

CHAPTER 7: ADDITIONAL STUDIES

Technical aspects of monitoring the effectiveness of mitigation measures (incl. Measurement methodologies frequency, location, data analysis, reporting schedules, emergency procedures and detailed budget & procurement schedules).

7.1 PUBLIC CONSULTATION

7.1.1 Public Hearing

As per Ministry of Environment, Forests & Climate Change, Government of India, New Delhi vide its notification no. S.O. 1533 dated 14/09/2006 and its subsequent s.o. 3067 (E) dated 01/12/2009, Public Hearing was arranged for proposed Synthetic Organic chemicals manufacturing Unit **M/s. SNF Flopam India Pvt. Ltd.**, covered under category “A” as mentioned in an application was made to Gujarat Pollution Control Board (GPCB).

An Advertisement covering the requirements laid out in EIA Notification Appendix IV Procedure for conduct of public hearing) Section 3 (Notice of Public Hearing) was issued by GPCB in widely circulated national daily ‘The Times of India (English)’ and regional vernacular daily ‘Divya Bhaskar’ (Gujarati) on 1st January, 2018. The proceedings of public hearing (Minutes of Meeting issued by GPCB) is attached as **Annexure – XIV**.

Vide publicity in Auto-Rickshaw was made in All Villages with Loud Speaker, so that maximum number of locally affected people can participate in the public hearing.

7.1.2 Photographs of showing vide publicity is shown in below photo documentation.





7.1.3 Name of the Persons attended Public Hearing and raised issues related to the proposed project are as follows:

Table 7.1 NUMBER OF PERSON RAISED THE QUESTION DURING THE PUBLIC HEARING PROCESS

Sr. No.	Name of the person raised issues during public hearing
1.	Mr. DineshbhaiDungariya, SarpanchVillage: Bhimasar
2.	Mr.AtmarambhaiGamotVill: Bhimasar Tal: AnjarDist; Kutch Vicepresident Anjar Taluka Congress Samiti
3.	Mr. DhanajibhaiNaranbhaiAhir, Vill. Padana

7.1.4 Panel

Shri D. R. Patel (GAS), appointed as Residential Additional Collector and Additional District Magistrate, Bhuj-Kutch and Shri K. B. Chaudhari, Regional Officer, GPCB, Kutch-East and committee Member, Representative of the Member Secretary, GPCB supervised and presided over the entire public hearing proceedings. Photographs of public hearing are shown below.





7.1.5 Issue raised during Public Hearing

The key objections, suggestions and comments raised during public hearing have been summarized in below table.

- | | |
|-----|--|
| Z1 | Regarding disposal of waste water |
| Z2 | Recycling of solvents/metals |
| Z3 | Risk to human health |
| Z4 | Regarding Closure Notice/Show cause Notice |
| Z5 | Regarding laying of Deep Sea Disposal Pipeline |
| Z6 | CSR Activities |
| Z7 | Job Opportunities |
| Z8 | Clogging of Nearby Storm water drain |
| Z9 | ETP Details and Water Consumption |
| Z10 | Regarding Employment of Land losers |
| Z11 | Regarding greenbelt & tree plantation |
| Z12 | Fire fighting related help |
| Z13 | Regarding Drainage System |
| Z14 | Insurance Policy for family of Employee |
| Z15 | Rain water Harvesting |
| Z16 | Regarding EIA Report, NABET related |
| Z17 | Hazardous Waste Disposal |
| Z18 | Air Pollution |
| Z19 | Land Possession |
| Z20 | Lack of Information regarding Public Hearing |
| Z21 | Environment Health & Safety |
| Z22 | In favour of Project Proponent |

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Additional Studies; Risk Assessment

Table 7.2 Issue Rose in Public Hearing

Sr. No.	Name of person and Location of his/her Residence	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19	Z20	Z21	Z22
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24
Written Queries before & During Public Hearing																							
1	Jitendra Patel, Ankleshvar																						
2	Dineshbhai v. Dungariya, Bhimasar						√	√														√	
3	Ramesh B. Gamot, Bhimasar						√															√	
4	MeraLagdhirKoli, Tappar						√															√	
5	Ravi Gogra, Vise president AnjarVidhanSabhaYuth congress, Bhimasar							√				√										√	
6	A. H. Jadeja, Sarpanch Varsana Gram Panchayat, Varsana							√															
7	Geetaben, Sarpanch Modvadar Gram Panchayat, Modvadar						√															√	
8	Shantiben, Sarpanch Padana Gram Panchayat, Padana							√														√	
9	Jiva Kana Rabari, Bhimasar							√														√	
10	Rajesh D. Humbal, Bhimasar											√											
11	Dipak RavjiAudicheya, Bhimasar																	√	√			√	
12	ParyavaranMitra, Ahemdabad	√					√	√														√	

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Additional Studies; Risk Assessment

Sr. No.	Name of person and Location of his/her Residence	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16	Z17	Z18	Z19	Z20	Z21	Z22
13	Javabdar Gram jan, Kutch	√																					
Verbal Queries during Public Hearing																							
1	Mr. DineshbhaiDungariya, Sarpanch Village: Bhimasar							√				√											
2	Mr. AtmarambhaiGamotVill: Bhimasar Tal: AnjarDist; Kutch Vice president Anjar Taluka Congress Samiti						√	√											√			√	√
3	Mr. DhanajibhaiNaranbhaiAhir, Vill. Padana							√											√				√

7.2 OBJECTIVE, PHILOSOPHY & METHODOLOGY OF RISK ASSESSMENT

OBJECTIVE:

The main objective of the Risk Assessment study is to determine damage due to major hazards having damage potential to life and property and provide a scientific basis to assess safety level of the facility.

The secondary objective is to identify major risk in manufacture of chemicals, storage of chemicals and provide control through assessment. To prepare on- site, off site, disaster management plan for control of hazards.

PHILOSOPHY:

The main philosophy of risk assessment is to find out the real cause of accident; and then based on it suggesting appropriate remedial measures to prevent its recurrence; to find out unsafe action negligence, omission or personal fault.

METHODOLOGY:

To carry out the quantitative Risk Assessment, following methodology was adopted.

Identify Vulnerable Zone for toxic dispersion, pool fire, Area on fire (Thermal Radiation), Flash Fire, and Explosion over pressure (Vapor Cloud Explosion) by using software, named ALOHA.

7.3 Quantity of hazardous chemicals

Details of quantity of each hazardous chemical (including solvent) to be stored, Material of Construction of major hazardous chemical storage tanks, dyke details, threshold storage quantity as per schedules of the Manufacture, Storage & Import of Hazardous Chemicals Rules of major hazardous chemicals, Size of the storage tank to be provided for each raw material & product etc are described below;

Table 7.3 Lists of Hazardous Chemicals Along With Their Toxicity Level as Per MSIHC Rules

The Toxicity level of hazardous chemicals as per Manufacture, storage and import of Hazardous Chemical (Amendment) Rules, 2000 (MSIHC) is shown as below.

Sr . No	Full name Of the raw materials and quantity in MT/Month	Phys ical Phas e	Mole cular form ula	Col our	Ma xi. stor age	Nos. of Cont aine r deta il	Main properties (refer MSDS)							Flamm ability
							M.P °C or F	B.P. °C or F	F.P. °C or F	LEL/ UEL %	TLV ppm Or mg/ m ³	Spe cific gra vity	LD ₅₀ mg/kg LC ₅₀ mg/l	
1	Acrylonitrile	Liquid	C ₃ H ₃ N	Colou r less	900 m ³	2 tank (450 m ³)	- 82°C	77.3° C	- 1.11°C (CC), 0°C (OC)	3.1/ 17	2 ppm	0.8 06	78 mg/kg / 334 ppm	Flamma ble

Sr. No	Full name Of the raw materials and quantity in MT/Month	Physical Phase	Molecular formula	Colour	Maxi. storage	Nos. of Container detail	Main properties (refer MSDS)							Flammability
							M.P. °C or F	B.P. °C or F	F.P. °C or F	LEL/UEL %	TLV ppm Or mg/m ³	Specific gravity	LD ₅₀ mg/kg LC ₅₀ mg/l	
2	Acrylic Acid	Liquid	C ₃ H ₄ O ₂	Colour less	3600 m ³	18 tank (200 m ³)	14°C	111°C	50°C(C)	NA	2 ppm	1.05	33500 mg/kg / 75 ppm	Flammable
3	Caustic Soda (50%)	Liquid	NaOH	Colour less	1200 m ³	6 tank (200 m ³)	318°C	111-121°C	NA	NA	2 mg/m ³	1.11-1.53	1350 mg/kg / --	Corrosive
4	Acrylamide	Liquid	H ₂ C=C HCONH ₂ or C ₃ H ₅ N-O	Colour less	1600 m ³	8 tank (200 m ³)	84.5°C	125°C	138°C(CC)	NA	0.3 mg/m ³	1.122	400 mg/kg / --	combustible
5	Oil	Liquid	NA	Clear blue liquid	1575 m ³	--	NA	>316°C	210 °C	0.9/7	5 mg/m ³	0.87	5 mg/kg / --	Flammable

