

The major fire risk rests on the fuel oil storage tank having capacity of 1500MT. in case of catastrophic failure of the tank and the leakage of catching fire, the critical radiation level of 12.5kW/m² would be felt at a distance of 260 m. the farthest distance of flash fire is 450 m.

DETAILS REGARDING:

Warning, alarm and safety security systems

The plant has built-in safety features, which include the following:

- Fail safe instrumentation with trips and alarms has been incorporated in the plant design. Other mechanical safety hardware like pressure safety valves etc has been provided wherever required.
- Testing schedule is followed to test and calibrate alarms and trips for their accuracy.
- Color coding has been followed as under:
  - **Water : Sea Green**
  - **Air : Sky Blue**
  - **Steam : Aluminum Jacketed**
  - **Gases : Yellow**
  - **Oil : Light Brown**
  - **Fire hydrant : Red**
  - **Sulphuric acid : Dark Violet**
  - **Phosphoric acid : Green**
  - **Ammonia : Aluminum Cladded**
- There is full-fledged security department in the company. This department handles all matters connected with security. The role to be played by the security department during an emergency is detailed in the On-site emergency plan.

- **Alarm and hazard control plans in line with disaster control and hazard control planning, ensuring the necessary technical and organizational precautions**
- Electric sirens (2 nos) are installed in the factory premises for warning and alarm in the event of emergency. The Emergency alarm code is established & mentioned in 14.9.
- The hazards of chemicals handled in the plant and their remedial measures are circulated among the people residing in and around the plant through pamphlets and public address system.

- Sulfuric acid tank vent is fitted with silica gel breather for moisture absorption during air breathing. The dyke floor of phosphoric acid and sulfuric acid tanks is concreted to prevent ingress of acid in to the ground in case of spillage.
- Vibration monitoring, NDT, DPT and condition monitoring is carried out as per schedule.
- During turn-around all the critical vessels are opened for internal inspection.
- **Reliable measuring instruments, control units and servicing of such equipment**

The measuring instruments and control units are procured from reliable vendors.

- The measuring and control instruments are calibrated as per the schedule described by ISO 9001 and ISO 14001.
- The factory has an instrument department staffed with suitable qualified and experienced personnel to service and maintain the measuring instruments and control units etc.

- **Precautions in designing of the foundation and load bearing parts of the building**

All constructions have been designed and installed by reputed engineering organizations as per good practices. All required precautions have been taken regarding the designing of the foundation and load bearing parts of the buildings. The foundations have been designed suitable to the seismic Zone III.

- **Continuous surveillance of operations**

The plant is subjected to continuous monitoring in the form of surveillance and checks in the control room and locally in the form of hourly inspection tours through the plants to check for the normalcy in working conditions.

Continuous, intermittent and standby loads are identified and operating systems are suitably evolved through continuous observations of the various operations. Emergency equipment power supply are identified, listed and electrically configured to receive power from standby generators in the event of main power outage.

- **Maintenance and repair work according to the generally recognized rules of good engineering practices**

All maintenance and repair works are carried out as per good engineering practices. All shut down works are preplanned and requirement of spares etc are provisioned.

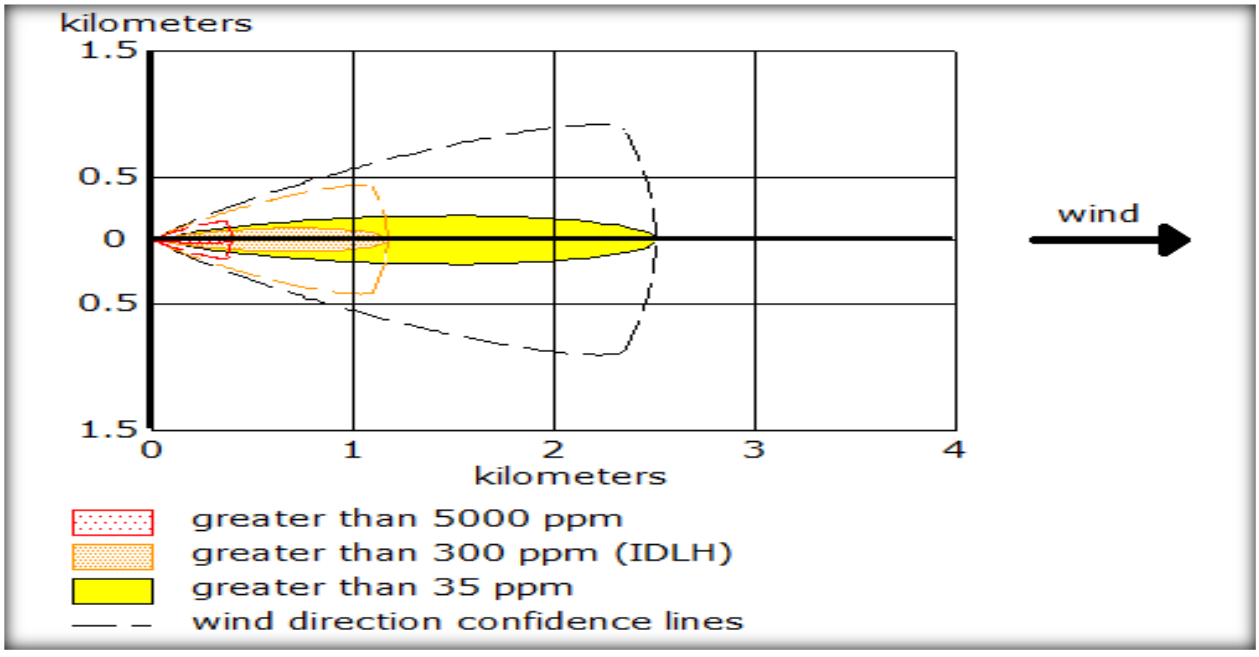
Predictive maintenance is carried out and on this basis, preventive maintenance schedules are drawn.

Most of the maintenance jobs are carried out in-house by trained and experienced maintenance personnel. Whatever required, some of the jobs are contracted out.

DISPERSION MODELLING:

Maximum Impact Distances/End point distance due to release of 6000 MT ammonia vapour:

Scenario and Modelled quantity	Concentration (ppm)	Distance
Catastrophic failure of ammonia refrigeration tank resulting in to instantaneous release when the protection system fails and/or during natural disasters like cyclone/high wind speed. Modelled quantity = 6000 MT (assuming the 60% release of 10000 MT tank)	5000 (fatal)	9.5 km
	300 (IDLH)	25.9 km
	35 (STEL)	> 50 Km
Major Leakage of Ammonia due to full bore rupture of ammonia transfer line Modelled quantity = 2700 Kg	5000 (fatal)	407 m
	300 (IDLH)	1.2 km
	35 (STEL)	2.5 km



Full bore rupture of transfer pipeline from Jetty to plant Ammonia Storage:

Chemical	Liquid Ammonia	
Pipeline Length	3.2 km	
Pipeline Diameter	400 mm	
Pressure	4.5 kgf/cm2	
Temperature	-33 deg. C	
Mass flow rate	500 MT/HR	
Release duration	5 minutes	
Modelled quantity	41.6 MT	
Atmospheric Stability	D Class (Neutral)	
Wind speed	4 m/s	
Concentration level	Fatal (5000ppm)	IDLH (300ppm)
Maximum downwind distance	719 m	2.8 km
Area likely to be affected	1.62 sq. km	24.61 sq. km

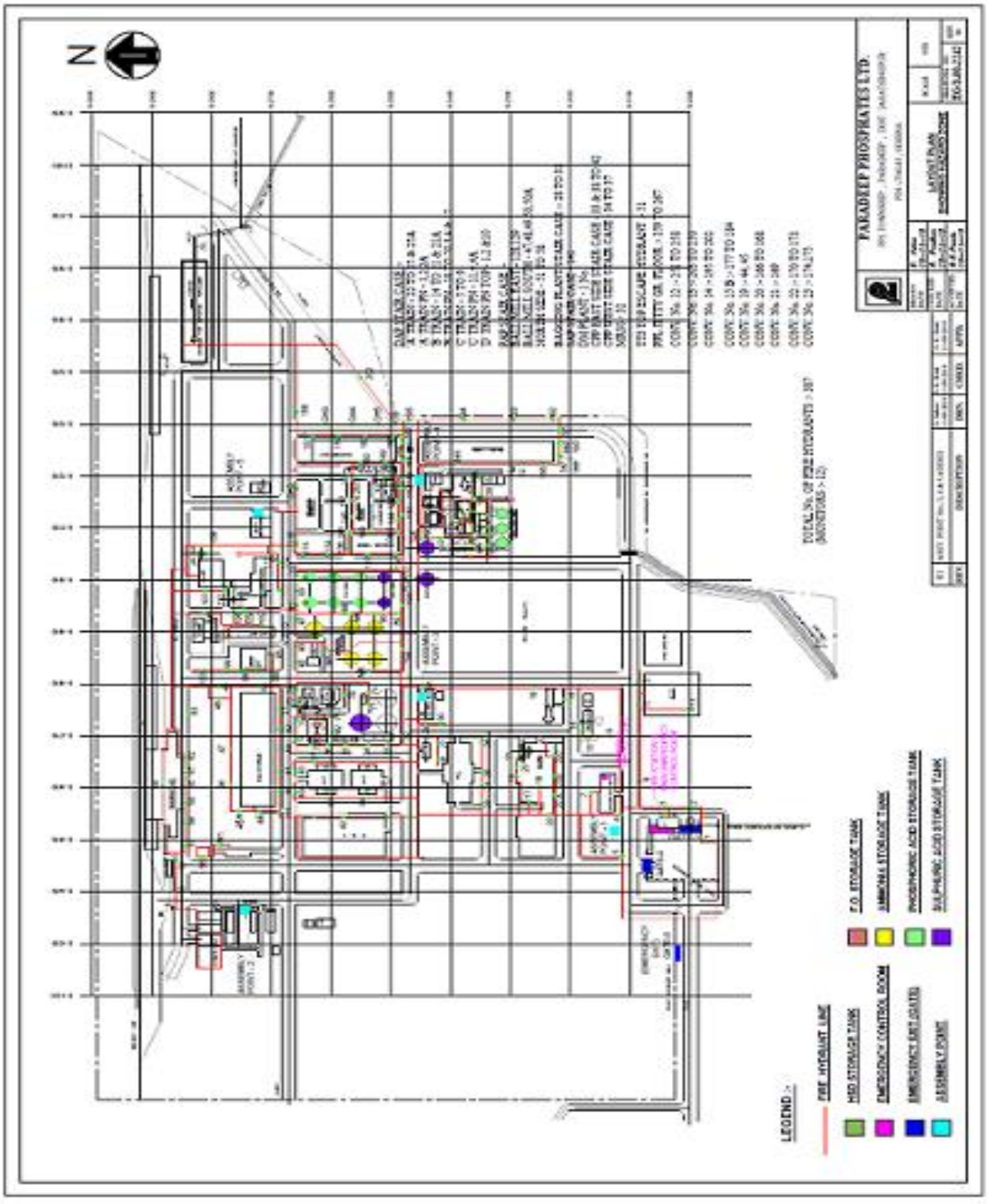
Consequence zones during accidental release of Ammonia from a tanker while being transported on road:

Chemical	Liquid Ammonia	
Inventory	15 MT	
Modelled quantity (assuming 75% release)	11 MT	
Pressure	12 bar	
Temperature	Ambient	
Atmospheric Stability Class	D Class (Neutral)	
Wind speed	4 m/s	
Concentration level	Fatal (5000ppm)	IDLH (300ppm)
Maximum downwind distance	684 m	1.9 km
Area likely to be affected	468 sq. km	3.61 sq. km

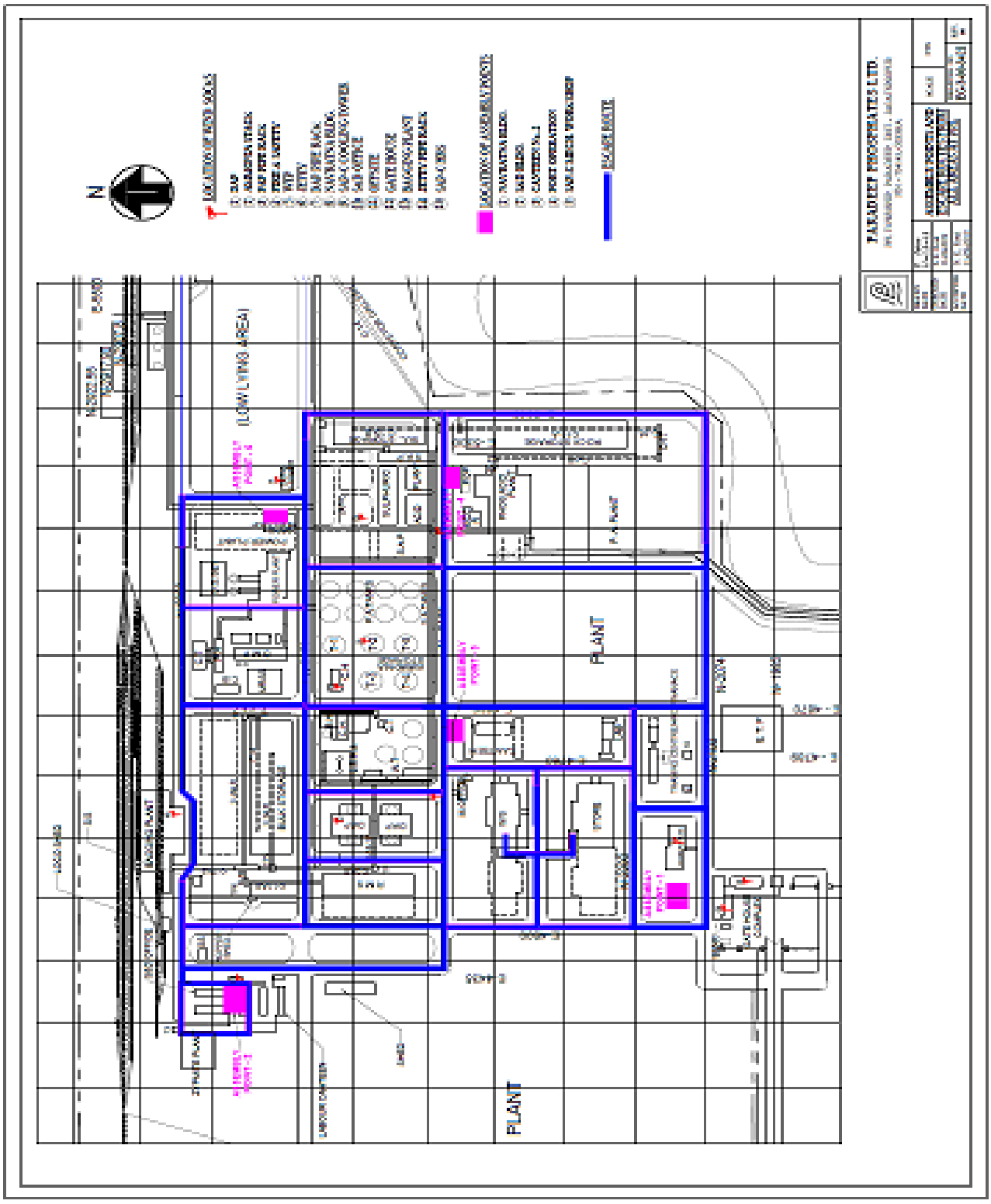
Release of Chlorine vapour due to catastrophic failure of a single Chlorine Tonner:

Chemical	Liquid Chlorine	
Inventory	900 Kg	
Modelled quantity	900 Kg	
Pressure	9 bar	
Temperature	Ambient	
Atmospheric Stability Class	D Class (Neutral)	
Wind speed	3 m/s	
Concentration level	LC50 (35ppm)	IDLH (10ppm)
Maximum downwind distance	1.5 km	2.6 km
Area likely to be affected	7 sq. km	21 sq. km

10. PLOT PLAN:


N
PARADEEP PHOSPHATES LTD.
LAYOUT PLAN
LEGEND :-
FIRE HYDRANT LINE
H.S.D. STORAGE TANK
EMERGENCY CONTROL ROOM
EMERGENCY EXIT (GATE)
ASSEMBLY POINT
F.O. STORAGE TANK
AMMONIA STORAGE TANK
PHOSPHORIC ACID STORAGE TANK
SULPHURIC ACID STORAGE TANK

Assembly Points & Escape Routes:



- **Risk Contours**

The risk contour in Figure 9-1 is obtained from Phast Risk and it shows the risk contours for risk levels of 10^{-3}/ average year and 10^{-4}/ average year. The maximum risk within the facility is estimated at 10^{-3} (red contour) fatalities/average year and the area where the pipeline carrying NH_3 to DAP Plant storage area appear to be exposed in this risk range.