Note: CC: Close Cup, OC: Open Cup, N.A.: Not Available

Table 7.4 Details of hazardous characteristics of products

Sr. No	Full name of the products and production capacity MT/Month	Physical Phase	Maxi. storage	Nos. Of Container detail or Tank Size	Main properties (refer MSDS)						
					B.P. °C	F.P. °C	LEL/UEL %	TLV ppm or mg/m ³	Specific gravity	LD ₅₀ mg/Kg LC ₅₀ mg/l	Flammability
1	Acrylamide (50%)	Liquid	1600 MT	8 X 200 m ³	125°C	138°C (CC)	NA	0.3 mg/m ³	1.122	400 mg/kg/	combustible
2	Poly Acrylamide Powder	Solid	1000 MT	8 silos X 11 T 900 T in big Bags	NA	NA	NA	NA	NA	> 1000 mg/kg/ --	--
3	Poly Acrylamide Liquid	Liquid	360 m ³	6 X 35 m ³ 6 X 25 m ³	NA	NA	NA	NA	NA	--	--
4	Poly Acrylamide Emulsions	Semi liquid	300 *m ³	12 X 25 m ³	NA	NA	NA	NA	NA	--	--

Table -7.5 Toxicity Index as per MSIHC Rule 2000

Sr. No	Toxicity	Oral Toxicity LD50 (Mg/Kg)	Dermal Toxicity LD50 (Mg/Kg)	Inhalation Toxicity LD50 (Mg/Kg)
1	Extremely Toxic	<5	<40	<0.5
2	Highly Toxic	>5- 50	>40-200	>0.5-2
3	Toxic	>50-200	>200-1000	>2-10

Table -7.6 Threshold Storage Quantities as per MSIHC Rules

Sr. No.	Chemical	Quantity (Rule no: 4,5,7 to 9 & 13 to 15); Metric Tonne	Quantity(Rule no 10 to 12) ; Metric Tonne
1	Acrylonitrile	20	5000
2	Ammonia	50	500
3	Chlorine	10	50
4	Hydrogen fluoride	5	50
5	Flammable gases	15	200
6	Extremely flammable liquids	1000	5000
7	Very highly flammable liquids	1500	10000
8	highly flammable liquids (pressurized form)	25	200
9	highly flammable liquids (Ambient Pressure)	2500	20000
10	Flammable liquid	5000	50000

As per MSIHC rule no:

Rule No:4: General responsibilities of the occupier

Rule No : 5 : Notification of industrial activity

Rule No : 6 : Industrial activity to which rules 7 to 15 apply

Rule No : 7 : Approval and notification of sites

Rule No : 9 : Transitional provision

Rule No : 10 : Safety report

Rule No : 11 : up dating of safety report

Rule No : 12 : Requirements for further information

Rule No : 13: Preparation of onsite emergency plan

Rule No : 14 : Preparation of off site emergency plan

Rule No : 15 : Information to be given to person likely to be affected by a Major accident.

7.4 HAZARD IDENTIFICATION AND PREVENTIVE MEASURES**Table 7.7 RAW MATERIAL HAZARDS AND CONTROLS**

Sr. No.	Name of material stored	Type of hazard / Risk involved	Control Measures
(1)	Acrylic Acid, Oil	➤ Flammable	➤ Earthing & bonding provision ➤ Separate storage area ➤ Safety boards displayed near storage area ➤ Sprinkler system ➤ Handling of material with PPE like Safety glasses, hand gloves, gumboot, Apron etc. ➤ Fire protection system ➤ Hot work permit system
(2)	Acrylonitrile	➤ Flammable	➤ Earthing & bonding provision ➤ Flame proof light fitting ➤ Separate storage area ➤ Temperature sensors ➤ Safety boards displayed near storage area ➤ Sprinkler system ➤ Handling of material with PPE like Safety glasses, hand gloves, gumboot, Apron etc. ➤ Fire protection system ➤ Hot work permit system ➤ Foam System ➤ PPE full respiratory mask ➤ AN detectors
(3)	Caustic Soda	➤ Corrosive	➤ Stored out of direct sunlight and convenient height. ➤ Separate in storage from incompatible chemicals. ➤ Labeling is done. ➤ Removal of steam fumes and dust. ➤ Adequate ventilation. ➤ Use of drum pump for transferring. ➤ Emergency shower and eyewash provided. ➤ Check valve, hoses, pipes, gland, clips, pumps. ➤ PPE and First Aid is provided.

Table 7.8 PROCESS HAZARDS AND CONTROLS

Name of hazardous process and operation	Type of hazard possible toxic gas release / fire / explosion / run away	Control measured provided
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	reaction / rupture, etc.	
Condenser	➤ Bursting of Condensing tubes ➤ Cold burns	a) Licensed Condensers b) Annual inspections c) Safety interlocks to be provided d) Safety and pressure gauge valves fitted e) Properly supported and protected against corrosion f) Testing of Jackets and joints of tubes regularly
Reactor Vessels	➤ Exothermic Run-away reaction ➤ Release of Heat and Flammable gases ➤ Fire, Toxic gas release and Explosion	a) Raw Materials quantity must be controlled either volumetrically or gravimetrically. b) Process control devices must be installed includes the use of sensors, alarms, trips and other control systems that either take automatic action or allow for manual intervention to prevent the conditions for uncontrolled reaction occurring. c) High Temperature indicator valve and alarm system must be provided d) Auto cutoff system must be provided after reaching of predetermined maximum safe temperature. e) Pressure gauge is must be provided. f) Safety Control valve is must be provided. g) The Vessel Emergency Relief vent should discharge to a suitably designed catch pot or should be so positioned that people working in the area and members of the public will not be in danger if the contents of the vessel are discharged. h) Use skilled worker i) Proper selection of MOC j) Mechanical seal in all pumps and reactors k) Transportation of finished product from vessel to storage area through

Table 7.9 GENERAL HAZARDS AND CONTROLS

Type of Emergency	Possible Causes	Preventive/ control Measures
Fire	- Fire due to ➤ Drum leakage ➤ During transportation ➤ Failure of pipelines ➤ Loading /Unloading of drums ➤ Process failure	➤ Flame proof fittings. ➤ Fire Protection system ➤ Earthing while unloading. ➤ Spark arrestor at main gate. ➤ Good house keeping ➤ Earthing & bonding to motors, vessels, pipelines etc. ➤ Get approval from an explosive department for plan approval, equipment layout & emergency control measures.

		➤ Hot work permit system
Toxic Gas Release	➤ Cylinder blast ➤ Rupture of discharge valve ➤ Rupture of gas cylinder body ➤ Bursting of pipelines ➤ Process failure	➤ Storage Area stored under shed and good ventilated area. ➤ Procured by license holder party. ➤ Fitted with valve protection cap. ➤ Valve opened with special key. ➤ Loading/unloading done safely. ➤ Trained persons for Material Handling in and Storage Area area. ➤ Periodic hydraulic testing through competent person by supplier ➤ Painted according to its color code
Explosion	➤ Improper discharge of static charge ➤ Use of non FLP equipment for solvent handling ➤ Metal to metal impact ➤ Electrical short circuit ➤ Open flame	➤ Flameproof electric installation areas & use spark less tools ➤ Isolated storage of Flammable material drums ➤ Hot work permit for hot working in the plant ➤ Earthing for human static charge ➤ Good ventilated area for Flammable material storage
Material handling	➤ Fire and health Hazards	➤ Trained employee ➤ Required PPE and Fire Protective equipment Provided ➤ Good engineering practice ➤ Separate storage are with dyke valve system provided

7.4.1 OCCUPATIONAL HAZARDS AND CONTROL

Provision of industrial hygienist and monitoring of the occupational injury to workers as well as impact on the workers. Plan for periodic medical check-up of the workers exposed. Details of work place, ambient air quality monitoring plan as per Gujarat Factories Rule. Approximately 20 Lac allocated for the Health and safety purpose.

Table -7.10 Occupational Hazards & Controls

Hazards	Preventive/ control Measures
Noise	➤ Persons working in this area to be provided with Ear Plugs / Muffs. ➤ Regular health Check-ups and records maintained in form 32 & 33 as per GFR Requirements.
Acid and Alkali Burn	➤ Chemical Dosing to be done by pumps. ➤ Preventive Maintenance of Equipments & Flanges to avoid Leakages. ➤ Safety Showers & Face Showers to be provided in all plants. ➤ Gloves & Protective Clothing to be provided. ➤ Trap & collect spills with Sand , dry lime or other inert solids ➤ Remove contaminated clothing. ➤ Store well ventilated place

	➤ Local exhaust / General dilution ventilation must be provided.
Inhalation of Product and Raw Material Dust	➤ Persons working in the Production area, it irritating the lung, skin, eye, which can be controlled by the engineering control by isolation. ➤ Engineering control is provided ➤ Eye protection is provided with side shield, goggles, face shield ➤ Respiratory protection is provided at high dust level ➤ Exhaust fans to be provided in production area for ventilation. Local exhaust / General dilution ventilation must be provided. ➤ Handling of with Safety goggles, face shield, hand gloves, gumboot, protective clothing ➤ Hygiene measures by hand wash, removing contaminated clothing. ➤ Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. ➤ Regular First Aid Training to be given to Workers ➤ Nose Mask to be provided at vulnerable areas. ➤ Carry out the pulmonary function test ➤ Workplace monitoring should carried out ➤ Liver function test and health surveillance program should carried out

❖ Requisite PPE's to be provided as mentioned below:

1. Hand gloves
 2. Safety goggles
 3. Chemical cartridge masks
 4. Apron
 5. Safety shoes/gum boots
 6. Safety Helmet
 7. Full body Safety harness with double lanyard
 8. B.A. Set
 9. Ear plug/ Ear muff
- Most of the occupational injury to worker is due to skin absorption, eye contact, inhalation and ingestion. Effect can be irritation, vomiting, dizziness, nausea, irritation to lungs, nose, and throat. It can be controlled by the proper engg. Control, use of PPE.
- Appointment of industrial hygienist as per GFR.
- Medical check up of worker will be carried out on six monthly.
- Workplace ambient air quality monitoring will be carried out on six monthly.

7.5 PRECAUTION FOR STORAGE:

- Storage will be in cool, dry well-ventilated location away from alkaline oxidizing agent, storing acid nitro-aromatic compound metal, heat, any area where the fire hazard may be acute.
- Outside or detached storage will be done for solvents storage and separate from incompatible
- Dyke wall be provided to all storage tanks
- Corrosion resistant structural material will be used in the storage area.
- Effective ventilation will be applied to prevent accumulation of flammable vapours.
- Quantities of all flammable substance should be kept to absolute minimum.
- Vessel will be bonded and grounded for transfer to avoid static sparks.

- Low Oxygen atmosphere for ACN
- Scrubbers for NH_3 and H_2SO_4
- A closed system transfer of flammable /toxic chemical should be used to prevent emission of flammable vapour
- Safety device such as automatic temp. controlled sensor will be used to warn operators of overheating in process vessels so that appropriate measure taken immediately.
- Regular housekeeping should be practiced to minimise flammable dust accumulation.
- Storage and use area shall be identified and maintained as “no smoking area”.
- Use non-sparking type tools and equipment, including explosion proof ventilation.
- Special protective equipment for maintenance breaks in or where exposures may exceed established exposure levels.
- Smoking, welding, flam cutting and other hot work should be prohibited where flammable material is handled.
- Avoiding cross contamination of street clothes. Safety shower and eye washer shall be installed near storage area.
- Lightening arrestor on all chimney and building shall be provided.
- Safety permit system shall be followed for loading, unloading of hazardous chemical.
- Fencing, caution note, hazardous identification board should be provided.
- Only authorized person shall be permitted in storage tank area and register will be maintained.

Table 7.11 Storage detail of Raw Materials

Name of Raw Material	Chemical Formula	Source	Trans- portation	MOC	Maxi. storage	Capacity of container	No.
Acrylonitrile	Liquid	Overseas	Ship/Truck	CS	900 m ³	450 m ³	2 tank
Acrylic Acid	Liquid	Overseas	Ship /Truck	SS	3600 m ³	200 m ³	18 tank
Caustic Soda (50%)	Liquid	Gujarat	Truck	SS	1200 m ³	200 m ³	6 tank
Acrylamide	Liquid	One of the products at this site	Not required	SS	16000 MT	200 m ³	8 tanks
Oil	Liquid	Overseas	Ship/ Truck	SS	1575 m ³	1 x 25m ³ 1 x 50 m ³ 1 x 100 m ³ 7 x 200 m ³	10 Tanks

7.6 ACTION PLAN FOR HANDLING AND SAFETY SYSTEM

- Unload by gravitational flow pumping. Never pressurized unloading.
- Air Vent will be provided.
- Avoid over heating which lead spillage and cause thermal expansion.
- Method for unloading AN truck or tanker, by pumping from top of vessel through a plunging pipe. NRV will be provided on pump discharge line.
- Alternative vessel may be unloaded from top by pressuring with compressed nitrogen or from bottom of pumping or nitrogen pressurization.
- Personal Protective Equipment (safety goggles, hand gloves, apron, masks, gum boots etc.) will be provided.

7.6.1 STEPS IF A SPILL OCCURS:

- Stop or reduce the release of material, if it can be done safely.
- If there are noxious vapours, evacuate and notify supervisor or emergency coordinator.
- Eliminate all sources of ignition.
- Evacuate all people not wearing protective equipment from the area of the spill or leak until cleanup is complete.
- Notify supervisor or emergency coordinator of the spill.
- Do not walk through spilled product. Avoid skin contact and inhalation.
- Stay upwind and keep out of low lying area.
- For large spills and fires, immediately call your fire department.
- Earthing/bonding shall be provided for static charges.
- Container shall be bonded and grounded for transfer to avoid static sparks.

7.6.2 FOLLOWING EMERGENCY EQUIPMENT SHALL BE PRESENT ON SITE

- Fire extinguishers
- Industrial first aid kit
- Portable eye- washes station, capable of supplying 15 minutes of water.
- Emergency shower
- Ample supply of potable water for washing as well as for drinking purpose.
- Emergency communication devices, such as mobile phone, or two way radios
- Vehicle suitable for emergency transport.

7.6.3 MINIMIZATION OF THE MANUAL HANDLING OF HAZARDOUS SUBSTANCE

- Training and education, applying general safety principles such as proper work practices, equipment, and controls can help to reduce workplace accidents involving the moving, handling and storing of materials.
- Whether moving materials manually or mechanically handled, employees should know and understand the potential hazards associated with the task at hand and how to control their workplaces to minimize the danger.
- Employers and employees should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take corrective action.
- Provide flameproof electrical motor & transfer chemicals through the pipelines.
- Use specially designed pallets to hold, move raw materials, finished products through work areas.
- Proper ordering,labelling, storage and disposal of chemical
- Minimize lifting of raw materials, heavy loads by using appropriate platforms, trolleys etc.
- Avoid the moving, manual handling of hazardous material.

7.7 DETAILS OF THE SEPARATE ISOLATED STORAGE AREAAND SAFETY MEASURE

Separate isolated storage area proposed for flammable chemicals. Flame proof electrical fittings, DCP extinguishers and other safety measures areproposed. Specific safety details / provisions for various hazardous chemicals and detailed fire control plan for flammable substances and processes showing hydrant pipeline network, provision of D.G.Sets, fire pumps, jockey pump, toxic gas detectors etc.

➤ **FIRE CONTROL PLAN:**

Table -7.12Details of Proposed Fire Hydrant Pumps:

Sr. No.	Name of Pump	Nos. of Pump	Capacity
1.	Electrical Pump	1	400 m ³ /hr
2.	Jockey Pump	1	10 m ³ /hr
3.	Diesel Pump	1	400 m ³ /hr

Details of Proposed Fire Water Reservoir: FOUR TANKS OF 310 m³ each

Table -7.13PROPOSED FIRE EXTINGUISHERS AS PER IS 15683:

Sr.No.	Type of Fire Extinguishers & location	Capacity	Qty
1	ABC type (QC Lab)	1.0 kg	2
2	ABC type (Production Area)	5.0 kg	5
3	ABC type (Production Area)	25.0 kg	1
4	CO ₂ type (Production Area)	4.5 kg	2

7.7.1 PROPOSED FIRE & SAFETY MEASURES:

- Flameproof electrical light fittings will be provided in chemical storage area & process areas.
- Bund wall is provided to all above ground storage of material.
- Automatic fire sprinkler will be installed at flammable area. Smoke, gas & spark detection system will be provided at chemical storage & process area.
- Safety manual will be perorated for the Health & safety awareness and distributed to important key personnel's.
- Mock drill/evacuation drill will be conducted to combat any emergency.
- Fire & safety training/Audit programs will be organised on regular basis.
- Safety boards, posters & signage's will be displayed.
- Requisite PPE's will be provided to workers & ensure the usage of them.
- Provisions of Spark arrestors to vehicle exhausts.
- Earthling & bonding will be provided
- Proper ventilation will be provided in process area & storage areas.
- Required Fire extinguishers, fire hydrant, fire alarms & sprinklers will be installed will be provided.
- Emergency/spill kit will be provided. Sensor for flammable chemical is provided.
- Safety shower and eye washer shall be installed
- Hazardous material should be stored away from the plant and safe distance shall be maintained.
- Safety permit system shall be followed for loading, unloading of hazardous chemical.
- Only authorized person shall be permitted in flammable storage area and register will be maintained.
- Corrosive chemical is spilled, use neutralizing agent to neutralized it and flush with water or use an absorbent to absorb it and dispose off in plastic bags.
- Protective gloves, safety glasses, face shield and apron should be worn during handling.
- Quantity should be kept to minimum.
- Appropriate decontamination procedure should be followed when handling spillages of toxic Chemicals.

7.7.2 SAFETY PROVISIONS FOR HAZARDOUS CHEMICAL:

- Foam System is provided
- Dyke wall is provided to all above ground storage tank.
- Fire hydrant system will be installed.
- Safety shower and eye washer are installed near hazardous chemical storage area.