Infrastructure:

Emergency Control Rooms:

- **Main Emergency Control Room: Fire and Safety office**
- **Alternative Emergency Control Room: Navratna Complex (Ground floor)**

The control rooms are well equipped with communication, emergency organization chart, dispersion details for loss of containment of ammonia and chlorine, telephone directory (updated), On-Site Emergency Plan document etc.

Assembly Points: Five assembly points have been identified and they are as under.

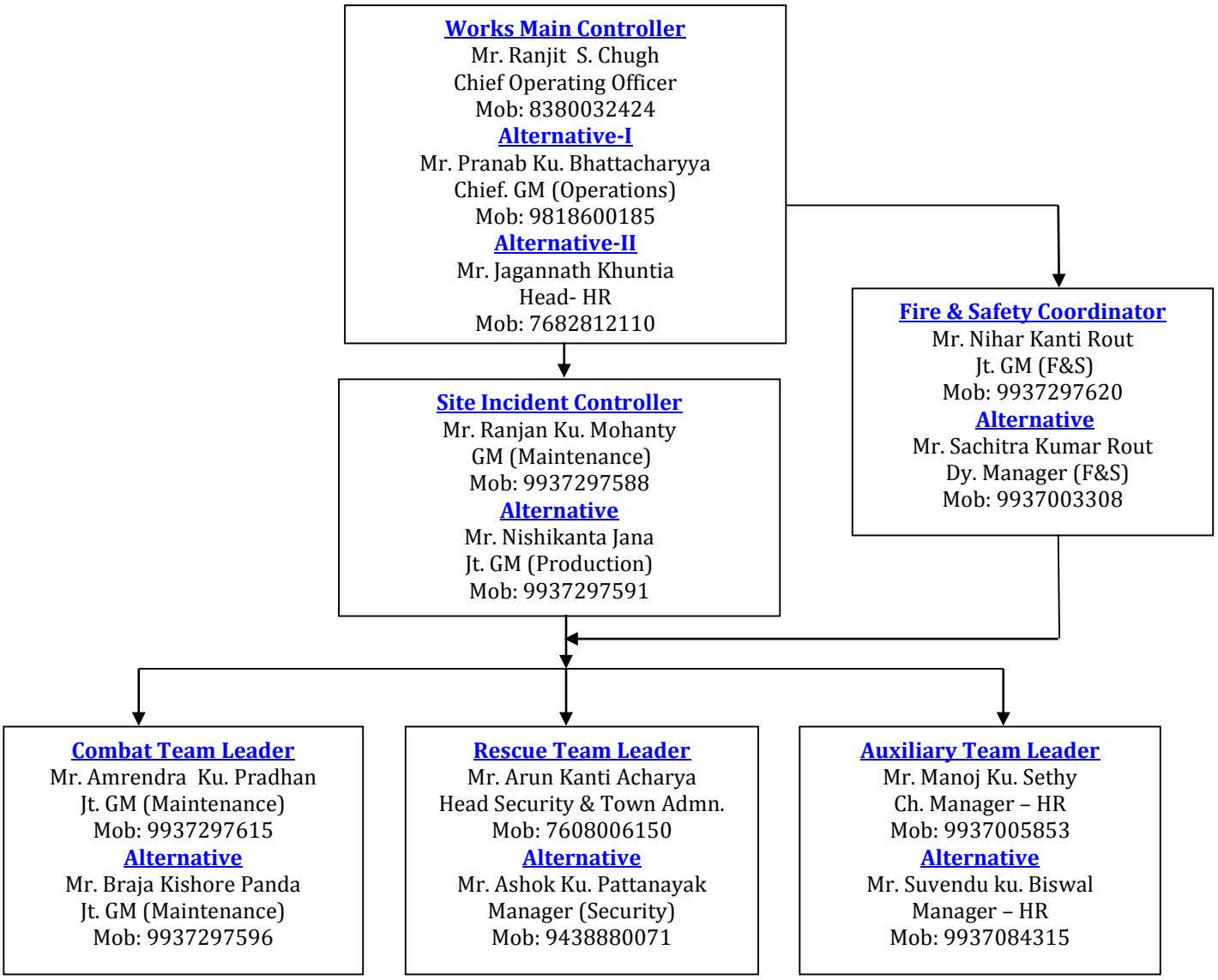
1. Gate house complex (near the main emergency control room)
2. Near S&D office (west side of Bagging plant)
3. Near Canteen No.-1
4. Near POP Control room
5. Near SAP-C Cooling tower

Evacuation Facility:

- Towards Gate House Complex, which is SSW of ammonia storage
- Towards Bagging plant, which is NNW of the ammonia storage

11. EMERGENCY COMMAND STRUCTURE:

The organogram should be drawn by appointing key personnel and defining shown details their specific duties which will be handy in an emergency. The number of co-ordinators at a location would depend on the manpower available in that specific location. However, three co-ordinators as detailed below will serve the purpose in general.



11.1. Emergency Command Structure and its Members

Rescue / Emergency Team and their Composition-

S No.	Team	Leader/Alternate Leader	Team Members
1	Fire Fighting, Safety Team	Jt. GM (Fire and Safety) Alternate: Dy. Manager (F&S)	Available Fire service, fire crew and safety personnel
2	Incident Control Team	Plant in charge (maintenance) of the affected plant Alternate: Jt.GM-Production/Shift Incharge	Available production personnel of the affected plant
3	Engineering Team	Jt. GM(maintenance) Alternate: Sectional Head (Mechanical) of the affected plant	Available maintenance personnel of Electrical, Mechanical, Civil and Instrumentation Sections of the affected plant.
4	First Aid and Medical Team	Chief Medical Officer Alternate: Manager (Medical Services)	Available medical and paramedical staff
5	Security, Communication and Rescue Team	Head Security & Town Admn. Alternate: Manager-Security	Available security personnel
6	Transport Team	Ch. Manager-HR Alternate: Manager (HR)	Available transport section personnel
7	Roll Call Team	Ch. Manager (HR) Alternate: Manager, (P&A)	Available time office personnel

Key Personnel of the Organization during Emergency

S.N.	Key Personnel During Emergency	Designation	Major Roles During Emergency
1	Works Main Controller	Chief operation Officer (COO) Alternate: I Chief GM -Operations Alternate: II Head - HR	Overall in charge for localization, control and mitigation of Emergency
2	Incident controller	General Manager (Maint.) Alternate: Jt.GM (Production)	Overall in charge for the incident control including Fire Fighting and Engineering activities
3	Combat Team Leader	Jt.GM (Maint.) Alternate- Jt.GM (Maintanance)	Over all in charge of the emergency response activities are promptly and properly activated
4	Auxiliary Team Leader	Ch.Manager (HR & IR) Alternate: .Manager-HR	In charge of all logistics activities including First Aid & Medical, Securities, Communication & Rescue, Evacuation, Transportation & Roll Call
5	Rescue Team Leader	Chief Security Officer Alternate: Manager -Security	In charge of Fire Fighting, Rescue and Safety activities
6	Leader (Incident Control Team)	Plant in charge ((Production) Alternate: Deputy Plant in charge (Production)	In charge of combat activities
7	Leader (Engineering Team)	Jt.General Manager (Maintenance) Alternate: Sectional Head (Mechanical) of affected plant	In charge of Emergency maintenance activities
8	Leader (First Aid and Medical Team)	Chief Medical Officer Alternate: Manager (Medical Services)	In charge of treatment of affected persons
9	Leader (Security, Communication and Rescue Team)	Head Security & Town. Admn. Alternate: Manager-Security	In charge of Security, Communication, Evacuation & Rescue activities
10	Leader (Transport Team)	Ch. Manger (P&A) Alternate: Manager (HR)	All transportation arrangements
11	Leader (Roll Call Team)	Ch. Manager (HR) Alternate: Manager (HR)	In charge of Assembly and Roll Call activities
12	Telephone Operator	Receptionist Alternate: Staff of Time Office	Communication to different key persons
13	Store Keeper	DGM (Materials) Alternate: Dy.Manager (Matls)	Issue of materials for emergency activities

12. Specific Role of Key Persons of Emergency Command Structure:

Works Main Controller:

- For On-Site Emergency Preparedness Plan (EPP), the Head Of Unit shall be the works main controller to co-ordinate the execution of the plan during an emergency or a mock drill. He is responsible for preparation / updation of the plan, getting approval from the District authorities / Factory Inspectorate; and its implementation in the hour of need. His responsibilities are -
- Assess the magnitude of the situation and ensure activation of EPP and its implementation
- Mobilise the Incident Controllers / Key Personnel and exercise direct operational control of areas, other than those affected.
- Declare danger zones and activate Emergency Control Centre.
- Ensure calling in Mutual aid members and District emergency agencies like Fire Brigade, Police and Medical authorities.
- Maintain a speculative continuous review of possible developments and assess these to determine most probable course of events and appropriate response.
- Ensure information to Area Office, Head Quarters, Police, Statutory authorities, District authorities about the magnitude of the emergency causalities and rescue operations.
- Ensure causalities are receiving required attention and their relatives are informed.
- Ensure accounting of personnel.
- Ensure issue of authorized statements to Press, Radio, TV etc., regarding the emergency and its possible impact on the surroundings.
- Authorize procurement of emergency material.
- Log important developments in chronological order and preserve material evidence for investigation. Direct isolation of power supply, plant shutdown, and evacuation of personnel inside the premises as deemed necessary.

- Ensure advice to Police, District authorities regarding evacuation of public in the near vicinity/vulnerable zone. Ensure raising the siren in EMERGENCY & All Clear Signal.
- When effects are likely to be felt outside, get in touch with District Authorities, who will take over the management and declare "Off-Site Emergency ".
- Control rehabilitation of affected areas on cessation of emergency.

Combat Team Leader:

- Ensure availability & use of required personal protective equipments for safe stoppage of the Operations; switching off main instruments, shut off valves on product lines; and isolation of affected area.
- Demarcate Danger and Safe zones by putting RED and GREEN flags.
- Mobilise the Fire fighting crew and direct the Fire Fighting operation.
- Effectively deploy manpower, both internal and external.
- Direct & utilize the Fire Brigade personnel.
- Arrange the replacement of various Fire Fighting squads with the Mutual and External aid members on need basis.
- Ensure/maintain sufficient pressure in the Hydrant mains.
- Assess water level in the storage tank/reservoir and plan replenishment. Monitor the requirements of Fire equipment and co-ordinate for procurement of spares.
- Arrange for flood lighting of the affected areas and dewatering of the Fire fighting area, if required.
- Arrange to remove and park the tank lorries (Bulk & Packed) to a safer place, as necessary.

Auxiliary Team Leader:

- Liaise with works main controller and other co-ordinators.
- Inform and co-ordinate with External agencies and Mutual aid members for agreed assistance. Direct them on arrival to the respective co-ordinators.
- In case communication means fail, send messengers to Mutual aid members/Emergency department. Co-ordinate with Police in controlling the traffic and mob outside the premises.
- Activate the medical centre and mobilise medical team. Arrange ambulance and transfer causalities to hospitals. Also co-ordinate with police in case of fatalities.
- Arrange for head count at the assembly points.
- Arrange procurement of spares for fire fighting and additional medical drugs/appliances.
- Monitor entry/exit of personnel in the premises. Permit only authorized personnel/vehicles inside the premises.
- Control and disperse crowd from the emergency site. Regulate traffic inside the location.
- Arrange food, beverages and drinking water for all those involved in execution of ERP in case the emergency prolongs.
- Communicate with relatives of persons injured/involved in fire fighting activities.
- Arrange evacuation of premises as directed by Works Main Controller.
- Co-ordinate with civil authorities for evacuating public from the danger zone and arrange for refreshments at the evacuation centre.
- Rush to the spot and assess the situation. Ensure raising the siren in EMERGENCY mode & announce the emergency on the PAS, if not done.
- Take overall charge of all emergency actions at the site and of the affected plant.
- Mobilize the available personnel, resources, facilities, Emergency Teams to the emergency spot and ensure that the emergency response activities are promptly and properly activated.

- Advise/direct/guide/coordinate the Incident Control Team, Engineering Team, Fire & Safety Team and other key personnel of the organization for the control of the emergency situation.
- Ensure safe stoppage of plant operation (if necessary) in co-ordination with the Woks Main Controller.
- Remain in the incident spot or the control room of the affected plant till the cessation of the emergency.

Rescue Team Leader:

- Rush to the spot and assess the situation.
- Mobilize adequate manpower, equipment, resources, etc for fire fighting and safety team.
- Coordinate with the Incident Controller and other emergency teams
- Render all necessary guidance to the site personnel on matters connected with fire and safety operation
- Arrange for sufficient extra equipment, accessories, etc for fire fighting and safety
- Shift the injured person to hospital by ambulance after providing necessary first-aid.
- To inform the Auxiliary team leader for necessary extra help from Mutual aid partners.

Resources (Internal/External):

The list of resources such as fire fighting system, personnel protective equipments, etc. available within and with local fire brigade and mutual aid members shall be listed and updated.

Mutual Aid:

Combating major emergencies might be beyond the capability of individual unit and it is essential to have mutual aid arrangements with neighboring industries. Mutual aid arrangements are to be worked out in the plan to facilitate additional help in the event of fire fighting or in rescue operation by way of rendering manpower, medical aid or fire

fighting equipments etc. To make the emergency plan a success, the following exchange of information is considered essential:

The types of hazards in each plant and fire fighting measures.

The type of equipment, that would be deployed and procedure for making the replenishment.

Written procedure which spell out the communication system for help and how it will be responded. This is also required to get acquainted with operation of different fire fighting equipment available at Mutual aid members and compatibility for connecting at users place.

Joint orientation programme for staff, joint inspection and mock drills.

13. Action plan in the event of an emergency involving the role of emergency command structure:

An On-site Emergency is caused by an accident that takes place in an Installation and the effects are confined within the premises involving only the people working in the unit. The on site emergency action plan outlined in this chapter defines the major steps to be taken by the personnel of the organization during major emergency. It details out the management system that would work at the time of the emergency and defines the major responsibilities and step-by-step duties of the key personnel of the organization.

The fire alarm system & procedure is described in 12.9

Communication team will handle all the emergency communication, to and fro as per the command structure.

Action Plan during General Shift Hours on working days:

The following plan gives a general description of emergency preparedness during general shift hours.

Step No.	Initiator	Action to take
1	The Person noticing the emergency	• Inform to control room who in turn will inform Fire, Safety, Ambulance Incident controller and Will main controller regarding the gas leakage and other emergency.
2	Works Main Controller (WMC)	• Rush to emergency site and observe the ongoing activities. • Takes stock of the situation in consultation with Site Incharge. • Move to "Main emergency control room" • Take decision on declaration of emergency and ask for emergency waling siren. • Decided on declaration of normally of emergency after combating of situation. • Ensure that the emergency operation are recorded chronologically
3	Site Incident Controller (SIC)	• Rushes to the emergency site and take over all charges of the situation • Start Fire fighting operation and close/isolate all the gases sources with combat team • Shutdowns the plants. • Arrange to evacuated the unwanted persons and call for additional helps. • Time to time passes information to the works main controller about the situation at site.
4	Combat Team Leader (CTL)	• Rush to the spot and assess the situation. • Mobilize the available personnel, direct/guide/coordinate the emergency and ensure that the emergency response activities are promptly and properly activated. • Finds out root cause of fire / gas leakage and took necessary action for preventing fire / gas leakage. • Start combating, shutdown equipments and takes step to extinguish fire /arrest the gas leakage. • Inform to site controller if completed the job and controlled the situation.
5	Rescue Team Leader (RTL)	• Rush to the spot and assess the situation. • Mobilize adequate manpower, equipment, resources, etc for fire fighting and safety team.