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- Flame proof light fitting is provided at flammable storage area.
- Proper selection of MOC for tank, Sprinkler system
- Earthing/bonding is provided for static charges.
- Flame arrestor is provided on flammable material storage tank vent.
- Level gauge and level measurement instrument is provided on material storage tank.
- Lightening arrestor on all chimney and building is provided.
- Hazardous materials are stored away from the plant and safe distance maintained.
- Safety permit system is followed for loading, unloading of hazardous chemical.
- Fencing, caution note, hazardous identification board is provided.
- Only authorized person will be permitted in storage tank area and register will be maintained.
- Corrosive chemical is spilled, use neutralizing agent to neutralized it and flush with water or use
- Protective gloves, safety glasses, face shield and apron should be worn during handling.
- Quantity should be kept to minimum.
- Spilled flammable liquid is volatile; it evaporated and is exhausted by ventilation system.
- Appropriate decontamination procedure should be followed when handling spillages of toxic chemicals.
- Bisulphite for ACN

7.7.3 DETAILS OF ANTIDOTES:

Only antidote is available for AN: Hydroxocobalamin (CYANOKIT). No Antidotes Available for other Chemicals.

7.7.4 FIRE CONTROL PLAN:

Following FIRE safety devices will be provided to protect from any malfunctioning of plant equipments. Following fire protection systems will be provided.

- Water storage of adequate capacity to meet the requirements of water for firefighting purposes.
- Fixed fire Installation will be installed such as Fire hydrants, Fire hose reel and automatic sprinkler system will be provided.
- HIRARC (Hazard Identification, Risk analysis and Risk Control) to be done for entire process, activity and storage of chemicals.
- Diesel driven pumps and headers to supply water to fire hydrant network.
- Smoke, gas and spark detectors to be provided at chemical storage areas and process area.
- Adequate Portable fire extinguishers, sand bucket, wheeled fire & safety equipment will be provided at the required places.
- Equipment required for personal safety like blankets, gloves, apron, gum boots, face mask helmets, safety belts, first aid boxes etc. to be provided. Proximity suits and self-contained breathing apparatus to be provided.
- Dedicated, experienced Firefighting trained persons will be deployed.
- Emergency evacuation plan will be prepared and displayed.
- Emergency phone number will be displayed at strategic locations.
- Emergency drills will be carried out periodically to ensure preparedness must continue.
- All hot/cold work, height work and confined space jobs will be done with proper permit system.
- Provision of flameproof electrical fittings / equipment's.
- Proper maintenance of earth pits and maintain record.

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- Strict enforcement of no smoking.
- Earthing and bonding to be provided to dissipate static electricity.
- Periodic training and refresher courses to train the staff in safety firefighting.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material storage may be provided as knock on effect in case of fire is possible.
- Fire NOC to be obtained after completion of fire protection system installation from state government.
- Nitrogen inerting must be ensured whenever handling flammable materials or those with incompatibility with air. Similarly breaking vacuum in presence of flammable vapours MUST be with Nitrogen only and never air. This must be ensured. N2 cylinders must be kept in sufficient supply.
- Foam System is also provided.

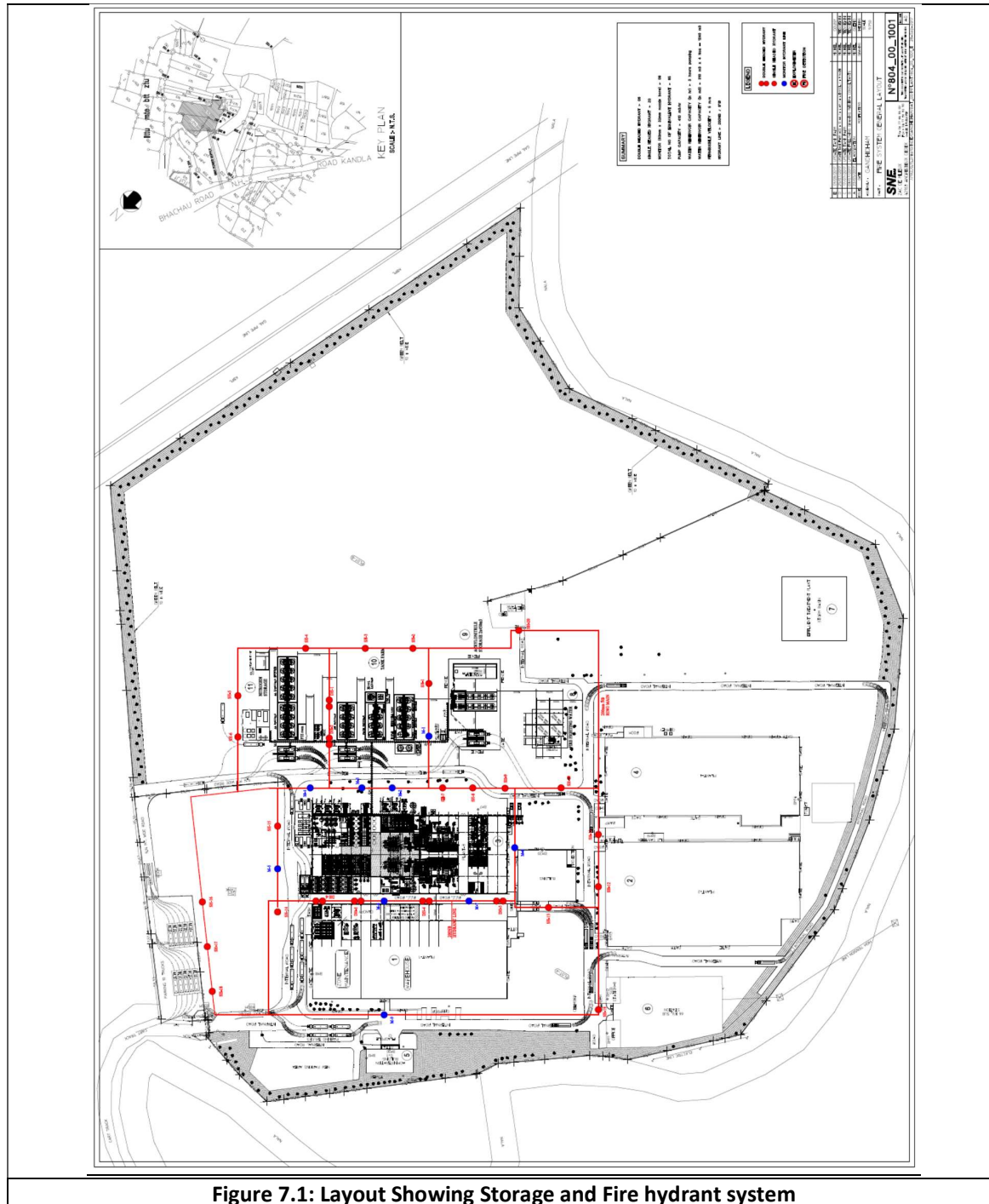


Figure 7.1: Layout Showing Storage and Fire hydrant system

7.8 MSDS OF ALL THE PRODUCTS AND RAW MATERIALS

Details of hazardous characteristics and toxicity of raw materials and products to be handled and the control measures proposed to ensure safety and avoid the human health impacts. This shall include the details of Antidotes also. Detailed material handling plan to avoid / minimize human exposure. The unit will maintain the MSDS of Products and Raw material with EHS department.

7.8.1 RISK ANALYSIS AND CONSEQUENCE ANALYSIS

The consequence analysis has been done for selected scenarios. This has been done for weather conditions having wind speed 3.9 m/s. Software used for calculation- ALOHA (Areal locations of Hazardous atmospheres).

ALOHA is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA can predict the rates at which chemical vapours may escape into the atmosphere from broken gas pipes, leaking tanks and evaporating puddles. It can then predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.

ALOHA is an air dispersion model, for predicting the movement and dispersion of gases. It predicts pollutant concentrations downwind from the sources of a spill, taking into consideration the physical characteristics of the spilled material. ALOHA also accounts for some of the physical characteristics of the release site, weather conditions, and the circumstances of the release. Like many computer programs, it can solve problems rapidly and provide results in a graphic, easy to use format. This can be helpful during an emergency response or planning for such a response.

ALOHA provide output as amount of chemical discharged from the source as well as its concentration in air it takes into account different levels of concentrations for a specified chemical.

7.9 Worst case Scenario

Risk assessment including prediction of the worst-case scenario and maximum credible accident scenarios should be carried out. The worst-case scenario should take into account the maximum inventory of storage at site at any point of time. The risk contours should be plotted on the plant layout map clearly showing which of the facilities would be affected in case of an accident taking place. Based on the same, proposed safeguard measures including On-Site / Off-Site Emergency Plan should be provided.

Table -7.14 Worst case scenario of chemical

Sr. No	Short description of scenario	Chemical involved	Type of Risk	Probability	Concentration	Damage Distance from source
1	Release from storage area (900 cubic meters)	ACRYLONITRILE	Toxic effect	Very unlikely	1.7 ppm 28 ppm	>10 km >10 km
			Flammable Area of Vapor Cloud	Very unlikely	3050 ppm 18300 ppm	4.2 km 2.0 km
			Overpressure (blast force) from vapor cloud explosion	Very unlikely	1 psi 3.5 psi 8.0 psi	1.9 km (Shatter glass) 1.6 km (Serious injury) LOC was never exceed
2	Release from storage area (1500 cubic meters)	ACRYLIC ACID	Toxic effect	Very unlikely	1.5 ppm 46 ppm 180 ppm	>10 km >10 km >10 km
			Flammable Area of Vapor Cloud	Very unlikely	2400 ppm 14400 ppm	5.5 km 2.6 km
			Overpressure (blast force) from vapor cloud explosion	Very unlikely	1 psi 3.5 psi 8.0 psi	2.4 km (Shatter glass) 2.1 km (Serious injury) LOC was never exceed

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CHEMICAL DATA:

Chemical Name: ACRYLONITRILE Molecular Weight: 53.06 g/mol
 AEGL-1 (60 min): N/A AEGL-2 (60 min): 1.7 ppm AEGL-3 (60 min): 28 ppm
 IDLH: 85 ppm LEL: 30500 ppm UEL: 170000 ppm
 Carcinogenic risk - see CAMEO Chemicals
 Ambient Boiling Point: 77.3° C
 Vapor Pressure at Ambient Temperature: 0.22 atm
 Ambient Saturation Concentration: 224,164 ppm or 22.4%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 5.32 meters/second from SW at 3 meters
 Ground Roughness: open country Cloud Cover: 5 tenths
 Air Temperature: 37° C Stability Class: D
 No Inversion Height Relative Humidity: 43%

SOURCE STRENGTH:

Direct Source: 900 cubic meters Source Height: 0
 Source State: Liquid
 Source Temperature: equal to ambient
 Release Duration: 1 minute
 Release Rate: 11,800 kilograms/sec
 Total Amount Released: 708,323 kilograms

THREAT ZONE:

Model Run: Heavy Gas
 Red : greater than 10 kilometers --- (28 ppm = AEGL-3 [60 min])
 Orange: greater than 10 kilometers --- (1.7 ppm = AEGL-2 [60 min])
 Yellow: no recommended LOC value --- (N/A = AEGL-1 [60 min])

THREAT ZONE:

Threat Modeled: Flammable Area of Vapor Cloud
 Model Run: Heavy Gas
 Red : 2.0 kilometers --- (18300 ppm = 60% LEL = Flame Pockets)
 Yellow: 4.2 kilometers --- (3050 ppm = 10% LEL)

THREAT ZONE:

Threat Modeled: Overpressure (blast force) from vapor cloud explosion
 Type of Ignition: ignited by spark or flame
 Level of Congestion: congested
 Model Run: Heavy Gas
 Red : LOC was never exceeded --- (8.0 psi = destruction of buildings)
 Orange: 1.6 kilometers --- (3.5 psi = serious injury likely)
 Yellow: 1.9 kilometers --- (1.0 psi = shatters glass)

Toxic Threat Zone

ALOHA® 5.4.5



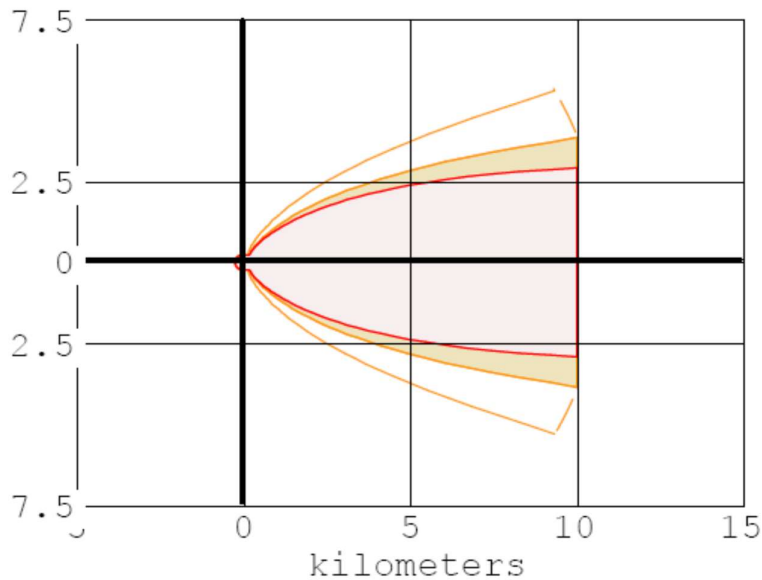
Time: September 1, 2017 1747 hours ST (using computer's clock)

Chemical Name: ACRYLONITRILE
Carcinogenic risk - see CAMEO Chemicals

Wind: 5.32 meters/second from SW at 3 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : greater than 10 kilometers --- (28 ppm = AEGL-3 [60 min])
Orange: greater than 10 kilometers --- (1.7 ppm = AEGL-2 [60 min])
Yellow: no recommended LOC value --- (N/A = AEGL-1 [60 min])

kilometers



- greater than 28 ppm (AEGL-3 [60 min])
- greater than 1.7 ppm (AEGL-2 [60 min])
- no recommended LOC value for AEGL-1 (60 min) (not shown)
- wind direction confidence lines

Note: Threat zone picture is truncated at the 10 km limit

Fig No. 7.2: Toxic Threat Zone of Acrylonitrile

Flammable Threat Zone

ALOHA® 5.4.5



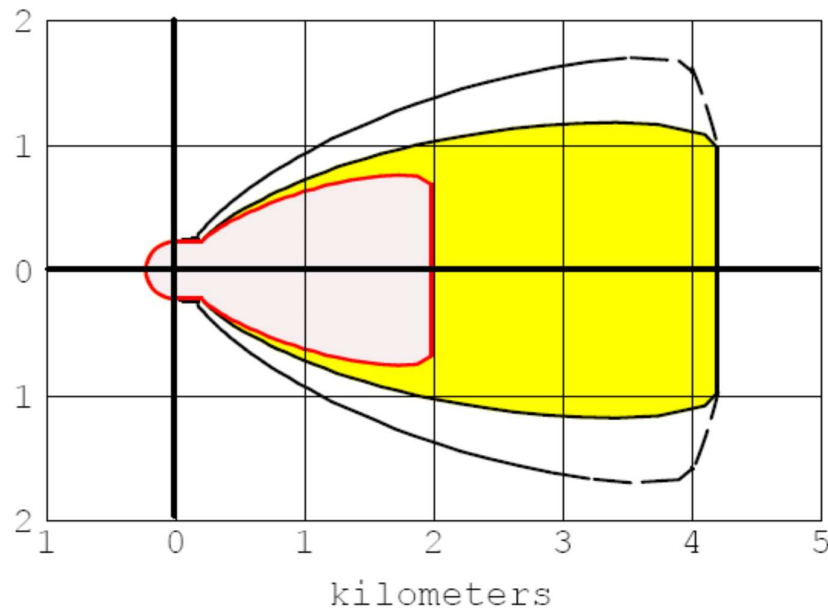
Time: September 1, 2017 1747 hours ST (using computer's clock)

Chemical Name: ACRYLONITRILE
Carcinogenic risk - see CAMEO Chemicals

Wind: 5.32 meters/second from SW at 3 meters

THREAT ZONE:
Threat Modeled: Flammable Area of Vapor Cloud
Model Run: Heavy Gas
Red : 2.0 kilometers --- (18300 ppm = 60% LEL = Flame Pockets)
Yellow: 4.2 kilometers --- (3050 ppm = 10% LEL)

kilometers



- greater than 18300 ppm (60% LEL = Flame Pockets)
- greater than 3050 ppm (10% LEL)
- wind direction confidence lines

Fig No. 7.3: Flammable Threat Zone for Acrylonitrile

Overpressure (Blast Force) Threat Zone

ALOHA® 5.4.5



Time: September 1, 2017 1747 hours ST (using computer's clock)

Chemical Name: ACRYLONITRILE
Carcinogenic risk - see CAMEO Chemicals

Wind: 5.32 meters/second from SW at 3 meters

THREAT ZONE:
Threat Modeled: Overpressure (blast force) from vapor cloud explosion
Type of Ignition: ignited by spark or flame
Level of Congestion: congested
Model Run: Heavy Gas
Red : LOC was never exceeded --- (8.0 psi = destruction of buildings)
Orange: 1.6 kilometers --- (3.5 psi = serious injury likely)
Yellow: 1.9 kilometers --- (1.0 psi = shatters glass)