		• Coordinate with the Incident Controller and other emergency teams • Render all necessary guidance to the site personnel on matters connected with fire and safety operation. • Arrange for sufficient extra equipment, accessories, etc for fire fighting and safety • Shift the injured person to hospital by ambulance after provide necessary first-aid. • To inform the Auxiliary team leader for necessary extra help form Mutual aid partner.
6	Auxiliary team leader (ATL)	• Help to other team leaders • Find out the location, nature and severity of the situation. • Rush to main emergency control room. • Mobilize required personnel, accessories and finance for all logistics activities and direct the logistics team. • Inform about the emergency to statutory authorities depending upon the situation. • Seeks help of mutual aid partner and coordinate with Mutual aid partner to render their services if required. • Takes roll call to find out the missing peoples if any. • Arrange to inform the relatives of casualties • Takes care of visit of the statutory authorities to the emergency site.
7	Team Members	• Each of team members should follow the instruction of concerned team leader to mitigate the emergency.
8	Fire & Safety Co-coordinator	• Rushes to the site and coordinate the work between works main controller, site controller & leader of Combat, Rescue & Auxiliary Teams. • Mobilize the adequate manpower, equipment, resources, etc. for fire fighting and safety team. • Direct the Fire and Safety Team at the site • Coordinate with the Incident Controller and other emergency teams. • Render all necessary guidance to the site personnel on matters connected with Fire and Safety operation • Co-ordinate with external fire service personnel • Arrange sufficient extra equipment, accessories etc. for fire fighting and safety.

Combat Team Member (Engg)

i. Rush to the spot.

ii. Coordinate with the incident control team.

iii. Keep non-essential personnel away form the site.

iv. Cordon off the affected area.

v. Attend to urgent repairs.

vi. Mobilize additional manpower, equipment, etc as required.

vii. Be in constant touch with the incident controller and act promptly according to his instructions.

Auxiliary Team Member (First Aid and Medical Team)

i. Promptly render first aid to casualties.

ii. Arrange for stretchers.

iii. Arrange for immediate external medical attention.

iv. Inform the transport department for the transport of casualties to hospitals.

v. Ensure the availability of all first aid and emergency medicines, drugs and equipment.

Rescue Team Member (Security, Communications and Rescue Team):

i. Organize security, communication, evacuation and rescue arrangements.

ii. Security guards at the gate should close down the main and other gates and stop traffic through the gates except the emergency vehicle.

iii. Ensure unhindered movement of emergency vehicles through the gates and if possible inside the plant areas.

iv. Direct the non-essential personnel of the affected plant/likely to be affected to safe assembly points.

v. All available extra security guards should report to the security officer- those guards (extra) who are assigned for fire fighting should join fire fighting team.

vi. The guards who are assigned security jobs should do the following:

- Man all gates
- Direct external emergency service to the site of emergency
- Permit the entry of external emergency services, mutual aid partners, their vehicles etc.
- Stop entry of unauthorized personnel.
- Allow the emergency services like ambulance, fire tender etc to go through the gates without normal checks.

vii. Convey messages to key personnel and keep in touch with incident controller.

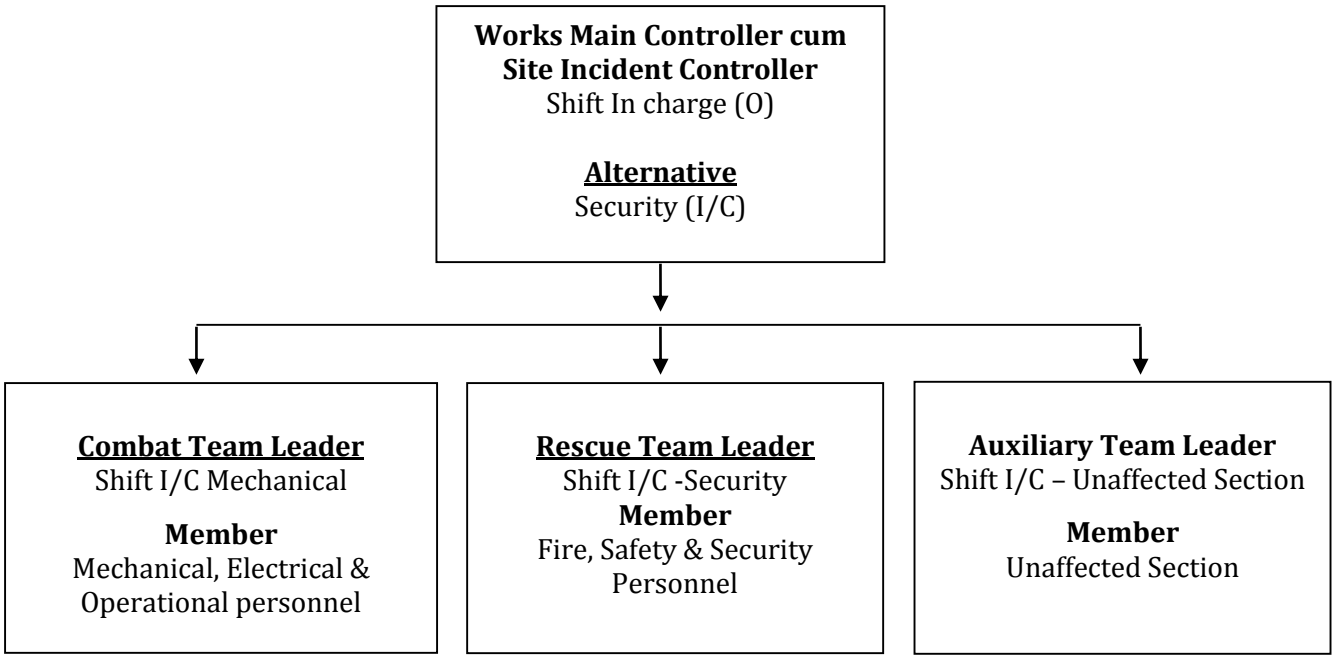
viii. Regulate the traffic/parking of vehicles other than emergency ones in such a way that they do not hinder emergency movements.

ix. Maintain law and order in coordination with police.

x. Report to Incident Controller as often as necessary

xi. Maintain record of casualties.

14. SILENT HOURS COMMAND STRUCTURE:



14.1. Action Plan during "Silent Hours"

Actions to be taken on hearing the siren or on coming to know of Emergency

Shift in charge of the affected plant

- Immediately find out the location, nature and severity of the situation.
- Arrange to give the respective siren & declare the state of emergency.
- Mobilize the available personnel and arrange immediate mitigation steps.
- Immediately call the required emergency services.
- Immediately inform incident controller and site controller.
- Instruct the main gate office to inform the other key personnel of the organization.
- Assume the role of Incident Controller and Site Controller till either of them arrives at the site.
- Draw the required personnel from other sections/departments.
- Hand over the charge to Site Incident Controller when either of them comes at site and leads the incident control team.

Shift in charge of mechanical crew of the affected plant

- Assume the role of Combat Team Controller till he comes. If necessary, draw the required personnel from other unaffected sections/departments.
- When Combat Team Controller (comes, hand over the charge to him and lead engineering team as per the emergency command structure till the arrival of team leader.
- Rush to the spot immediately on coming to know of the emergency and assess the situation and take over charge from the shift Incharge (P).

Auxiliary Team Leader

- Rush to emergency control room immediately on coming to know of emergency and assess the situation & take over the charge from shift Incharge (Production).

Works Main Controller/Site Incident Controller

- Rush to the spot immediately on coming to know of emergency.
- Take charge of site from the person who is acting in his place.

Other Senior Personnel of the affected plant (above the rank of shift in charge)

- Rush to the spot immediately on coming to know of emergency.
- Report to the person who is acting as Site Controller.
- Coordinate the plant shut down if required.

14.2 Emergency Response Procedures for the envisaged scenarios:

Actions to be taken in case of leak of ammonia gas

- PPE required compulsorily.
- If possible, arrest the leak by closing the required valves while taking all precautions.
- Stop the pumps.
- Spray water over the leakage for dilution, using fire hydrant system.
- Cover the spilled liquid ammonia by Hazmat foam or polyurethane sheets.
- In case of tank failure, carry inter tank transfer.
- Closed vent & drain system for ammonia.

- Nitrogen purging system and NH3 Flare stack system is used under extreme emergency.
- Fire hydrants network and fire monitors around the ammonia storage tanks.
- Barricade the area and evacuate non-essential personnel from the affected site.

Actions to be taken in event of big fire:

- For Small fires immediately inform control room on the telephone.
- For major fires, with the wailing siren sounding, the control room should be immediately notified and immediate evacuation should start.
- Immediately call fire service.
- Try to put out fire by means of appropriate extinguishing media, only if safe and possible.
- Stop hot jobs in the vicinity, if any.
- Remove or cover ignition sources in the vicinity, if any.
- Spray copious amount of water to keep adjacent tanks cool.
- Control spread of vapor by water fog.
- The technical personnel in the shift who are trained in fire fighting will augment the fire team. The departmental head will arrange the required manpower and protective equipment to the external agencies.
- Adequate communication system like telephone/public address system / paging system/intrinsically safe walkie-talkie system should be considered.

Actions to be taken in case of leak of chlorine from cylinder/tonner:

- Leakages from the valve are the most common type encountered in handling chlorine containers. There are basically 4 types of valve leaks and these can be adequately controller with the use of emergency kit.
- If the chlorine container is leaking in such a manner that chlorine is escaping as a liquid, the container should be turned so that the gas escapes. As the quantity of chlorine escaping from a gas leak is about one fifteenth the amounts that escape from a liquid leak through the same size hole. (Liquid leak will get converted to 460 times volume of gas.

Leakage from valve	Tightening the gland nut with a spanner should control the leakage.
Leakage from valve seat spindle valve	This is due to spindle not getting seated properly. Gently open and close the valve to remove the scales. If this fails, remove the outer cap, insert a gasket (Lead or Teflon) and refit the cap with a spanner.
Leak due to defective threads	The threads might either be worn out or broken. Tighten the valve carefully into the container. If this fails, control the outflow of chlorine through a hood.
Broken Valve	Outflow of chlorine gas should be controlled by use of a chlorine leak hood or chlorine leak control kit.

Water should not be sprayed over the leaky spot, as this will worsen the leak. If the leak cannot be stopped by ordinary methods take away the cylinder to a safe isolated spot. Allow the gas ton escape under controller safe conditions to exhaust the cylinder.

DOs and DONTs while attending chlorine leak:

- Do not panic.
- Compulsorily wear PPE like gas mask (SCBA set), safety goggles, hand gloves, gun boots etc.
- Check the wind direction and always approach the incident location from the upwind direction.
- Do not approach a chlorine leak without gas mask (SCBA set) and other necessary safety kit.
- Identify the source of leak at the earliest using ammonia torch.
- Send always 2-3 persons at a time to check identify and attend the leak.
- Keep one man to give instructions and be standby for rescue.

Actions to be taken in case of leak of sulfuric acid from storage tanks

- In the event of acid leak in storage tanks, arrangements should be made to transfer the available acid to the spare tank. To avoid acid fuming, lime should be sprayed over the leak.
- The above process will be carried out with the help of shift personnel.

CAUTION: Water should not be sprayed over the leaking spot or acid on the floor under any circumstances.

- Approach the area of leak using full acid proof PPE only.

Actions to be taken in case of a Cyclone:

- The weather forecast will be taken by PPL from the Meteorological Data, Bhubaneswar & Paradeep periodically. The phone number of meteorological centers in Bhubaneswar is 0674 2596093, 0674-2534386 and Paradeep is 06722-2376051.
- In the event of a cyclone forecast, the following steps should be considered:
- Inform the HOU, HOD (F&S), HOD (P&A) & all HODs for necessary course of action.
- Disseminate information to the down line of all the departments for taking precautionary safety measures not limited to as mentioned below.
- Communicate the updated information relating to cyclone to the public through PAS.
- Go for safe shut down of plant or as instructed.
- Keep booms of all cranes (Hydra, Coles crane, TATA crane, drag line, etc.) in down position.
- Anchor of the rail engines, ammonia trolley, Auto ship unloaders (BMH) & other mobile equipments properly.
- Check for any loose material left at higher level which is vulnerable to fall during storm/cyclone.
- Check & ensure 1000 KVA DG Sets are ready for providing emergency power supply in case of power failure.
- Maintain minimum safety stock/level in all tanks (ammonia, sulphuric acid, phosphoric acid, process water, FO, diesel, etc.
- Maintain portable water tanks (overhead tanks) in filled condition including township.
- Secure doors, shutters and windows of all buildings properly.
- Secure glass doors, shutters and windows with supports or coverings.
- Check the drains and channels for free from blockage in plant & township.

- Keep emergency lights, torch lights & spare cells ready.
- Keep sufficient food material (non-perishable) in canteen and guest house.
- Keep all vehicles filled with fuel including fire vehicles, ambulance, etc.
- Park vehicles under solid shelter with hand brakes on and in gear.
- Keep one public address system ready.
- Keep Portable, battery-operated radio with extra batteries.
- Check all emergency phones are functional.
- Keep First aid boxes with required first aid material and in departments & sufficient health care facilities in the hospital.
- Trim dead or weak branches from trees. Trim coconuts from palms so they don't become deadly missiles during a storm.
- Store records, important documents & valuables in a waterproof room/place on the highest level of the self.
- Switch off lifts, elevators during cyclonic situation.
- Keep all electrical cable, wires tidy.
- Stay inside and shelter in the strongest part of the building.
- Check & ensure tools and tackles ready for clearing roads after the cyclone.
- Check & ensure dewatering pumps are ready
- Stop working at height, roof and temporary platform & outside the building.
- Keep emergency teams (Engineering team, fire fighting team, communication & rescue team, first aid & medical team) alert for the situation.
- Keep important telephone numbers readily available (available in on site emergency preparedness plan)
- Check & ensure safety valves of ammonia tanks are in working condition.
- Nitrogen purging system and NH3 Flare stack system is used under extreme emergency.

15. Activation and closing procedure in the event of an emergency:

15.1 SIREN SYSTEM:

Electrically operated emergency siren is installed inside the factory with UPS/Battery backup above the Navartan building . Actuation of the siren can be done from the fire station. Emergency siren code is different from the shift sirens.

Existing Siren Code:

S.N.	Type	Siren Code
1	In case of small Fire	Wailing sound for 10 seconds ON and for 5 seconds OFF – 3times.
2	On-Site Emergency	Wailing sound for 20 seconds ON and for 5 seconds OFF – 5times.
3	Off-Site Emergency	Wailing sound for 30 seconds ON and for 5 seconds OFF – 10times.
4	All Clear	2 minutes continuous
5	Testing of Siren	2 minutes continuous. Every Monday-11.00AM

Considering to the unification of Emergency siren code either as per OISD STD. 116 or PNERB siren code, it will be revised in near future as per advice from Directorate of Factories & Boilers, Odisha.

15.2 ACTIVATION AND CLOSING PROCEDURE:

Introduction

- Anybody notices FIRE/Gas leak, shout “FIRE, FIRE”, “FIRE” / GAS “GAS”, “GAS” and informs to the shift – in- charge.
- Being informed about gas leak/fire, the Shift – in – charge informs concerned sectional, head, Fire control room, First –Aid and Security.
- On hearing about the gas leak/fire, the Works Main Controller and the site incident Controller rush to the site and make quick assessment of the situation.
- On quick assessment of the situation, the Works main controller rushes to the emergency control room and declares emergency by blowing appropriate siren through SIC
- On hearing of Emergency Siren, the key personnel of Emergency Combat structure perform their responsibilities as per the work sheet instruction.

- During the emergency operation, the work main controller keeps records of activities carried on, supervises overall, maintains liaison with mutual aider and statutory Authorities.
- Critically review the status in consultation with Site Incident Controller other senior personnel of the organization and also with the senior officials of external emergency services.
- After control of the situation, the Works main controller declares normally by bowing all clear siren through site incident controller.

15.3 Actions to be taken by any person who finds an emergency

- Raise alarm by shouting.
- Inform other personnel in the vicinity, by shouting.
- Immediately inform the control room of the affected plant by phone/messenger

15.4 Actions to be taken by control room operator on coming to know of emergency

- Ring up fire station.
- Immediately inform the shift in-charge.
- Ring up the security gate office.

15.5 Actions to be taken by Shift Incharge on coming to know of emergency

- Rush to the spot. Assess the situation.
- Incase of major emergency/likely to escalate into major emergency, arrange to give the respective wailing siren.
- Declare major emergency on PAS.
- Proceed as per procedures stipulated in On-Site Emergency Plan

15.6 Procedure for Closing of "On-Site Emergency"

Actions to be taken by Shift Incharge of the affected plant at the termination of the emergency:

- Critically inspect the affected areas, if necessary with the required plant personnel.
- Assess the situation and doubly make sure that the incident is completely controlled.
- Instruct the emergency services to remain in the area till further instruction form the Works Main Controller/Site Incident Controller.
- Arrange to cordon off the affected areas.
- Strictly prohibit the areas for unauthorized entry.
- Instruct the security guards and one or two plant personnel to patrol the areas vigilantly.
- Ensure in consultation with the concerned personnel that the emergency is completely over and also that there is no potential anywhere for its revival.
- Report the realistic situation to the Site Incident Controller/Works Main Controller.

15.7 Actions to be taken by Site Incident Controller at the termination of the emergency:

Personally inspect the affected areas.

Review and assess the situation in consultation with the shift in charge, senior personnel of the affected plant and the senior personnel of emergency services (internal and external).

Ensure the following:

- The emergency is over.
- There is absolutely no symptom of any revival of the emergency.
- The affected areas are properly cordoned off.
- The emergency services are at site.
- Unauthorized entry is strictly prohibited.

- The affected plant is retained as such without any tampering of the evidences to ensure smooth investigation later.
- No operation is restarted without clearance from Site Controller. viii. Report the situation to Works Main Controller.
- Wait for Works Main Controller instruction.
- Only on definite instructions from Works Main Controller, arrange to give all clear siren.
- Arrange to announce termination of emergency on PAS system.

15.8 Actions to be taken by WMC at the termination of the emergency

- Personally ensure that the emergency is over and also that there is no chance of its revival.
- Instruct the Incident Controller (Tech) to arrange for giving all clear siren.
- Ensure that no operations are restarted in the affected plant without his clearance.
- Arrange for the required immediate rehabilitation measures without tampering with any evidence.
- Report to the higher-ups of the organization.
- Critically review the status in consultation with Site Incident Controller other senior personnel of the organization and also with the senior officials of external emergency services.
- Arrange for the investigation of the incident.

ANNEXURE

16.1	**Details of facilities available in the unit for combat emergency**
16.2	**Mutual Aid Agreement**
16.3	**Details of telephone number of key persons of emergency command structure, silent hour command structure and statutory authorities**
16.4	**Material Safety Data Sheet of each hazardous substances**

16.1 Details of facilities available in the unit for combat emergency:

PUBLIC ADDRESS SYSTEM (PAS)

Public address system (PAS) is provided in the control rooms of all the plants.

COMMUNICATION FACILITIES

- RAX Telephones - 272nos.
- Mobile Telephone - 90nos.
- P&T Telephones - 10nos.
- Siren - 04nos.
- Public Address System - 08nos.
- EPABX system - 02nos.
- Walkie-Talkie - 45nos.
- Hot Line Phone - 02no.
- Satellite Phone - 02nos.
- Communication Ear muff - 06nos.

TRANSPORT FACILITIES

- Fire jeep 01
- Bus (hired) 02
- Ambulance 02
- Hire car 05
- Jeep 02
- Truck (TATA 407) 01
- Crane (Coles) 01
- Crane (TATA) 01
- Crane (Libereh) 01
- Hydra Crane 10
- Personal and official vehicles of employees

MEDICAL FACILITIES

- First-aid centre
- 4 (Four) bed hospital in township.
- Two numbers of ambulances (One at the plant site & other at the hospital)

FIRE FIGHTING ARRANGEMENT

Fire prevention and fighting have been given much importance in the factory. The salient features of the system are;

- Fire station manned by qualified, experienced and trained personnel round the clock.
- 2nos Mobile Fire Tenders (Foam & water tenders)
- 1nos trailer pump
- 1nos portable pumps
- Fire water storage
- Fire hydrant network with monitors & hydrant points
- Portable fire extinguishers of different types including mechanical foam, water CO2, ABC, DCP and compressed CO2 cylinders.

FIRE STATION

A fire station, manned by qualified and experienced persons, is established to control any type of fire and release of ammonia gas. The following appliances are available at the Fire Station.

Appliances available at the Fire Station:

Appliance	Capacity	Quantity
Foam Tender	1500L water + 500L Foam	One
Water Tender (TATA)	2000L Water Tank	One
Trailer pumps	1800LPM	One
Portable fire pump	275LPM	One
Fire Jeep	-	One
Foam Monitor	1000LPM	One
SCBA sets (type L/H)	-	20nos.
Compressor for refill SCBA	-	01no.
Escape set	-	10nos.
Fire suit	-	06nos.
Ammonia Suit	-	04nos.
Aluminum suit	-	04nos.
Kevler suit	-	04nos.
High temp acid suit (300deg C)	-	20nos.
Gas Canister Mask	-	50nos.
Instrument air line BA set	-	04nos.
Portable Water curtain	-	06nos.
Oscillating Monitor	-	01no.
LED headlight	-	15nos.
Communication Ear muff	-	06nos.
Dragon search light	-	06nos.
Chlorine kit	-	01set
Diphoterene Solution for acid flash	-	06sets
Cooling vest	-	50nos.
Multi gas detectors	-	04nos.
Single detector (O2 & NH3)	-	08nos.
Other emergency PPE's are also available in the F&S stores.		

Fire water storage:

There are two numbers of process water storage tanks of 6000M3 capacities. During emergency water available in the above tank shall be utilized for fire water service. The source of water for the plant & fire fighting is from the Taladanda Canal, which originates from the Mahanadi barrage.

Fire Pumps at Composite Pump House:

There are four numbers of fire pumps and the specification are as below. Design pressure of the fire pumps is 8 Kg/cm2. Jockey Pump is provided for maintaining the hydrant pressure at 7 Kg/cm2.

- Electrical Pump No.-01
- Electrical Pump No.-02
- Jockey Pump
- Diesel Operated Pump

Electric fire Hydrant Pump:

- Numbers : 02
- Make : Kirloskar Brothers
- Type /Model : Centrifugal, DSM-6150
- Capacity : 273 M3/Hr
- Head : 70M
- Motor : Siemens.
- Power rating : 125KW
- Current : 215 amps
- RPM : 1485
- Voltage : 415±10%

Diesel Fire Hydrant Pump

- Qty : 01
- Make : Kirloskar Brothers
- Type / Model : Centrifugal, DSM-6150
- Capacity : 273 M3/Hr
- Head : 70M

Jockey Fire hydrant Pump

- Qty : 01
- Make : Kirloskar Brothers
- Type /Model : Centrifugal, KPD/50/26
- Capacity : 50 M3/Hr
- Head : 75M

- Motor : Siemens.
- Power rating : 30KW
- Current : 52 amps
- RPM : 2950
- Voltage : 415±10%

Alternate Power Supply:

Alternate power supply from Emergency Diesel Set is available. There 2 numbers 1 MVA DG sets to meet the emergency power requirements.

FIRE HYDRANT SYSTEM:

The fire hydrant system is provided as per the Tariff Advisory Committee recommendations.

Some of the salient features of system design are:

- Sulphur conveyor belts have been provided with water spray system.
- Monitors have been provided for controlling the Ammonia leaks.
- Fire hydrant system is a Ring Main Network so that all the hydrants will have a flow from at least two directions.

There is extensive fire hydrant system as detailed below:

- Single Head Street hydrants : 227 nos
- Escape hydrants : 136 nos
- Double Head Street hydrants : 12 nos
- Water jet monitors (63mm) : 12 nos
- **TOTAL : 387 nos**

FIRST AID FIRE FIGHTING EQUIPMENT

The following first aid fire fighting equipment is provided at convenient and suitable locations in the factory.

Table 12 1: Details of First aid Fire Fighting Equipment

Description	Capacity	Quantity
Water Type CO2	9L each	105
Mechanical Foam type	9L/25L	166
ABC Type	5 kgs	90
Carbon dioxide	3.2/4.5/6.8/22.5/45 kgs	532
Dry chemical (DCP)	5 kgs	67
Total		**960**

Fire Fighting Personnel:

Apart from the fire crews, about 500 personnel in the plant have been trained in basic fire fighting and 150 Security trained as Auxiliary fire squad.

Emergency Control Rooms:

- **Main Emergency Control Room: Fire and Safety office**
- **Alternative Emergency Control Room: Navratna Complex (Ground floor)**

The control rooms are well equipped with communication, emergency organization chart, dispersion details for loss of containment of ammonia and chlorine, telephone directory (updated), On-Site Emergency Plan document etc.

Assembly Points: Five assembly points have been identified and they are as under.

6. Gate house complex (near the main emergency control room)
7. Near S&D office (west side of Bagging plant)
8. Near Canteen No.-1
9. Near POP Control room
10. Near SAP-C Cooling tower

Evacuation Facility:

a) Towards Gate House Complex, which is SSW of ammonia storage

b) Towards Bagging plant, which is NNW of the ammonia storage

Windsocks:

Fourteen numbers of Windsocks have been provided in critical locations in the factory as below to see wind direction and plant evacuation.

- DAP
- Ammonia Stack
- PAP Pipe Rack
- WTP
- Fire & Safety
- Jetty
- DAP Pipe Rack
- Navratna Building
- SAP-C Cooling Tower
- S & D Office
- Offsite
- Gate House
- Bagging Plant
- Jetty Pipe Rack

Wind Veins:

Three numbers of Wind Indicators have been provided as below;

- Fire & Safety
- Security Building (Gate No.-02)
- Offsite

Wind Rose:

Month wise wind rose is shown in 1.3. The predominant wind direction is from S, SW and N, NW.

16.2 Mutual Aid Agreement:

MUTUAL AID:

M/s Paradeep Phosphates Ltd (PPL) has "Mutual Aid" arrangement with the following neighborhood Industries:

- **Indian Oil Corporation LTD. (Refineries Division), Paradeep**
- **Indian Oil Corporation Ltd. (Pipelines Division), Paradeep**
- **IFFCO, Paradeep**
- **Paradeep Port Trust, Paradeep**

PPL maintains very cordial relationship with the above organizations and as such, they extend wholehearted cooperation and help, whenever needed.

DETAILS OF LIAISON ARRANGEMENT BETWEEN THE ORGANIZATIONS

The following officers to be contacted for help during an emergency

Name of Organization	**Contact Person**	**Telephone Number**
Indian Oil Corporation Ltd. Refinery Division	Site in charge	Tel. - 06722-255555 - 06722-252111
Indian Oil Corporation Ltd. Pipeline Division	Site in charge	Tel. - 9238140562 Mob. - 9238340562
IFFCO, Paradeep.	Manager (F&S)	Tel. - 06722-224600 Mob. - 9937238353
Paradeep Port Trust	Deputy Commandant, CISF	Tel. - 06722-222299 - 06722-221188 Mob. - 9937100648

PARADIP PORT TRUST | IndianOil PDR & PIPELINES | PARADIP PHOSPHATES LTD. | IFFCO

MEMORANDUM OF UNDERSTANDING

AMONG

NEIGHBOURING INDUSTRIES

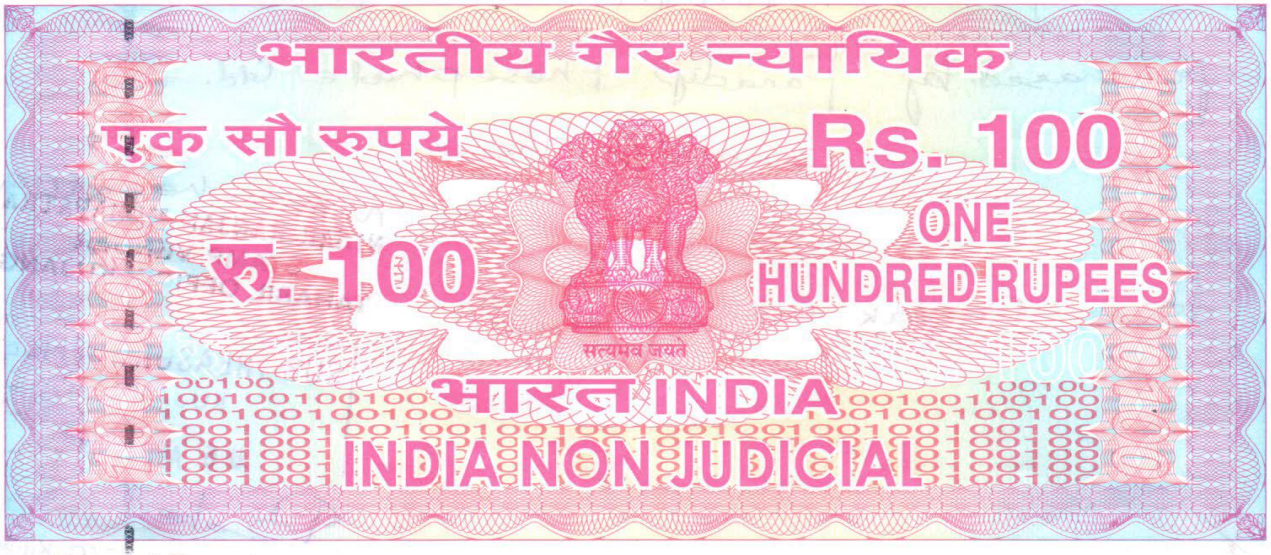
AT

PARADIP

FOR

MUTUAL AID SCHEME

(MAS)



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MEMORANDUM OF UNDERSTANDING FOR MUTUAL AID SCHEME

This present Memorandum of Understanding is made at Paradip Dist – Jagatsinghpur-754141 on this 17th **day of April 2018** between the following, the aforesaid being hereafter referred to as "MOU" for a period of three (3) years

(i) Paradip Refinery of Indian Oil Corporation Limited, PO: Jhimani, Dist: Jagatsinghpur, Pin Code: 754141, Odisha, hereinafter called the "Refinery" of the first part.

And

(ii) Paradip Phosphate Limited (PPL), PO: PPL town ship, Dist: Jagatsinghpur, Pin Code: 754145, Odisha, hereinafter called the "PPL" of the second part.

And

(iii) Pipelines Division of Indian Oil Corporation Limited, PO: Jhimani, Dist: Jagatsinghpur, Pin Code: 754141, Odisha, hereinafter called the "Pipelines" of the third part.

And

(iv) Indian Farmers Fertiliser Cooperative Limited (IFFCO), PO: Paradip, Dist: Jagatsinghpur, Pin Code: 754141, Odisha, hereinafter called the "IFFCO" of the fourth part.

And

(v) Paradip Port Trust, Paradip, Post : Paradip, District: Jagatsinghpur, Odisha-754 142, hereinafter will call as "PPT" of the Fifth Part.

Whereas all the above parties, the "Refinery" of the first part, the "PPL" of the second part, the "Pipelines" of the third part, "IFFCO" of the fourth part and "PPT" of the fifth part, hereinafter collectively referred as "Member Units" and individually each as "Member Unit" have agreed to have a voluntary Memorandum of Understanding for Mutual Aid hereinafter called the "Mutual Aid scheme (MAS)" for fighting the outbreak of Fire & helping in Major industrial accidents in their respective establishments and with the view to prevent devastation causing damage to life and property.

Now this indenture WITNESSETH that member units of "scheme" the "Refinery" of the first part, the "PPL" of the second part, the "Pipelines" of the third part, "IFFCO" of the fourth part and "PPT" of the fifth part, hereto agree as follows

PREAMBLE

a. WHEREAS the member units desire to provide mutual assistance to each other for the purpose of ensuring that any possible hazards at their respective manufacturing sites are dealt with effectively.

b. AND WHEREAS the Parties hereby agree to abide by the Mutual Aid Scheme ("**MAS**") which has been formulated jointly by them for governing and regulating their relationship upon occurrence of any major and serious fire or any other emergency or eventuality in their respective Factory premises (**Schedule-1**).

c. AND WHEREAS the member units hereto have arrived at consensus and desire to put the same in writing containing the terms and conditions, appearing herein below:

NOW THEREFORE THIS AGREEEMNT WITNESSES: -

1.0 SCHEME & SCOPE:

1.1 The member units hereby agree to become Members to the MAS and to be bound by and perform ALL the obligations and other terms and conditions of the MAS.