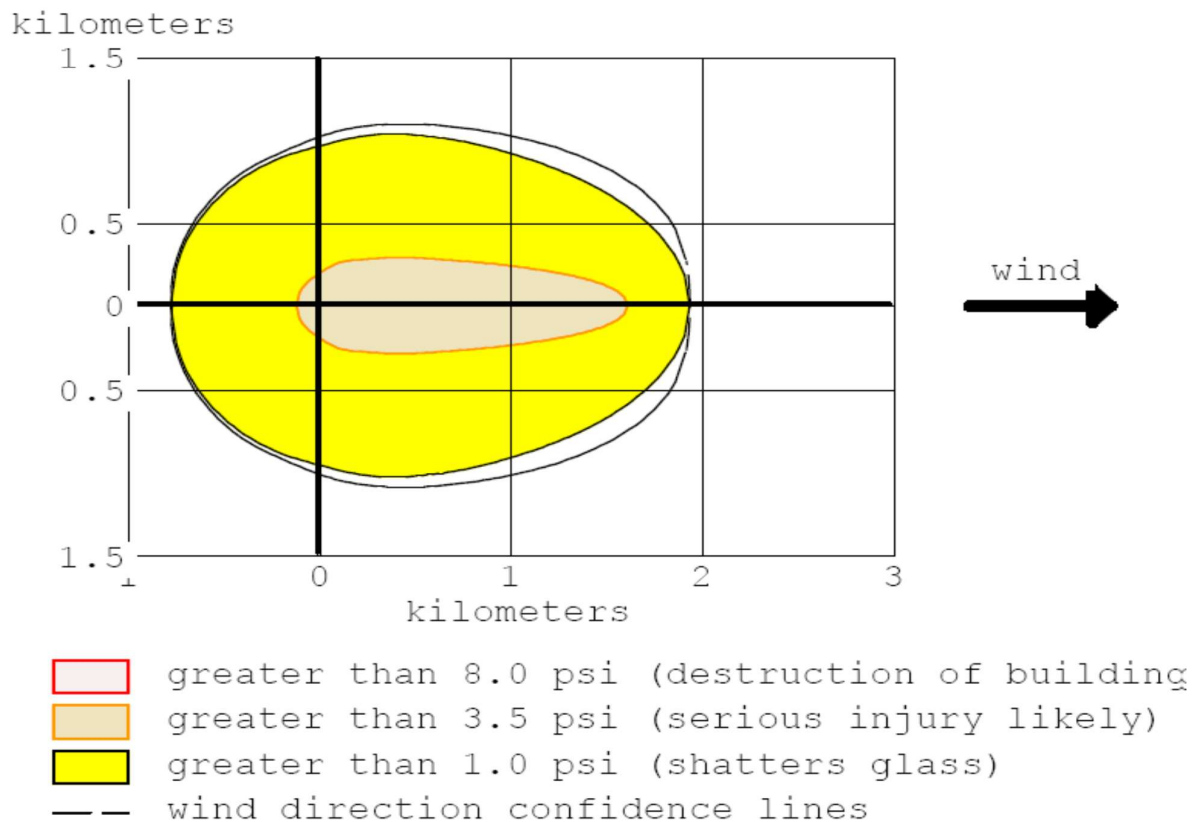


Fig 7.4: Overpressure (Blast Force) Threat Zone for Acrylonitrile

SITE DATA:

Location: SNF FLOPAM INDIA PVT LTD, INDIA

Building Air Exchanges Per Hour: 1.18 (unsheltered single storied)

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Time: September 1, 2017 1758 hours ST (using computer's clock)

CHEMICAL DATA:

Chemical Name: ACRYLIC ACID Molecular Weight: 72.06 g/mol
 AEGL-1 (60 min): 1.5 ppm AEGL-2 (60 min): 46 ppm AEGL-3 (60 min): 180 ppm
 LEL: 24000 ppm UEL: 170000 ppm
 Ambient Boiling Point: 141.0° C
 Vapor Pressure at Ambient Temperature: 0.012 atm
 Ambient Saturation Concentration: 11,713 ppm or 1.17%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 5.32 meters/second from SW at 3 meters
 Ground Roughness: open country Cloud Cover: 5 tenths
 Air Temperature: 37° C Stability Class: D
 No Inversion Height Relative Humidity: 43%

SOURCE STRENGTH:

Direct Source: 1500 cubic meters Source Height: 0
 Source State: Liquid
 Source Temperature: 37° C
 Release Duration: 1 minute
 Release Rate: 25,800 kilograms/sec
 Total Amount Released: 1,547,960 kilograms

THREAT ZONE:

Model Run: Heavy Gas
 Red : greater than 10 kilometers --- (180 ppm = AEGL-3 [60 min])
 Orange: greater than 10 kilometers --- (46 ppm = AEGL-2 [60 min])
 Yellow: greater than 10 kilometers --- (1.5 ppm = AEGL-1 [60 min])

THREAT ZONE:

Threat Modeled: Flammable Area of Vapor Cloud
 Model Run: Heavy Gas
 Red : 2.6 kilometers --- (14400 ppm = 60% LEL = Flame Pockets)
 Yellow: 5.5 kilometers --- (2400 ppm = 10% LEL)

THREAT ZONE:

Threat Modeled: Overpressure (blast force) from vapor cloud explosion
 Type of Ignition: ignited by spark or flame
 Level of Congestion: congested
 Model Run: Heavy Gas
 Red : LOC was never exceeded --- (8.0 psi = destruction of buildings)
 Orange: 2.1 kilometers --- (3.5 psi = serious injury likely)
 Yellow: 2.4 kilometers --- (1.0 psi = shatters glass)

Toxic Threat Zone

ALOHA® 5.4.5



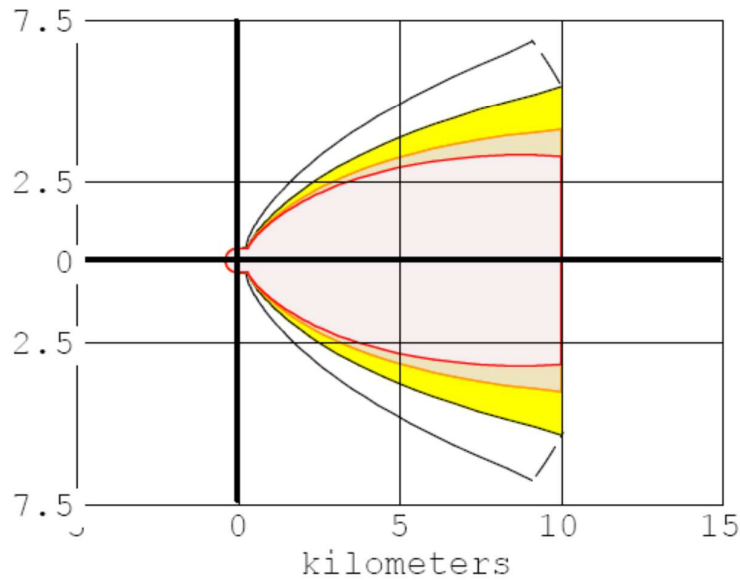
Time: September 1, 2017 1758 hours ST (using computer's clock)

Chemical Name: ACRYLIC ACID

Wind: 5.32 meters/second from SW at 3 meters

THREAT ZONE:
 Model Run: Heavy Gas
 Red : greater than 10 kilometers --- (180 ppm = AEGL-3 [60 min])
 Orange: greater than 10 kilometers --- (46 ppm = AEGL-2 [60 min])
 Yellow: greater than 10 kilometers --- (1.5 ppm = AEGL-1 [60 min])

kilometers



- greater than 180 ppm (AEGL-3 [60 min])
- greater than 46 ppm (AEGL-2 [60 min])
- greater than 1.5 ppm (AEGL-1 [60 min])
- wind direction confidence lines

Note: Threat zone picture is truncated at the 10 km

Fig 7.5 Toxic Threat Zone for Acrylic Acid

Flammable Threat Zone

ALOHA® 5.4.5



Time: September 1, 2017 1758 hours ST (using computer's clock)

Chemical Name: ACRYLIC ACID

Wind: 5.32 meters/second from SW at 3 meters

THREAT ZONE:

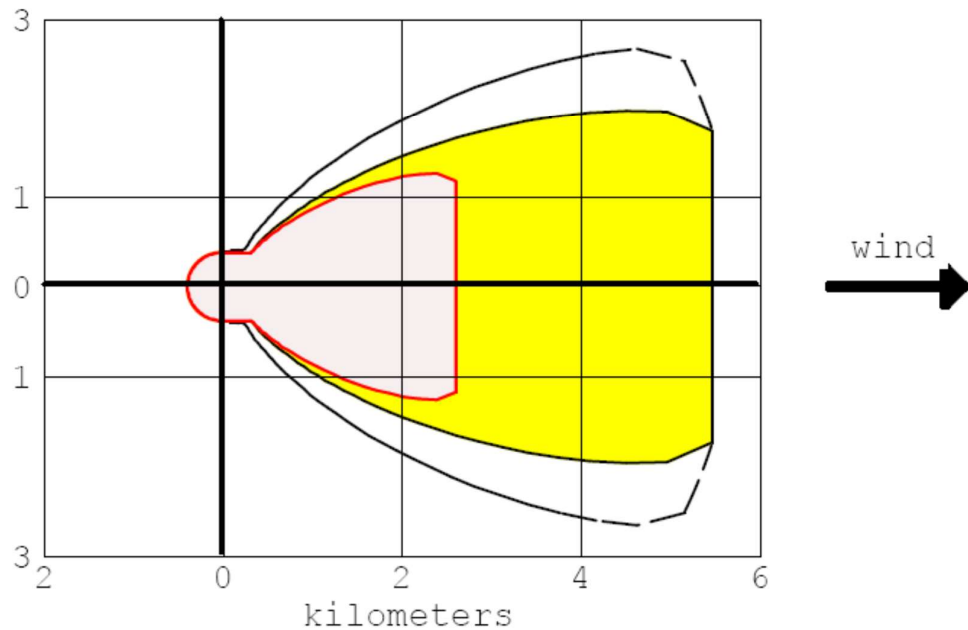
Threat Modeled: Flammable Area of Vapor Cloud

Model Run: Heavy Gas

Red : 2.6 kilometers --- (14400 ppm = 60% LEL = Flame Pockets)

Yellow: 5.5 kilometers --- (2400 ppm = 10% LEL)

kilometers



- greater than 14400 ppm (60% LEL = Flame Pockets)
- greater than 2400 ppm (10% LEL)
- wind direction confidence lines

Fig 7.6: Flammable Threat Zone for Acrylic Acid

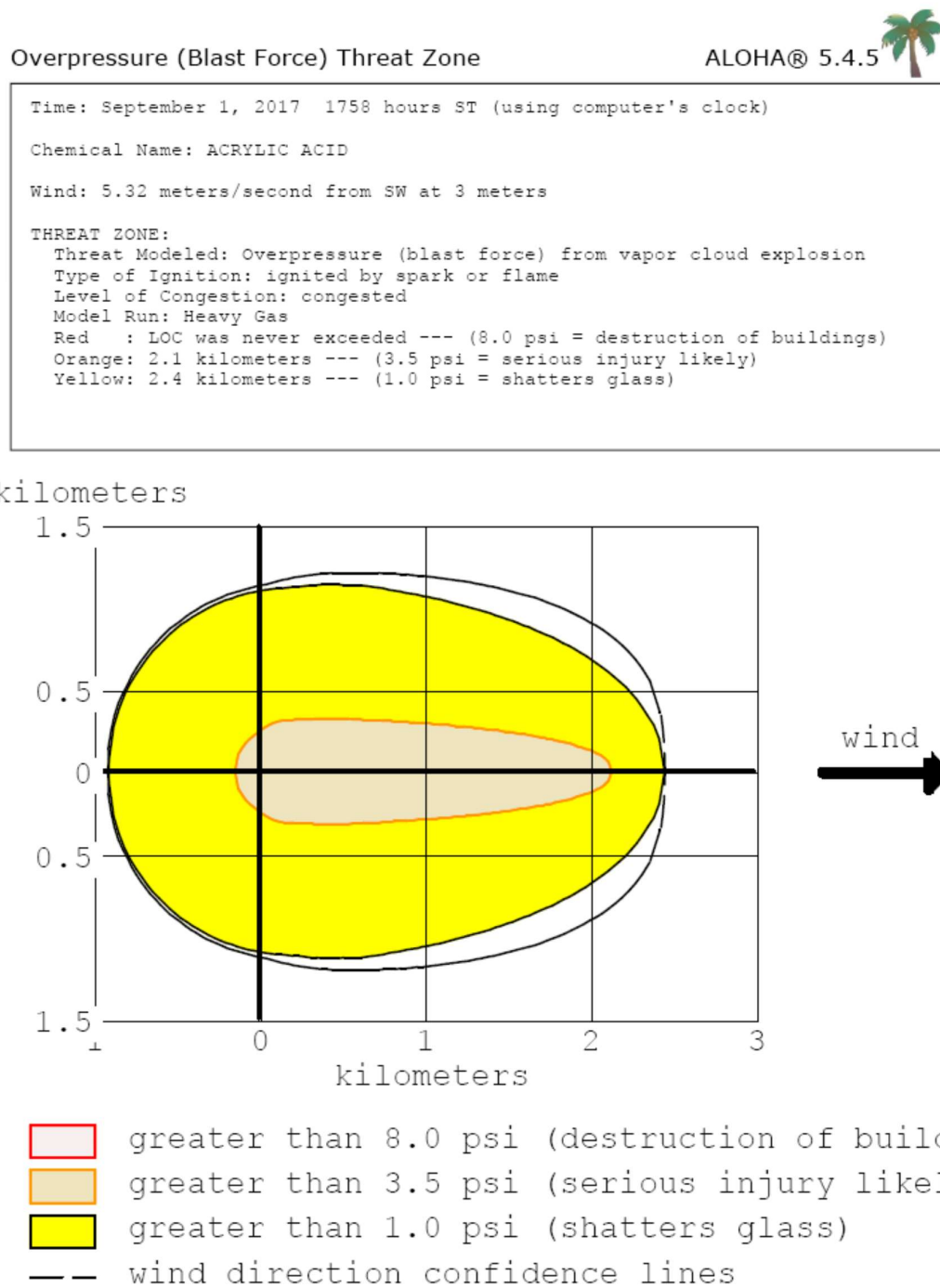


Fig 7.7: Overpressure (Blast Force) Threat Zone for Acrylic Acid

7.10 ON SITE EMERGENCY PLAN

INTRODUCTION:

An emergency in the premises has the potential to cause serious injury or loss of lives or extensive damage to the property and/or environment and serious disruption both inside and outside the plant. In such cases sometimes outside agencies are required to call for help in handling the situation. The causative factors like plant/equipment failure, human error, earth quake, sabotage etc can lead to fire, explosion, toxic release, structure collapse if not prevented/attended on time.

This OEP lays down the code of conduct of all personnel in the Plant and the procedures to be adopted by them in the event of an "Emergency". These procedures have been prepared taking into account the minimum strength of manpower available at all times in the premises. The individuals under the direction of the respective Team Leaders shall carry out the responsibilities assigned.

The emergency procedures outlined are suitable for round the clock coverage including holidays. These emergency procedures shall be followed as outlined in the OEP during all shifts.

7.10.1 OBJECTIVES

The overall objectives of OEP are:

- To control (and if possible eliminate) the situation as quickly as possible.
- To avoid confusion/panic and to attend the emergency with clear-cut line of action.
- To minimize the loss of property to the plant as well as to our neighbourhood.
- To safe guard the non-affected areas.
- To alert the neighbourhood.
- To arrange head-count and rescue operations.
- Treatment of the injured.
- To safeguard others by timely evacuation.
- To prevent any cascade of emergencies.

7.10.2 DEFINITION

Environment as defined u/s 2(a) of the environment Protection Act includes water, air and land and the inter relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro organism and property.

Environment pollutant defined by the same Act as any solid, liquid or gaseous substances present in such concentration as may be tend to injurious to atmosphere.

Hazardous substance is also defined by the same Act and hazardous process is defined by sec.2 (b) of the Factories Act. 1948.

Hazard is a physical situation, which may cause human injury, damage to property or the environment or any combination of these criteria.

Chemical Hazard is a hazard due to chemical (including its storage, process, handling etc.) and it is realized by fire, explosion, toxicity, corrosivity, radiation etc.

Risk is a likelihood of an undesired event (i.e. accident, injury or death) occurring within a specified period or under specified circumstances.

Individual risk is the frequency at which any individual may be expected to sustain a given level of harm from the realization of specific hazards.

Social risk is a measure of chances of a number of people being affected by a single event or set of events and is often presented as f/n curves (i.e. frequency v/s number of people affected)

The on-site emergency plan will deal with measures to prevent and control emergencies affecting public and the environment outside the premises. The manufacturer should provide the necessary information on the nature, extent and likely effects of such incidents.

Disaster is a catastrophic situation in which the day-to-day patterns of life are, in many instances, suddenly disrupted and people are plunged into helplessness and suffering and as a result need protection, clothing, shelter, medical and social care and other necessities of life, such as: -

- Disasters resulting from natural phenomenon like earthquake, volcanic eruptions, storm, surges, cyclones, tropical storms, floods, landslides, forest fires and massive insect infestation. Also in this group, violent draught which will cause a creeping disaster leading to famine, disease and death must be included.
- Second group includes disastrous events occasioned by man, or by man's impact upon the environment, such as armed conflict, industrial accidents, factory fires, explosion and escape of toxic gases or chemical substances, river pollution, mining and other structural collapses; air, sea, rail and road transport accidents, aircraft crashes, collision of vehicles carrying inflammable liquids, oil, spills at sea, and dam failures.

7.10.3 ACCIDENT

An accident is an unplanned event, which has a probability of causing personal injury or property damage or both. It may result in physical harm (injury or disease) to person (s), damage to property, loss to the company, a near miss or any combination of the effect.

A Major accident is a sudden, unexpected, unplanned event, resulting from uncontrolled developments during and industrial activity, which causes or has a potential to cause

- Serious adverse effects immediate or delayed (death, injuries, poisoning or hospitalization) to a number of people inside the installations and/ or to persons outside the establishment.
- Significant damage may be caused to crops, plants or animals or significant contamination of land, waters or air.
- An emergency intervention outside the establishment (evacuation of local population, stopping of local traffic).
- Any combination of above.