1.2 The member units herein agree to co-opt more members/other industrial units in Paradip Area, subject to the terms and conditions agreed upon between the Parties in writing.

2.0 PERIOD OF AGREEMENT:

2.1 This Agreement shall be effective from the date it is signed and shall remain in operation for three (03) years.

2.2 On expiry of the term of this Agreement, it may be renewed/extended by the member units on the conditions as may be mutually agreed to by the member units herein, in writing.

3.0 TERMINATION

This Agreement shall stand terminated –

3.1 Automatically, on the expiry of its period of three (03) years, unless it is extended/ renewed further in writing by the member units.

3.2 If any of the member units make default in rendering the necessary services to the other Party, or breach of any of the terms of this Agreement.

3.3 By giving notice of at least 30 days in writing to the Secretary.

4.0 AMENDMENTS

4.1 Any change, amendment, supplement or modification or addition to this shall be effective only if the same is in writing and signed by all the Parties.

In witness whereof the parties to have affixed their signature with seal on the day herein above written:

Signed, Sealed and Delivered by the member units

Paradip Refinery

Indian Oil Corporation Limited

1.Sign

Name: L.N. PHUKAN

एल.एन.फुकन / L. N. Phukan,
मुख्य महाप्रबंधक (एच.एस.ई)
Chief General Manager (HSE)
पारादीप रिफाइनरी (इंडियनऑयल)
Paradip Refinery (IndianOil)
Paradip -754 141(Odisha)

Paradip Phosphates Ltd.

2.Sign

Name: Nihar Kanti Rout.

MR. NIHAR KANTI ROUT
Dy. GM & Chief Safety Officer
Paradeep Phosphates Ltd.
PPL Township, Paradeep-754145

Pipelines Division

Indian Oil Corporation Limited

3.Sign

Name : N. SENTHIL KUMAR

N. S. Kumar
मुख्य महाप्रबंधक
Chief General Manger
आई.ओ.सी.एल.,एसईआरपीएल,पारादीप
IOCL, SERPL, Paradip

IFFCO

4. Sign

Name: J. P. SRIVASTAVA

J. P. SRIVASTAVA
Jt. General Manager (E & S)
IFFCO Limited, Paradeep Unit
Village-Musadia, P.O.-Paradeep
Dist.-Jagatsinghpur, Odisha-754142

Paradip Port Trust

Paradip Port Trust

5.Sign

एन. वैयापुरी/N. Vaiyapuri
उपाध्यक्ष/ Dy. Chairman
पारादीप पत्तन न्यास
PARADIP PORT TRUST

Name :

Paradip Refinery
Indian Oil Corporation Limited

WITNESSES

1.Sign

Name: B.K. PANDA

बी. के. पंडा / B. K. Panda
उप महाप्रबंधक (अग्नि एवं सुरक्षा)
Dy General Manager (Fire & Safety)
पारादीप रिफाइनरी (इंडियन ऑयल)
Paradip Refinery (Indian Oil)
पारादीप / Paradip - 754141 (Odisha)

Paradip Phosphates Ltd.

WITNESSES

2.Sign

Name: Sachitra Kumar Rout

Pipelines Division
Indian Oil Corporation Limited

WITNESSES

Sign 17/4/2018

Name : A.R-Gokhale

IFFCO

WITNESSES

Sign

Name: S.K.KAMBLE
MANAGER (F&S)

Paradip Port Trust
Paradip Port Trust
WITNESSES

Sign 17/4/18

Name : (R.V.K. NAIR)
DY. COMMANDANT/FIRE
CISF UNIT, PPT, PARADIP

SCHEDULE –1

[MUTUAL AID SCHEME along with ANNEXURE A]

MUTUAL AID SCHEME

This **Mutual Aid Scheme** ("**MAS**") is made on this **17th day of April, 2017**.

PREAMBLE

a. WHEREAS the Member units herein have huge industrial complexes, employ large number of employees and are engaged in the manufacturing operations which may be prone to causing Fire and Safety hazards.
b. AND WHEREAS the Member units intend to ensure avoidance of any possible hazards at their manufacturing sites and have created their own Fire Stations, Fire fighting equipments as also Personnel / Specialists in Fire Fighting / Prevention etc.
c. AND WHEREAS the Member units considered it necessary and expedient that a Mutual Aid Scheme is formulated between them to govern and regulate their relationship upon occurrence of any major and serious fire or any other emergency or eventuality in their respective Factory premises.
d. AND WHEREAS the Member units hereto have arrived at consensus and desire to form MAS for the provision of certain mutual aid services (as more particularly described below).
e. AND WHEREAS the industries wishing to join MAS may do so in future by executing an Agreement between them agreeing to be bound by and comply with the terms and conditions enlisted herein.

Now therefore this Agreement witnesseth as under: -

1.0 SCHEME & SCOPE:

1.1 In the event where a major fire/emergency/eventuality occurs at any Party's Manufacturing Site and it becomes essential for that Party to take aid from a neighboring organization for the fire fighting services/resources due to insufficiency of its own resources, the Member units hereto agree that in such cases of fire/emergency, mutual assistance should be rendered by them to each other. For the said purpose, MAS has been formulated and agreed to by the Member units herein for their respective Factory Premises at their addresses.

1.2 MAS will also include the following functions:

a. Rendering joint assistance to Member unit at major fires, explosion, Toxic gas release and oil spill that may be too large for the affected unit to handle efficiently.
b. Exchange of Technical information amongst the participant Member unit's `fire services` and to develop strategy for effective Fire & Rescue operations.

2.0 GOVERNANCE:

2.1 The duties under MAS shall be carried out by the 'Secretary' who shall be mutually appointed by the Member units in writing for a definite period from time to time.

2.2 The Member units shall ensure that the Secretary, MAS should be having relevant educational background and sufficient experience.

3.0 INDIVIDUAL MEMBERS `FIRE FIGHTING REQUIREMENT`:

3.1 The fire officers of each Party shall mutually establish the call and turn out procedure.

3.2 Each Party shall investigate the cause of fire or explosion and the findings shall be exchanged for the mutual benefit to prevent recurrence.

3.3 Fire officers of each Party shall evolve an effective liaison and communication system for prompt, reliable and effective emergency communication, UHF radio sets between the fire station control rooms (under District Disaster Management) is to be maintained.

4.0 LIST OF EQUIPMENT:

4.1 Each Party shall exchange full details of information regarding various fire fighting appliances available (Annexure-A), so that if necessary, suitable adopters can be made for hooking up the equipment.

5.0 COMMAND AND CONTROL

5.1 The Fire Officer of the Party, in whose premises the fire/emergency has occurred, shall be the over all In-charge of the situation and of the assisting fire fighting units.

5.2 The Party summoning assistance shall ensure complete personnel protection against health hazard and all other eventualities.

5.3 In case of an emergency, the industry in distress should contact on:

1. Paradip Refinery (PDR), IOCL
   (Fire control room : Tel No. 06722-255555/ 252111)
2. Paradip Phosphate Limited (PPL), Paradip
   (Fire control room Tel No–06722-229201 , Mob No-9438880002)
3. Pipelines Division, IOCL
   (Fire control room (PHBPL); Tel No-9238140562 Mob No-9238340562)
4. IFFCO, Paradip
   (Fire control room; Tel No--06722-224600 Mob. No-9937238353)
5. Paradip Port Trust (PPT)
   (Fire control room; Tel No--06722-222299/221188 Mob No-9937100468)

Note: The helping member before taking the turn out should cross –check the call with the caller member.

Note: The helping member before taking the turn out should cross –check the call with the caller member.

6.0 CHARGE FOR FIRE FIGHTING SERVICES

6.1 All attempts shall be made to replenish the same type of material consumed during fire incident to the assisting Party. On written demand from the assisting Party regarding replenishment of material consumed in any fire, hazard or any incident for which assistance from the Party is sought, the caller Party shall replenish the same to the assisting Party within one month.

6.2 No charge shall be recovered against the manpower deployed and fuel used for fire tender deployed for the emergency.

7.0 DAMAGE / INJURY / LOSS OF EQUIPMENT AND LIFE OF ANY PERSON:

7.1 During all emergencies (where aid of other participating Party to this Agreement is sought) it will be the responsibility of the respective Party facing the emergency to bear all costs, damage or loss of any fire appliance and equipment damaged either during fire fighting or while responding to or returning from the incident.

Any compensation required to be paid in the event of death / permanent disability/any injury to the person/ personnel or his/their family member (s), / legal heirs as applicable, in terms of the rules of the assisting member unit, such compensation shall be paid by the member unit where he/they is/are employed.

8.0 PRACTICE OF JOINT EMERGENCY EXERCISE / DRILLS

8.1 The Member units shall practice Mutual Aid drills / exercise once in a year and place of such drills exercise shall be in one of the Party's premises which shall be rotated every year between the Member units to make the employees of the fire services of the Member units familiar with topography and action expected of them during actual operation.

8.2 It will be the responsibility of the Fire officers of the Member units to train their own personnel in Fire fighting.

In witness whereof the member units to have affix their signatures with seal on the day herein above written

LIST OF FIRE FIGHTING FACILITIES CAN BE SPARED BY MEMBER UNITS

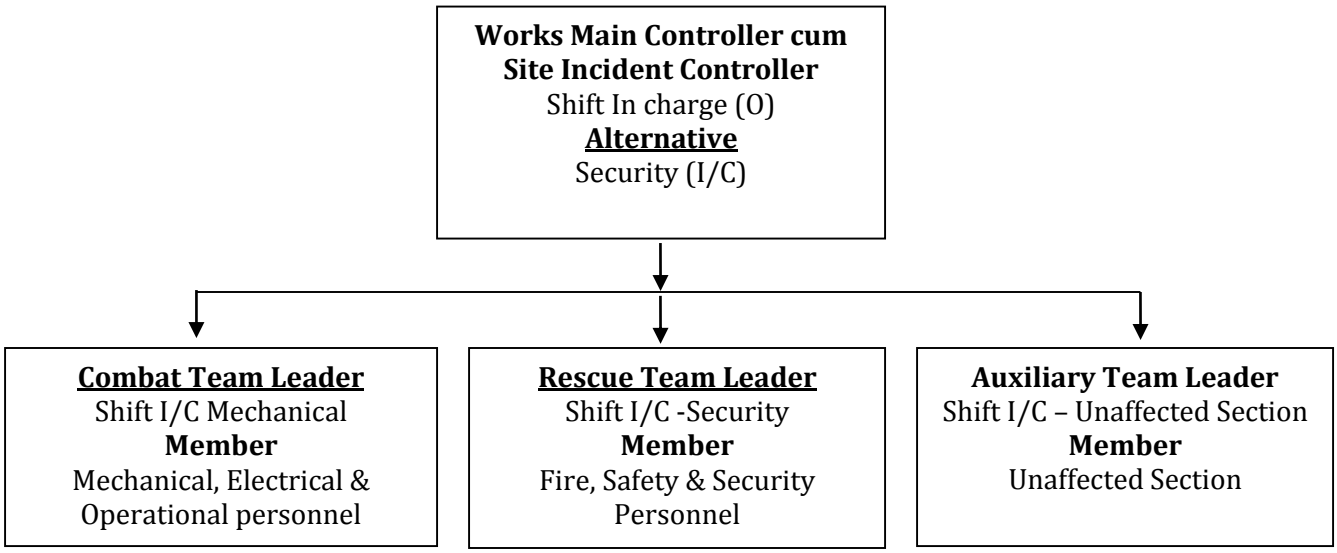
Sl	Item/ Equipment	PDR, IOCL	PPL	PIPELINES	IFFCO	PPT
1	Foam Tenders	01	01	01	01	01
2	Portable fire pumps	01	01	01	01	01
3	Ambulance	01	Nil	Nil	Nil	--
4	Quantity of AFFF in Litres	1000	1000	1000	1000	1000
5	Quantity of DCP	500 KG	100 KG	100 KG	Nil	500 KG
6	B.A. Sets	10	2	01	02	05
7	Gas Masks	05	10	Nil	Nil	05
8	Portable LEL/ Toxic Gas detectors	02 nos.	1no	02 nos.	01	02
9	Fire Proximity Suits	01	1	01	01	01
10	Manpower	06	04	06	03	06
11	Chlorine Leakage Kits	01	01	Nil	01	--
12	Chemical Handling Suits	02	02	Nil	02	--
13	Contact Nos. Fire control room	06722-255555/ 252111	06722-229201 9438880002	9238140562	101/4600	9937100468
14	P&T:	06722-255516/ 255600	06722-259600, Ext- 101/2444	9238140562	06722-224600	06722-222299/ 221188/ 220702
	Alternate	-	-	9238340562	9937238353	9937100468
15	**Contact Nos. HOD of Fire & Safety Department**					
	Name	Shri L. N. Phukan CGM(HSE)	Shri Nihar Kanti Rout DGM(F&S)	Shri A. R. Gokhale, CM(H,S&E)	Shri J.P.Srivastava JGM (E&S)	Shri A. Jayasimha Chief Mechanical Engr.
	Mobile	9435014675	9937297620	9650100901	7894445850	9438578887
	P&T	06722-255104	06722-259600, Ext-2285	06722-226108 9238107126	06722-224032	06722-222034/ 222350
	E-mail	phukanln@ indianoil.in	nkrout@ adventz.com	gokhaleash@in dianoil.in	jpsrivastava@iffc o.in	cme@paradippor t.gov.in
16	Alternate	Shri B.K. Panda, DGM(FS)	Shri S. K. Rout Dy. Mgr (F&S)	Sh. Vivek Paliwal O(H,S&E)	Sh. S. K. Kamble Manager (F&S)	Shri R.V.K. Nair DC (Fire) CISF
	Mobile	9437492701	9937003308	9981112454	9937238353	9937317555/901 3534529
	P&T	06722-255501/ 252044	06722-259600 Ext-2415	06722-226108 9238107126	06722224676	06722223015/22 2425
	E-mail	pandabk@ indianoil.in	sachitra.rout@ adventz.com	paliwalv@india noil.in	sureshkashinathka mble@iffco.in	rvknairfire@gmail. com

16.3 Details of telephone number of key persons of emergency command structure, silent hour command structure and statutory authorities

16.3.1. Telephone number of key persons of emergency command structure:

Name/Designation	Designation as per Emergency Command Structure	Telephone Numbers	
		Office	Residence
Mr. Ranjit S. Chugh Chief Operating Officer(COO)	Works main Controller	Rax-2200 Mob:8380032424	3282
Mr. Pranab Ku. Bhattacharyya Chief GM (Operations)	Alternate-I Works main Controller	Rax- 2210 Mob-9818600185	3425
Mr. Jagannath Khuntia General Manager (HR)	Alternate-II Works main Controller	Rax-2693 Mob-7682812110	3359
Mr. Ranjan Ku. Mohanty General Manager (Maint.)	Incident Controller	Rax - 2460 9937297588	3412
Mr. Nishikanta Jana Jt.GM(Production)	Alternate Incident Controller	Rax-2403 Mob-9937297591	3324
Mr. Amrendra Ku. Pradhan Jt. GM (Maint.)	Combat Team Leader(CTL)	Rax. –2427 Mob-9937297615	3429
Mr. Braja Kishore Panda Jt. GM (Maint.)	Alternate Combat Team Leader(CTL)	Rax-2220 9937297596	3278
Mr. Manoj Ku. Sethy Ch. Manager-HR	Auxiliary Team Leader	2229 9937005853	3261
Mr. Suvendu Ku. Biswal Manager (P&A)	Alternate Alternate Auxiliary Team Leader	2366 9937084315	3458
Mr. Nihar Kanti Rout Jt. GM (F&S)	Fire and Safety Coordinator	2285 9937297620	3307
Mr. Sachitra Kumar Rout Dy. Manager (F&S)	Alternate Fire and Safety Coordinator	2525 9937003308	-
Mr. Arun Kanti Acharya Head Security & Town Admn.	Rescue Team Leader (RTL)	2527 7608006150	3275
Mr. Ashok Ku. Pattanayak Manager, Security	Alternate Rescue Team Leader (RTL)	2417 9438880071	3508
Mr. Manoj Ku. Sethy Ch. Manager-HR	Leader of roll call team	2229 9937261809	3326
Mr. Suvendu Ku. Biswal Manager (P&A)	Alternate Leader of roll call team	2366 9937084315	3458
Dr. Asim Ku. Mohanty Chief Medical Officer (CMO)	Leader first aid & medical team	3403 9437423344	3348
Dr. Rajesh Mishra Manager (Med)	Alternate Leader first aid & medical team	3583 6371458320	-

16.3.2 DETAILS OF TELEPHONE NUMBER OF KEY PERSONS OF SILENT HOUR COMMAND STRUCTURE



Area	RAX-1	RAX-2	Mobile	Stores	2242	2499	9437669050
SAP	2401	2209	9437182013	Workshop	2308	2408	9937311752
PAP	2316	2206	7328834003	Stores	2242	2499	9437669050
POP	2356	2355	7328834006	QC Lab	2430	2537	9937295136
Jetty	2396	2402	7328834008	ETP	2274	2244	9937232858
Offsite	2360	2309	7328834007	Electrical CS	2277	2370	9438880060
WTP	3357	3396	7328834007	Security	100	2222	9438880001
CPP	2409	2301	7328834004	Emergency / Fire	101	2444 / 76	9438880002
MRSS	2255	2252	7328834009	Fire Station (General)	2333	-	9438880002
DAP (AB)	2280	2204	6371449124	Fire & Safety Cell	2415	2285	-
DAP (CD)	2530	2404	6371472208	First Aid Center	102	2295	-
Bagging	2340	2304	7328834005	Medical	3330	3403	9937044613

16.3.3 DETAILS OD TELEPHONE NUMBER OF KEY PERSONS OF STATUTORY AUTHORITIES

S.N.	STATE FACTORIES DIRECTORATE	TELEPHONE (OFFICE)	TELEPHONE (RESIDENCE)
1	Director of Factories and Boilers Odisha, Bhubaneshwar	0674-2396070	0674-2350369
2	Joint Director of Factories and Boilers Odisha, Bhubaneswar	0674-2401824	
3	Deputy Director of Factories and Boilers (Safety) Orissa, Bhubaneswar	0674-2393786	9437318802
4	Deputy Director of Factories and Boilers Odisha, Cuttack.	0671-2548575	9437318802
5	Asst. Director of Factories and Boilers, Paradeep. Zone	0671-2505575	9437167924
	POLLUTION CONTROL BOARD		
1	Chairman, Orissa State Pollution Control Board	0674-2560973	
2	Member Secretary	0674-2562368	
3	Environmental Scientist	0674-2564033	
4	Regional Officer, Cuttack	0671-2335478	
	DOCK SAFETY		
1	Assistant Director, Dock Safety	06722-222413	06722-222368
	OTHER GOVT. OFFICIALS		
1	District Collector, Jagatsinghpur	06724-220379	06724-220199
2	Addl ,District Magistrate, jagatsinghpur	06724-220147	
3	Addl ,District Magistrate, Paradeep		9437791525
4	Superintendent Police , Jagatsinghpur	06724-220115	06724-220015
5	Addl. Superintendent Police Paradeep	06722-222007	9437117177
6	Chief district Medical Officer, Jagatsinghpur	06724 - 220064	
7	District Labour Officer	06724-220729	
8	Paradeep Police Station	06722-222027	9937157783
	FIRE STATIONS		
1	Kujang Fire Station	06722-236246	7873721355
2	Paradeep Port Fire Station	06722-222299, 06722-221188	9937100648
3	Jagatsinghpur Fire Station	06724-22009	8763443458
4	Kendrapara Fire Station	06727-220301	

16.3.4. MATERIAL SAFETY DATA SHEET (MSDS)

- Phosphoric Acid
- Ammonia
- Sulphuric Acid
- Sulphur
- HSD
- Chlorine

MATERIAL SAFETY DATA SHEET

1. CHEMICAL IDENTITY

Chemical Name ***PHOSPHORIC ACID*** : Chemical Classification *Inorganic Acid*
Synonyms *Orthophosphoric Acid* :
: Trade Name

Formula H_3PO_4 : C.A.S. No. 7664-38-2 : U. N. No. *1805*
Regulated Identification
: Shipping Name : *Phosphoric Acid* Hazchem Code : *2 R*
: Codes / Label : *Corrosive, Class 8*
: Hazardous Waste ID No. *16* :

HAZARDOUS INGREDIENTS: C.A.S. No. : HAZARDOUS INGREDIENTS:

1. *Phosphoric Acid* *7664-38-2* 3.
2. 4.

2. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C *> 130* °C : Physical state *Thick liquid/solid* : Appearance *Colourless* : Vapour Pressure : Odour *Pleasing*
Melting / Freezing Pt °C *42.4* °C : @35°C 0.286 mm Hg at 20 °C :
Vapour Density : Solubility : Others Soluble *in Alcohol*
(Air = 1) : in water at 30°C *Soluble* :
Specific Gravity *1.892* at : pH *1.5 (0.1 N)*
(Water = 1) *25* *°C* :

3. FIRE / EXPLOSION HAZARD DATA

Flammability *NO* : LEL *Not Pertinent* % : Flash Point °C *Not Pertinent* (OC)
TDG Flammability *8* : UEL *Not Pertinent* % : Flash Point °C *Not Pertinent* (CC)

Autoignition Temperature °C : *Not Applicable*
Explosion sensitivity to impact : *Stable*
Explosion sensitivity to static electricity : *Data Not Available*
Hazardous Combustion Products : *Emits toxic fumes of POx*
Hazardous Polymerization : *Will not occur.*

Combustible Liquid *NO* : Explosive Material *NO* : Corrosive Material *YES*
Flammable Material *NO* : Oxidiser *NO* : Others
Pyrophoric Material *NO* : Organic Peroxide *NO* :

4. REACTIVITY DATA

Chemical Stability : *Stable*

Incompatibility : *Strong Caustics, Most Metals*
With other material :

Reactivity : *Potentially violent reaction with Sodium Tetrahydroborate.*

Hazardous : *Reacts with chlorides + Stainless Steel to form explosive Hydrogen gas. Forms*
Reaction Products : *explosive mixtures with Notromethane.*

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5. HEALTH HAZARD DATA

Routes of entry : *Inhalation, Ingestion Eyes & Skin*
Effects of : *Burns on mouth and lips, sour acrid taste, severe gastrointestinal irritation, nausea,*

EXPOSURE / **: VOMITING, BLOODY DIARRHEA, DIFFICULT SWALLOWING, SEVERE ABDOMINAL**

SYMPTOMS **PAINS, THIRST, ACIDEMIA, DIFFICULT BREATHING, CONVULSIONS, COLLAPSE, SHOCK AND DEATH.**

Emergency : *Ingestion : Do not induce vomiting. Give water, milk or vegetable oil.*
Treatment : *Skin & Eyes : Flush with water for atleast 15 mins. Seek Medical Aid.*

LD_{50} (oral-rat) *1530* mg/kg : STEL *0.75* ppm *3* mg/m^3
Permissible exposure limit 0.25 ppm *1* mg/m^3 : Odour Threshold *Not* ppm *Not* mg/m^3
TLV (ACGIH) 0.25 ppm *1* mg/m^3 : *Available* *Available*

NFPA Hazard

: Health	: Flammability	: Reactivity	: Special
Signals	: 2	0	0

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6. PREVENTIVE MEASURES

Personal : *Avoid contact with liquid or vapours*
Protective : *Provide face shield, rubber hand gloves, protective over clothing and shoes.*
Equipment :.

Handling : *Store in well ventilated area, away from active metals.*

& Storage :
Precautions :

7. EMERGENCY / FIRST AID MEASURES

FIRE : FIRE EXTINGUISHING Media : *Not Flammable* :

: Special Procedure : *Keep the containers cool by spraying water if exposed to heat or flame*

: Unusual Hazards :. *Flammable gas is produced on contact with metals.*

EXPOSURE : First Aid Measures : *If ingested, do not induce vomiting, Give milk, water and vegetable oil. If skin and eyes are affected flush with plenty of water. Seek Medical Aid immediately.*

: Antidotes / Dosages : *Not Available.*

SPILLS Steps to be taken : *Neutralise with alkali and dilute and drench with water*

: Waste Disposal Method : *Seal all waste in vapour tight plastic bags for eventual disposal*

8. ADDITIONAL INFORMATION / REFERENCES

A Human poison by an inspecified route. Toxic by ingestion and skin contact. Used to manufacture of fertilizers, detergents, food beverages and for water treatment.

9. MANUFACTURERS / SUPPLIERS DATA

NAME OF FIRM : Contact person
MAILING ADDRESS in Emergency
TELEPHONE / TELEX NOS
TELEPHONIC ADDRESS : Local Bodies involved
Standard Packing
Trem Card Details / Ref

10. DISCLAIMER

Information contained in this material data sheet is believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application or results to be obtained from them. It is upto the manufacture / seller to ensure that the information contained in the material safety data sheet is relevant to the product manufactured / handled or sold by him as the case may be. The I.C.M.A. makes no warranties expressed or implied in respect of the adequacy of this document for any particular purpose.

MATERIAL SAFETY DATA SHEET

1.IDENTITY OF MATERIAL

Product Name	**Ammonia**	Chemical Designation	
Trade Name	Ammonia	Synonyms	Anhydrous Ammonia

Formula	Label/Class	Category	CAS Number	UN Number
NH_3			7664-41-7	1005
Regulated Identification	Shipping Codes/Label		HAZCHEM Code	1005-15
	Hazardous Waste Identification Number	Nil		

	Hazardous Ingredients	CAS Number
1	Nil	-

2. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Boiling point (°C)	Vapour pressure (mm-Hg) @ 35 °C
Liquid/Gaseous	- 33.3	>1 atm.
Appearance	**Melting/Freezing point (°C)**	**Evaporation rate @ 30 °C**
Colourless	- 77.7	
Odour	**Vapour Density (air = 1)**	**Solubility in water @ 30 °C**
Penetrating pungent suffocating	0.6	Highly soluble
Others (Corrosivity etc.)	**Specific Gravity (Water = 1)**	**PH**
	0.77	11.7

3. FIRE AND EXPLOSIVE HAZARDS DATA

Explosion / Flammability	Flash Point (°C)	LEL (%)	Auto ignition Temperature (° C)
		16%	651
	Flash Point (°C)	UEL (%)	TDC Flammability (Classification)
Yes		25%	

4. REACTIVE HAZARDS

Stability to	Impact (Hazardous Combustion products)	Nil
	Static Discharge (Hazardous Decomposition product)	Nil
	Reactivity (Conditions to avoid)	Reactive with chlorine, violent reaction with acids, strong oxidants, halogens. Highly soluble in water generating heat.
Hazardous Polymerisation	May/May not occur (Conditions to avoid)	Nil
Incompatibility	(Materials to avoid)	Strong oxidizers, hypo chlorite bleaches, mercury chlorine, nitrogen oxide, halogens, Aluminimum, Zinc, Copper etc.

5. HEALTH HAZARD DATA

Routes of Entry	Eyes, Respiratory tract and skin contact.				
Effects of Exposure/ Symptoms	Liquid Ammonia causes cold burns on contact. 400-700ppm causes upper respiratory tract irritation. 1000-2000 ppm causes severe coughing, severe eye, nose and throat irritation. 3000-4000 ppm could be fatal after 30min's exposure.				
LD 50 (rat) (mg / kg of body wt.)			LC 50 (rat) (mg/1) / 4 hours		
(Orally or percutaneous absorption)					
Permissible Exposure Limit (PEL)	Ppm		Short Term Exposure Limit (STEL)	Ppm	35
	mg/cu.m.			mg/cu.m.	28
	Ppm	25	Odour Threshold	Ppm	

Threshold Limit Value (TLV) of ACGIH	mg/cu.m.	17		mg/cu.m.	
Emergency Treatment					

6. HAZARD SPECIFICATION

NFPA Hazard	Signal	Health	Flammability	Stability	Special
49	Gas & Liquid	2 & 3	3	0	-

Known Hazards		
Combustible Liquid	Water Reactive Material	Irritant
No		
Flammable Material	Oxidiser	Sensitizer
Yes	-	
Pyrophoric Material	Organic Peroxide	Carcinogen
No	-	
Explosive Material	Corrosive Material	Mutagen
no	no	
Unstable Material	Compressed Gas	Others (Specify)

7. SAFE USAGE DATA

Ventilation	General / Mechanical	
	Local Exhaust	
Protective Equipment Required	Eyes (Specify)	
	Respiratory (Specify)	Breathing apparatus set.
	Gloves (Specify)	Hand gloves
	Clothing (Specify)	
	Others (Specify)	Body protective suit.
Precautions	Handling & Storage	To be stored in recommended vessels
	Others (Specify)	Handled with the use of PPE only.

8. EMERGENCY RESPONSE DATA

Fire	Fire Extinguishing Media	Water, Alkaline Foam
	Special procedures	Water curtains
	Unusual Hazards	Spills

Exposure	First Aid Measures	Any person affected by ammonia should be taken immediately into fresh air. Eyes should be washed with an abundance of clean water for at least fifteen minutes. Any contaminated clothes with ammonia liquid should be drenched with water & be removed as soon as possible and affected point should be washed with copious amounts of water. Patient should be kept warm. Administer oxygen if available in case of difficult breathing or give artificial respiration. Must be consulted with doctor.
Spills	Steps to be taken	To be contained and mitigated with Alkaline Foams for avoiding rapid evaporation.
	Waste Disposal Method	

9. ADDITIONAL INFORMATION

10. SOURCES USED

Reference to books, journals, etc

11. MANUFACTURERS/SUPPLIER DATA

Firms Name	
	Standard packing
Mailing Address	
Telephone Number	
Telex Number	
	Others
Telegraphic Address	
Contact person in Emergency	
	Others
Emergency Telephone in Transit Areas	

MATERIAL SAFETY DATA SHEET

1.IDENTITY OF MATERIAL

Product Name	**Sulphuric Acid**	Chemical Designation	Inorganic Acid
Trade Name	Sulphuric Acid	Synonyms	Oil of vitriol, Battery acid, Chamber acid, Spent sulphuric acid

Formula	Label/Class	Category	CAS Number	UN Number
H_2SO_4	Corrosive, class 8		7664-93-9	1830
Regulated Identification	Shipping Codes/Label	Sulphuric acid Corrosive Class 8	HAZCHEM Code	2P
	Hazardous Waste Identification Number	16		

	Hazardous Ingredients	CAS Number
1	Sulphuric acid	7664-93-9

2. PHYSICAL AND CHEMICAL PROPERTIES

Physical State (Gas, Liquid, Solid)	Boiling point (°C)	Vapour pressure (mm-Hg)@ 145 ° C
Liquid	290	1
Appearance	**Melting/Freezing point (°C)**	**Evaporation rate@ 30 °C**
Colourless oily	3	Na
Odour	**Vapour Density (air = 1)**	**Solubility in water @ 30 °C**
Odorless	3.4	Visible
Others (Corrosivity etc.)	**Specific Gravity (Water = 1)**	**PH**
Corrosive	1.84	Less than 1

3. FIRE AND EXPLOSIVE HAZARDS DATA

Explosion / Flammability	Flash Point (°C)	LEL (%)	Auto ignition Temperature (°C)
	Flash Point (°C)	UEL (%)	TDC Flammability (Classification)

NA			

4. REACTIVE HAZARDS

	Impact (Hazardous Combustion products)	Emits toxic fumes of SO_2
	Static Discharge (Hazardous Decomposition product)	Stable
	Reactivity (Conditions to avoid)	Powerful oxidizer
Hazardous Polymerisation	May/May not occur (Conditions to avoid)	May not occur
Incompatibility	(Materials to avoid)	Organic chlorates, carbides, fulminates, picrates and metals

5. HEALTH HAZARD DATA

Routes of Entry	Inhalation, Ingestion, eyes, skin				
Effects of Exposure/Symptoms	Inhalation of vapour from hot concentration acid may injure lungs. Swallowing may cause injury or death Contact to skin or eyes causes severe burns. Dilute solution cause dermatitis. Exposure cause bronchitis.				
LD 50 (rat) (mg / kg of body wt.) (Orally or percutaneous absorption)	2140		LC 50 (rat) (mg/1) / 4 hours		
Permissible Exposure Limit (PEL)	ppm		Short Term Exposure Limit (STEL)	ppm	
	mg/cu.m.	1		mg/cu.m.	
Threshold Limit Value (TLV) of ACGIH	ppm		Odour Threshold	ppm	
	mg/cu.m.	1		mg/cu.m.	1

Emergency Treatment	Observe victim for delayed pulmonary reaction. Move him to fresh air. Give artificial respiration Skin: Remove clothes and shoes. Do not use oil or ointment. Flush affected area with plenty of water. Eyes: Wash with plenty of water for 15 min. Ingestion: Give plenty of water to drink. Do not induce vomiting. Seek medical aid.

6. HAZARD SPECIFICATION

NFPA	Signal	Health	Flammability	Stability	Special
Hazard		3	0		

Known Hazards		
Combustible Liquid	Water Reactive Material	Irritant
No	Yes	Yes
Flammable Material	Oxidiser	Sensitizer
No	Yes	
Pyrophoric Material	Organic Peroxide	Carcinogen
No	No	No
Explosive Material	Corrosive Material	Mutagen
No	Yes	
Unstable Material	Compressed Gas	Others (Specify)
No	No	

7. SAFE USAGE DATA

Ventilation	General / Mechanical	
	Local Exhaust	Well ventilated place away from oxidizer
Protective Equipment. Required	Eyes (Specify)	Safety goggles, face shielf
	Respiratory (Specify)	Self contained or air-line breathing apparatus
	Gloves (Specify)	Rubber
	Clothing (Specify)	Rubber apron
	Others (Specify)	Rubber shoes, safety showers, eye wash fountain
Precautions	Handling & Storage	Store in cool, well ventilated place away from oxidizers, Acids of 98 % are to be stored in MS or CI tanks/drums
	Others (Specify)	Safety showers, eye wash fountains

8. EMERGENCY RESPONSE DATA

Fire	Fire Extinguishing Media	DCP / CO_2 Do not use water
	Special procedures	Keep containers cool by spraying water if exposed to flame or heat
	Unusual Hazards	Poisonous gases may be produced
Exposure (inhalation, skin, eye contact and ingestion)	First Aid Measures	If inhaled, remove the victim to fresh air, provide artificial respiration or oxygen if required. If eyes are affected wash with plenty of water for 15 mins or more. If skin is affected remove contaminated clothes and shoes and wash the affected area with plenty of water and soap. Seek medical help immediately.
Spills	Steps to be taken	Shut off leaks if without risk. Contain leaking liquid on sand or earth. Do not absorb on saw dust or other combustibles
	Waste Disposal Method	

9. ADDITIONAL INFORMATION

Sensitivities to sulphuric acid mists or vapours vary with individuals. Normally 0.125 to 0.5 ppm may be mildly annoying. 1.5 to 2.5 ppm may be definitely be unpleasant, 10 to 20 ppm unbearable.
Contact with water cause violent reaction generating much heat and splattering of hot acid. Attacks many metals. Liberating hydrogen which is flammable and forms explosive mixture with air.

10. SOURCES USED

Reference to books, journals, etc
Indian chemical manufacturer association publication

11. MANUFACTURERS/SUPPLIER DATA

Firms Name _____ Standard packing

Mailing Address

Telephone Number

Telex Number _____ Others

Telegraphic Address

Contact person in Emergency	Others
Emergency Telephone in Transit Areas	

MATERIAL SAFETY DATA SHEET

1. CHEMICAL IDENTITY

Chemical Name ***SULPHUR*** : Chemical Classification *Non metallic element*

Synonyms Brimostone, Bensulfoid, Colsul

: Trade Name

Formula *S* : C.A.S. No. *7704-34-9* : U. N. No. *1350/2448*

Regulated Identification Code : 2Z : Shipping Name : *Sulphur or Sulphur molten* Hazchem

: Codes / Label : *Flammable solid, Class 4.1*

: Hazardous Waste ID No. *17*

HAZARDOUS INGREDIENTS :	C.A.S. No. :	HAZARDOUS INGREDIENTS:
1. Sulphur	7704-34-9	3.
2.		4.

3. PHYSICAL / CHEMICAL DATA

Boiling Pt / Range °C : 444.6 : Physical state : *solid or molten solid*

Appearance: *Yellow to Reddish Brown* Vapour Pressure:

Odour : *Faint rotten egg*

Melting / Freezing Pt °C *113 –119*: @35*C mmhg at 183.8 *C:

Vapour Density (Air = 1) 8.9 : Solubility in water at 30°C : *Not soluble*

Others : *Slightly soluble in alcohol, ether, soluble in benzene*

Specific Gravity 1.8 (Water = 1) *at –120*C (liq)* pH : – not pertinent

:

3.

FIRE / EXPLOSION HAZARD DATA

Flammability	: LEL	%	: Flash Point °C		(OC)
TDG Flammability	: UEL	%	: Flash Point °C	168 (CC)	

Autoignition Temperature °C : 230
Explosion sensitivity to impact : Stable
Explosion sensitivity to static electricity : Data not available.
Hazardous Combustion Products : Emits toxic fumes of SOx
Hazardous Polymerization : Will not occur.

Combustible Liquid	: Explosive Material	: Corrosive Material
Flammable Material	: Oxidizer	: Others
Pyrophoric Material	: Organic Peroxide	:

4. REACTIVITY DATA

Chemical Stability : Stable
Incompatibility : Oxidizers, Halogens, Carbides, Active metals
With other material :

E.I.D. PARRY (INDIA) LTD. **PSMS/MSDS/005/REV 0**

UNIT: ENNORE FERTILISERS **PAGE 2 OF 3**
PROCESS SAFETY INFORMATION
MATERIAL SAFETY DATA SHEETS
SULPHUR

Reactivity : Can react violently with halogens, carbides, halogenites, halogenates,
zinc, tin, sodium, lithium nickel, palladium, phosphorus, potassium, iridium.
Hazardous Reaction Products : Not available.

5. HEALTH HAZARD DATA

Routes of entry : Inhalation, Eyes and Skin.
Effects of Exposure / Symptoms : Can cause eye irritation, may irritate skin. The molten solid may cause skin burns
Emergency Treatment : Eyes: wash with plenty of water for 15 Mts. Skin: Treat molten sulphur

Burns with petroleum jelly or mineral oil. Seek medical aid immediately.

LD_{50} (oral-rat) mg/kg : STEL ppm

ppm mg/m^3 : Odour Threshold ppm 6.6 mg/m^3

TLV (ACGIH) PPM 3 mg/m3

NFPA Hazard : Health : Flammability : Reactivity : Special Signals : 2

6. PREVENTIVE MEASURES

Personal Protective Equipment : Safety goggles or face shield, rubber hand gloves, rubber boots and mask for the dust.

Handling & Storage Precautions : Store in cool, dry well ventilated area, away form heat, flame and oxidizing materials :

7. EMERGENCY / FIRST AID MEASURES

FIRE : FIRE EXTINGUISHING Media : Water

: Special Procedure : Keep the containers cool by spraying water if exposed to heat to flame.

: Unusual Hazards : Burns with blue flame, difficult to see in daylight.

EXPOSURE : First Aid Measures : *Skin: Treat molten Sulphur burns with petroleum jelly or mineral oil.*
Eyes: Wash with plenty of water for 15 mins. Seek medical aid immediatley :

: Antidotes / Dosages : Not available

SPILLS: Steps to be taken : Allow the molten liquid to solidify and then sweep and collect. Wash the surface with plenty of water.

Waste Disposal Method : Seal all waste in vapour tight plastic bags for eventual disposal.

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA

NAME OF FIRM : Contact person
MAILING ADDRESS in Emergency
TELEPHONE / TELEX NOS
TELEPHONIC ADDRESS : Local Bodies involved
Standard Packing
Trem Card Details / Ref

10. DISCLAIMER

Information contained in this material data sheet is believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application or results to be obtained from them. It is upto the manufacture / seller to ensure that the information contained in the material safety data sheet is relevant to the product manufactured / handled or sold by him as the case may be. The I.C.M.A. makes no warranties expressed or implied in respect of the adequacy of this document for any particular purpose.

MATERIAL SAFETY DATA SHEET

1.IDENTITY OF MATERIAL

Product Name	**High speed diesel**	Chemical Designation	Fuel
Trade Name	Diesel oil	Synonyms	Gas oil

Formula	Label/Class	Category	CAS Number	UN Number
A complex mixture of Hydrocarbons				1202
Regulated Identification	Shipping Name/ Codes/Label	Diesel oil 30/class 3, Flammable liquid	HAZCHEM No./Code	3
	Hazardous Waste Identification Number	5		

	Hazardous Ingredients	CAS Number
1		

2. PHYSICAL AND CHEMICAL PROPERTIES

Physical State @ 15 °C	Boiling point (°C)	Vapour pressure (mm-Hg) @ 35 °C
Liquid	110 to 400	
Appearance	Melting/Freezing point (°C)	Evaporation rate @ 30 °C
Oily brown to yellow	0-18	
Odour	Vapour Density (air = 1)	Solubility in water @ 30 °C
Characteristic odour	3.0 –5.0	Insoluble in water Floats on water
Others (Corrosivity etc.)	Specific Gravity (Water = 1) @ 15 °C	PH
Sulphur content 1% max	0.840	Not pertinent

3. FIRE AND EXPLOSIVE HAZARDS DATA

Explosion / Flammability	Flash Point (°C) closed cup	LEL (%)	Auto ignition Temperature (°C)
	>32	0.5	230-250
	Flash Point (°C)	UEL (%)	TDC Flammability (Classification)
Yes	Na	5.0	3

4. REACTIVE HAZARDS

Stability to	Impact (Hazardous Combustion products)	Acrid smoke/CO/CO_2/NOx
	Static Discharge (Hazardous Decomposition product)	
	Reactivity (Conditions to avoid)	Does not react with common materials but may react with oxidizing agents.
Hazardous Polymerisation	May/May not occur (Conditions to avoid)	Does not occur
Incompatibility	(Materials to avoid)	Incompatible with strong oxidizers.

5. HEALTH HAZARD DATA

Routes of Entry	Inhalation/Ingestion/Skin/Eye

Effects of Exposure/Symptoms	Inhalation: Dizziness, headache, Ingestion: Nausea and vomiting, irritation of mouth, and gastro intestinal tract may follow. Rapidly developing potentially fatal chemical pneumonitis. Skin and Eye Contact: Irritation will remove natural fat from skin. Prolonged or repeated contact should be avoided, otherwise skin chapping, cracking or possible contact dermatitis may result. Dry skin, erythema, oil acne, and oil follicultis & warty growth may occur which may become skin cancer				
LD 50 (rat) (mg / kg of body wt.)	Not listed		LC 50 (rat) (mg/1) / 4 hours	Not listed	
(Orally or percutaneous absorption)					
Permissible Exposure Limit (PEL)	Ppm	300	Short Term Exposure Limit (STEL)	ppm	500
	mg/cu.m.	900		mg/cu.m.	1500
Threshold Limit Value (TLV) of ACGIH	ppm	300	Odour Threshold	ppm	0.25
	mg/cu.m.	900		mg/cu.m.	300
Emergency Treatment	If inhaled remove victim to fresh air. If not breathing, give artificial respiration. If unconscious but breathing, place in unconscious (recovery) position. Give external cardiac massage if necessary. If ingested do not induce vomiting. Remove contaminated clothing; wash all the affected skin thoroughly with soap and water. Irrigate affected eyes with copious amount of water. Administration of medical paraffin may reduce absorption through digestive tract. Gastric lavage should be done only after endotracheal intubation in view of respiration, which may cause serious chemical pneumonitis for which antibiotic, and corticosteroid therapy may be indicated.				

6. HAZARD SPECIFICATION

NFPA Hazard	Signal	Health	Flammability	Stability	Special
		1	4	0	nil

Known Hazards		
Combustible Liquid	Water Reactive Material	Irritant
Yes		
Flammable Material	Oxidiser	Sensitizer
Yes	No	
Pyrophoric Material	Organic Peroxide	Carcinogen
No	No	
Explosive Material	Corrosive Material	Mutagen

No	No	
Unstable Material	Compressed Gas	Others (Specify)
		No

7. SAFE USAGE DATA

Ventilation	General / Mechanical	
	Local Exhaust	
Protective Equipment Required	Eyes (Specify)	
	Respiratory (Specify)	
	Gloves (Specify)	Hand gloves
	Clothing (Specify)	PVC Suit
	Others (Specify)	Gas mask
Precautions	Handling & Storage	Avoid contact with liquid or vapours Use flameproof equipments only. Stay upwind while gauging/sampling/handling Do not wash/clean hands with the product. Earth all equipment and pipelines properly. Store in an enclosed vessel in a cool, well-ventilated area away from heat & flame. Gas free the tank before entering/cleaning. Change oil soaked clothing promptly. No smoking or open flames. Provide adequate ventilation at work site.
	Others (Specify)	

8. EMERGENCY RESPONSE DATA

Fire	Fire Extinguishing Media	Foam, DCP, CO_2
	Special procedures	Keep the containers cool by spraying water if exposed to fire.
	Unusual Hazards	Flashback may occur along vapour trail.

Exposure	First Aid Measures	If inhaled remove victim to fresh air. If not breathing, give artificial respiration. If unconscious but breathing, place in unconscious (recovery) position. Give external cardiac massage if necessary. If ingested do not induce vomiting. Remove contaminated clothing; wash all the affected skin thoroughly with soap and water. Irrigate affected eyes with copious amount of water,. Administration of medical paraffin may reduce absorption through digestive tract. Gastric lavage should be done only after endotracheal intubation in view of respiration, which may cause serious chemical pneumonitis for which antibiotic, and corticosteroid therapy may be indicated.
Spills	Steps to be taken	Eliminate all sources of ignition. Ventilate the area. Stop leaks if no risk involved. Collect leaking product into closed container. Contain/absorb spillage in sand/earth bund. Use water sprays to disperse/dilute the vapours if necessary. Prevent run-off from entering into sewers
	Waste Disposal Method	Collect all the waste in vapour tight plastic bags for eventual disposal.

9. ADDITIONAL INFORMATION

10. SOURCES USED

Reference to books, journals, etc

11. MANUFACTURERS/SUPPLIER DATA

Firms Name	
	Standard packing
Mailing Address	
Telephone Number	
Telex Number	
	Others
Telegraphic Address	
Contact person in Emergency	
	Others
Emergency Telephone in Transit Areas	

MATERIAL SAFETY DATA SHEET

1.IDENTITY OF MATERIAL

Product Name	**Chlorine**	Chemical Designation	Inorganic gas or liquid
Trade Name	Chlorine	Synonyms	None

Formula	Label/Class	Category	CAS Number	UN Number
Cl_2			7782-50-5	1017
Regulated Identification	Shipping Codes/Label	Non-flammable gas, poison Class 2	HAZCHEM No/Code	1017-20
	Hazardous Waste Identification Number	17		

	Hazardous Ingredients	CAS Number
1	Chlorine	7782-50-5

2. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Boiling point (°C)	Vapour pressure (mm-Hg) @ 35 °C
Gas/Liquid	(-) 34.6	>1 atm. (4800)
Appearance	**Melting/Freezing point (°C)**	**Evaporation rate @ 30 °C**
Greenish Yellow Gas		
Odour	**Vapour Density (air = 1)**	**Solubility in water @ 30 °C**
suffocating	2.49	Insoluble
Others (Corrosivity etc.)	**Specific Gravity (Water = 1)**	**PH**
corrosive	1.47	na

3. FIRE AND EXPLOSIVE HAZARDS DATA

Explosion / Flammability	Flash Point (°C)	LEL (%)	Auto ignition Temperature (°C)
	-	-	-
	Flash Point (°C)	**UEL (%)**	**TDC Flammability (Classification)**
No	-	-	-

Stability to	Impact (Hazardous Combustion products)	Toxic product are generated and combustibles burn in chlorine
	Static Discharge (Hazardous Decomposition product)	Stable
	Reactivity (Conditions to avoid)	Reaction with alcohol metals, sulphites, trialhilboranes
Hazardous Polymerisation	May/May not occur (Conditions to avoid)	May not occur
Incompatibility	(Materials to avoid)	Combustible substances, finally divided metals

5. HEALTH HAZARD DATA

Routes of Entry	Eyes, Respiratory tract and skin contact.				
Effects of Exposure/Symptoms	Causes eye irritation, sneezing, copious salivation, general excitement, and restlessness. High concentration causes respiratory distress and violent coughing, often with retching. Death may result from suffocation. 30 ppm causes intense coughting fits & burning. 40-00 ppm causes cardiac paralysis & bronchits. 1000 ppm danger to life even after few deep inahalation.				
LD 50 (rat) (mg / kg of body wt.) (Orally or percutaneous absorption)	Not listed		LC 50 (rat) (mg/1) / 4 hours	Not listed	
Permissible Exposure Limit (PEL)	Ppm	1	Short Term Exposure Limit (STEL)	Ppm	3
	mg/cu.m.	3		mg/cu.m.	9
Threshold Limit Value (TLV) of ACGIH	ppm	1	Odour Threshold	Ppm	3.5
	mg/cu.m.	3		mg/cu.m.	10.2
Emergency Treatment	Inhalation: Remove the victim to fresh air area, support respiration, give oxygen, if necessary. Eyes: Flush with large amounts of water for at least 15 mins. Seek medical and immediately				

6. HAZARD SPECIFICATION

NFPA Hazard	Signal	Health	Flammability	Stability	Special
		3	0	0	-

Known Hazards		
Combustible Liquid	Water Reactive Material	Irritant
No	No	

Flammable Material	Oxidiser	Sensitizer
no	yes	
Pyrophoric Material	Organic Peroxide	Carcinogen
No	No	no
Explosive Material	Corrosive Material	Mutagen
No	Yes	
Unstable Material	Compressed Gas	Others (Specify)
No	yes	

7. SAFE USAGE DATA

Ventilation	General / Mechanical	Well ventilated area preferably with a hood with a forced ventilation
	Local Exhaust	Tonners should always be handled, using a lifting clamp, cradle or carrier
Protective Equipment. Required	Eyes (Specify)	Head mask
	Respiratory (Specify)	SCBA
	Gloves (Specify)	Hand gloves PVC
	Clothing (Specify)	Rubber over coat
	Others (Specify)	Gumboots
Precautions	Handling & Storage	Store in well ventilated areas or outdoors.
	Others (Specify)	Protect against physical damage. Separation from combustible organic or easily oxidisable material. Isolate from Acetylene, Ammonia, Hydrogen, Hydrocarbons, Ether, Turpentine & Finely divided material.

8. EMERGENCY RESPONSE DATA

Fire	Fire Extinguishing Media	Water
	Special procedures	Water curtains
	Unusual Hazards	Poisonous gases emitted on burning
Exposure (inhalation, skin, eye contact and ingestion)	First Aid Measures	Evacuate the contaminated zone. Call a Doctor Affected clothing should be removed and skin should be washed thoroughly with water. In case of unconsciousness transport him to a quiet place and keep him warm, inhale oxygen or give artificial respiration till doctor arrive. Wash thoroughly on contaminated area of the body.

Spills	Steps to be taken	Shut off leaks if without risk. Contain liquid with sand or earth. Prevent the liquid from entering the sewer. Vapours create toxic atmosphere. Knock down vapours with water spray.
	Waste Disposal Method	Neutralize small liquid spillages with soda ash and drain with abundant water. Cover pool with protein foam, so that the release of vapour to atmosphere is low and under control.

9. ADDITIONAL INFORMATION

In case of large gas escapes, the presence of cloud can be marked with ammonia with which it will turn into a mist. Run away from the gas clouds in a direction perpendicular to the wind direction. Avoid liquid chlorine from leaking and body contact. Persons with pulmonary diseases should avoid the exposure. A concentration of 3.5 ppm produces a detectable odour; 15 ppm causes immediate irritation of the throat. Concs of 50 ppm are dangerous for even short exposures. 1000 ppm is fatal. Can react to cause fires/explosion on contact with Turpentine, illuminating gas, Polypropylene, Rubber, Sulfamic acid, Acetaldehyde, Alcohols. Bring the leaking portion of the cylinder to the uppermost position, so that only the gas escapes and not the liquid.

10. SOURCES USED

Reference to books, journals, etc

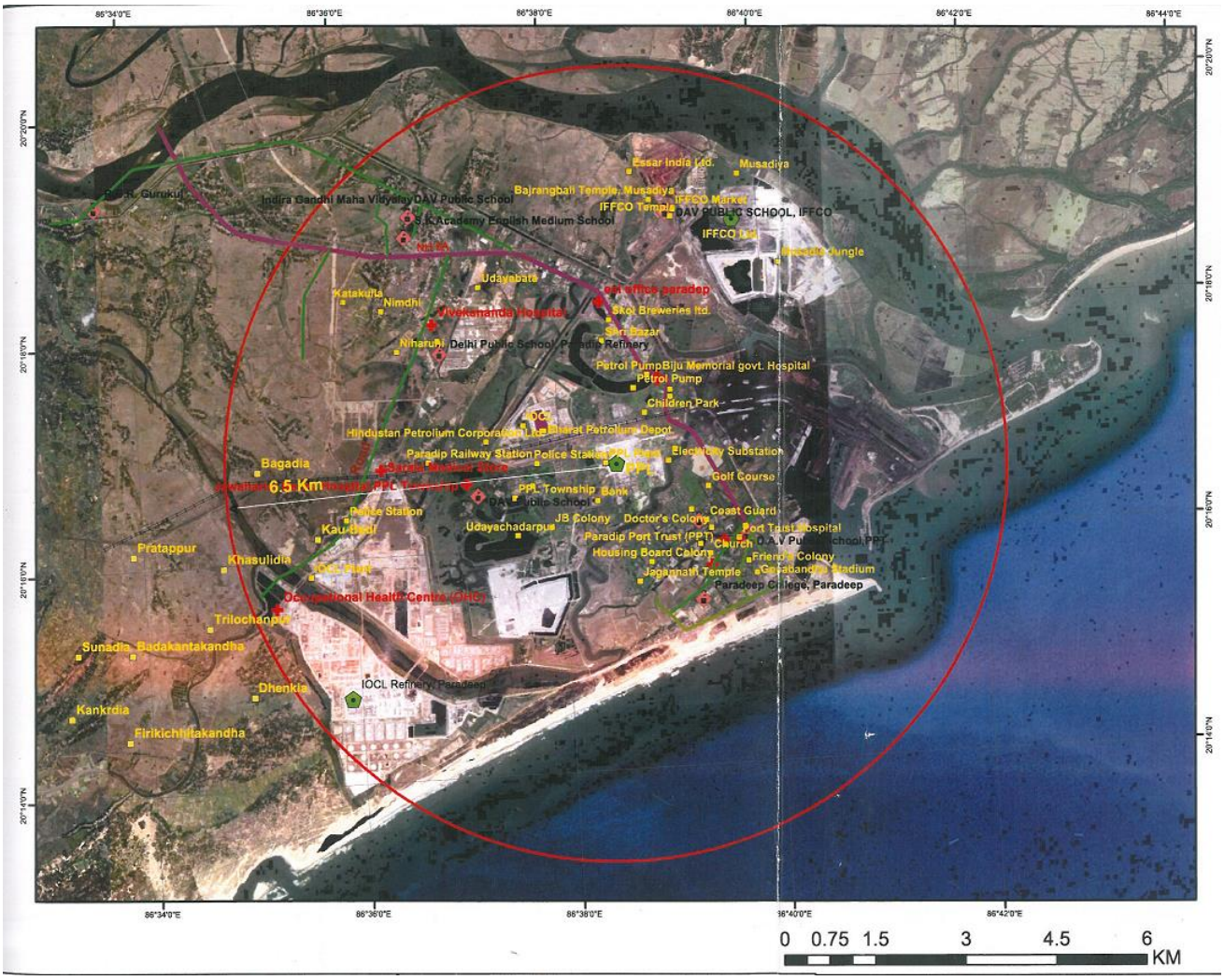
11. MANUFACTURERS/SUPPLIER DATA

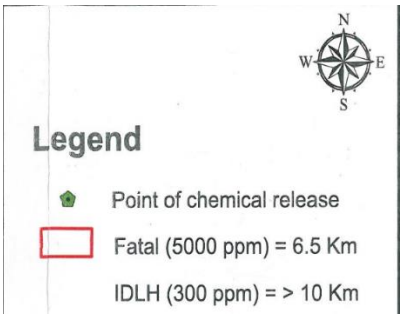
Firms Name	
	Standard packing
Mailing Address	
Telephone Number	
Telex Number	
	Others
Telegraphic Address	
Contact person in Emergency	
	Others
Emergency Telephone in Transit Areas	

DISPERSION MODELLING:

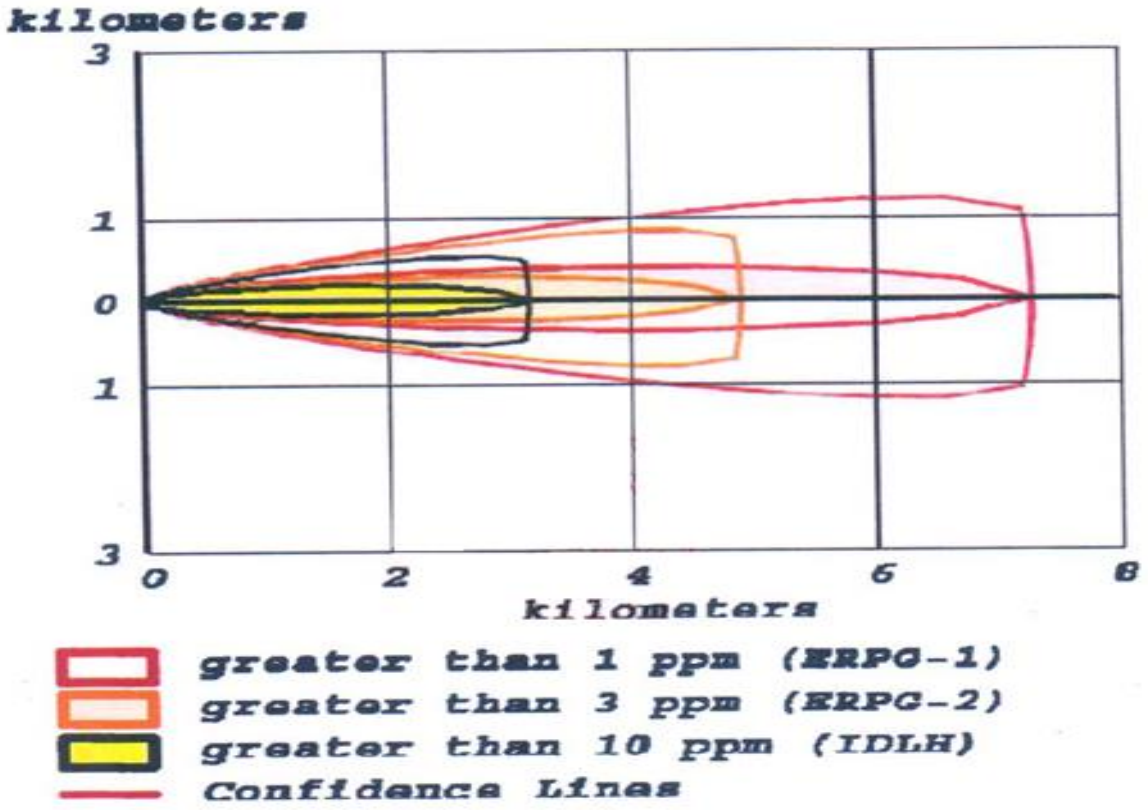
Iso risk contour of hazard Zones: - Ammonia Gas release from Storage tank

Release of ammonia vapour due to catastrophic failure of ammonia tank resulting in to instantaneous release sue to earthquake, structural collapse, over- pressurization



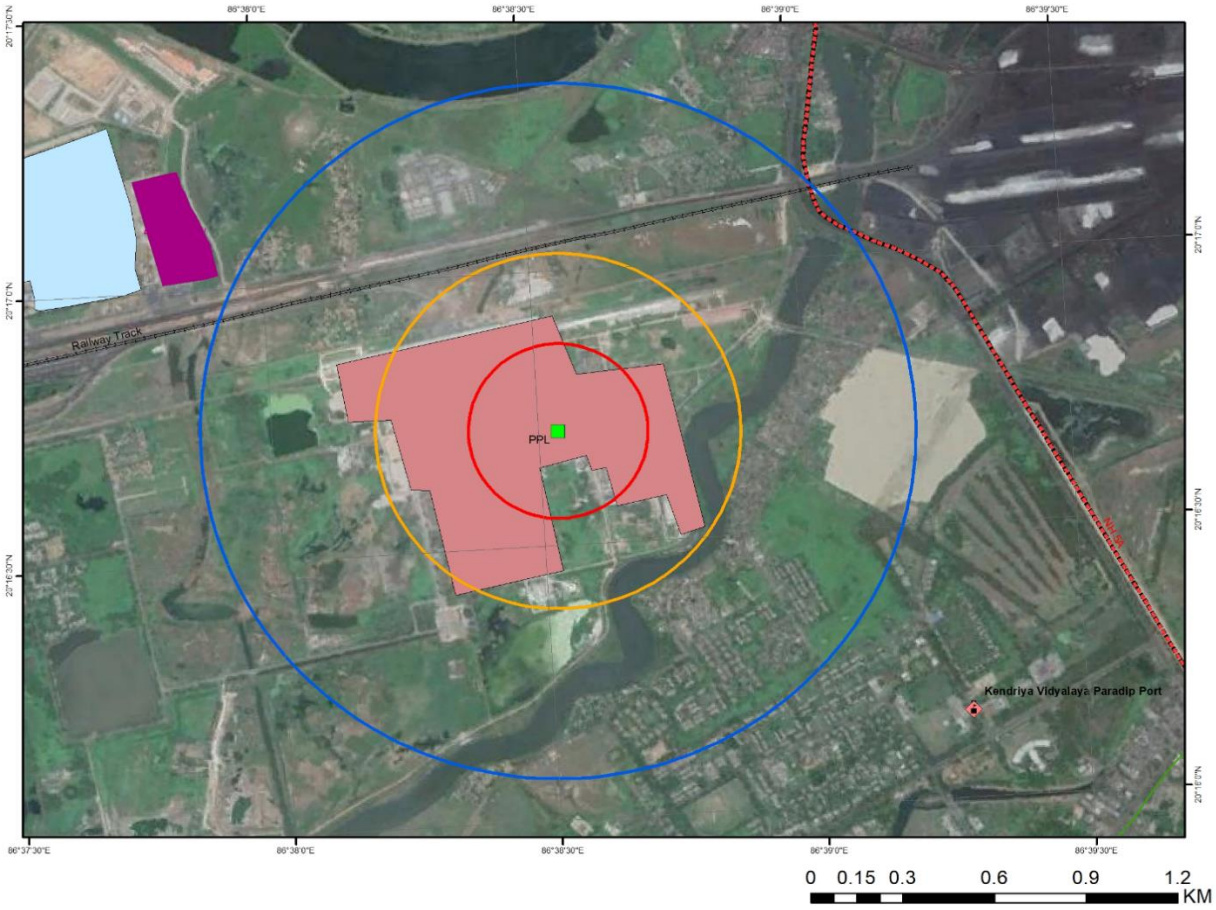


Release of Chlorine vapour due to catastrophic failure of a single Chlorine Tonner:



Iso risk contour of hazard Zones: - Chlorine Gas

Release of Chlorine vapour due to rapture of a single Chlorine Tonner:



Legend

Radious of Effect Circle/Zone

- Point of chemical release
- LC-50 (35ppm) = 294 m
- IDLH (10 ppm) = 598 m
- STEL (03 ppm) = 1171 m.