7.10.4 EMERGENCY

An emergency is the situation, which has potential to cause a large-scale damage or destruction to life or property or Environment or combination of these within or outside the factory. Therefore it is essential to have a laid down procedure to meet emergency systematically.

In any industry, emergency can arise at any moment and this depends on the type of:

- Raw Materials
- Machines
- Nearby Industries
- Location of the Industry etc.

7.10.5 NATURE OF EMERGENCY

The "Emergency" specified in this plan will refer to occurrence of one or more of the following natural/manmade events.

- Fire
- Explosion
- Release of Toxic Gas/ Vapour
- Spillage of flammable liquid /gas
- Deliberate Sabotage, Terrorism, Air Raid etc.
- Natural Calamities: - Lightening, Storm, Earthquake, Flood etc.
- Collapsing of structure
- Overturning of tanker containing flammable / toxic substances.

7.10.6 MEDICAL HELP

First Aid Boxes have been provided at various strategic locations. Requisite number employees are trained about First Aid, Liaison with nearest hospitals in gandhidham.

7.10.7 COMMUNICATION SYSTEM

- Alarm Raising for Emergency by blowing the sirens installed
- The siren will be used for raising the emergency alarm and also for all clear signals.
- Emergency Siren: The wailing alarm will be sounded intermittently at fixed interval of 30 seconds for a period of two minutes in case of emergency, such alarm will signify the employees that an emergency has occurred and that the emergency services should be put into operation.
- Incident Controller after assessing the situation will declare that emergency is over. Till the Incident Controller issues the declaration, all the leaders will adhere to the task and be present at the prescribed location.
- All clear signal will be sounded through continuous siren for 1 minute. Even after the emergency is over a skeleton staff of the Rescue/Evacuation Team will be available at the site of emergency for at least 30 minutes to ensure that the situation is absolutely free from danger.
- After the emergency is over, all the team leaders should meet at the Emergency Control Center and each team leader should submit a report to the Incident Controller about team performance and other details observed.
- In addition to the above systems, internal telephones, P.A.System, Mobile telephones, Computer System etc. will be used for communication.
- If situation is beyond the control, the external agencies will be informed accordingly and asked for the help. Direct telephone, cell phone or messengers / runners may achieve this.

7.10.8 ASSEMBLY POINT

In case of emergency some locations are considered as Assembly Points. Depending on the wind direction and location of emergency, Assembly Point will be declared. The employees should run across the wind direction and not against the wind direction.

Depending upon the location of the emergency the Incident Controller will fix the Assembly Point and Officer will announce the location of the Assembly Point. Employee's attendance, visitors and contractors workmen register will be made available at the Assembly Point for head count.

7.10.9 EMERGENCY CONTROL CENTRE

Factory Manager Office will be declared as an Emergency control center. Emergency control center is facilities with:

- Address and Telephone numbers of the Factory Inspectorate, Gujarat Pollution Control Board, Police, Fire Brigade, Hospitals and OEP Team Members
- Plant layout-indicating storage of hazardous materials, layout of fire Hydrants/extinguishers, entrances/exits, roads etc.
- Portable P.A. System, Manual Siren, Torches, Saw, Nylon Ropes.
- First Aid Box.
- List of employees with address, telephone number, blood group etc.
- Material Safety Data Sheets of all chemicals handled.

7.10.10 WIND SOCKS

Wind direction will be determined with the help of installed windsocks

7.10.11 MOCK DRILL

Mock drills are carried out regularly to familiarize the staff with their roles, fire protection equipment/system installed in the plant and use of personnel protective equipment. Senior officials monitor this and shortcomings are thoroughly studied and necessary corrective measures are taken.

PROCEDURES FOR MOCK DRILLS

- Inform all the employees about mock drills and the signal to be given.
- Fix the date and location of the emergency for mock drills.
- Mock drills will be monitored by observers.
- Raise the siren for emergency.
- After hearing the siren the Incident Controller, Site Controller, Officers and Team Members should actuate the "On-site Emergency Plan".

7.10.12 PROCEDURE ON NOTICING AN EMERGENCY

- If anybody notices any situation, which may lead to a disaster, should be immediately inform the Shift In-charge / site controller / Incident Controller / Fire & Safety Supervisor / Security.
- Take charge of the situation as Incident Controller.
- Rush to the site of emergency to get the correct picture and then to Emergency Control Center for speedy control over the situation by making an arrangement for raising the alarm.
- On arrival of Team members, he shall assign duties as required and activate the On-Site Emergency Plan.
- Ensure safety of the plant and the personnel in the plant. He will make an assessment of the emergency and decide on external assistance.
- Communicate and Coordinate among the Incidents Controller/ Site Controller/ Factory manager/ fire safety supervisor etc. and will be the final authority on all matters related with management of emergency such as:
 - Fire fighting.
 - Welfare and rescue operations.
 - Arrange for Civil/Mechanical/Electrical work during emergency.
 - Transport.

Logistic facility /Tel Nos.	Destination	Distance Km.
Nearest Hospital	Bachau	18.0 Km
Fire Brigade (101)	Gandhidham	15.0 Km
Nearest Police Station (100)	Anjar	22.0 Km

7.10.13 INCIDENT CONTROLLER / SITE CONTROLLER

- Rush immediately to the scene of the fire/emergency, select and set out appropriate fire/emergency equipment. He will take the below mentioned actions at the earliest opportunity, if the fire/emergency is not controlled. He will call the security personnel from their residences for additional manpower if required.
- Regulate entry and exit of personnel required for controlling the fire/emergency.
- Restrict exit of personnel required for controlling the fire/emergency.
- Arrange for Personnel Protective Equipment required for the emergency.
- Call, the Fire Brigade, Police in case of necessity in consultation with the incident controller.
- Arrange transport facilities for removal of casualties to dispensary / hospital.
- Take responsibility of law and order.
- Keep detailed records of the incident and progress of operations to fight the emergency.

7.10.14 FACTORY MANAGER

He will rush to the Emergency Control Centre and collect the information from the Incident Controller. Further he will,

- Announce the location of the Assembly Point after getting information from Incident Controller / site controller.
- Take the list of persons to be communicated internally and externally.
- Maintain liaison with the press, government agencies i.e. Police, Fire Brigade etc. and the neighborhood regarding the emergency under instructions from Incident Controller.
- Courteously Receive officers from the State Government or neighbors to the Administration Block only and inform to Incident Controller that they can be taken care off.
- Take all the steps required for the welfare such as providing tea, snacks, emergency temporary Medical Center in consultation with the incident controller/site controller.
- Disclose all the necessary information in the plant and media so as to avoid rumors and confusion.
- Also be responsible for the head counts at the Assembly Points.

7.10.15 FIRE & SAFETY SUPERVISOR/ SHIFT INCHARGE & SECURITY

- Proceed to the scene; establish contact with firemen and incident controller to supplement efforts in fire fighting.
- Assist in searching casualties and help to remove them to the medical center.
- Organize outside assistance in fire fighting and rescue operations if required.
- Mobilize personal protective equipment and safety appliances and assist personnel handling emergency in using them.
- Keep and check on any new development of unsafe situation and report the same to Site Main Controller.
- Collect and preserve evidence to facilitate future inquiries.
- Effectively cordon off the emergency area and will prevent unauthorized people entering the scene.

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- Permit the Fire tenders or Ambulance requisitioned by Incident Controller to the plant.
- Ensure that vehicles and Lorries are sent out of the plant premises.
- Ensure that all the employees are conducted out of plant and assembled at Assembly Point.
- Control Traffic Movement.
- Remove tankers, tanker drivers outside.
- Entry of unauthorized public to be prevented.
- Arrange for vehicles for shifting casualties and essential workers to safe assembly points.

7.10.16 ENGINEERING/ OPERATION & MAINTENANCE

- Ensure the safety of the remaining part of the plant.
- Take necessary steps for plant shutdown in consultation with the site controller.
- Ensure that an Operator is immediately available at the Water Pump House for fire fighting.
- Mobilize with necessary tools and tackles to handle any repair work on an emergency basis.

7.11 RISK REDUCTION MEASUREMENT & RECOMMENDATION

- Storage area of raw material will be installed away from the plant area.
- Automatic sprinkler system and foam system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Containment dykes with proper sloping and collection sumps should be provided so that any spillages in the bulk storage and other handling areas shall not stagnate and shall be quickly lead away to a safe distance from the source of leakage. This reduces the risk of any major fire on the bulk storages and the risk to the environment shall be minimized/ eliminated.
- Inspection of the storage tanks as per prefixed inspection schedule for thickness measurement, joint and weld efficiency etc.
- Provision of flameproof electrical fittings / equipment's.
- Proper maintenance of earth pits.
- Strict compliance of security procedures like issue of identity badges for outsiders, gate passes system for vehicles, checking of spark arrestors fitted to the tank lorries etc.
- Strict enforcement of no smoking.
- Periodic training and refresher courses to train the staff in safety fire fighting.
- Employee training and education will be carried out.
- Emergency drills should be carried out periodically to ensure preparedness must continue.
- Many operations involve use of highly toxic/flammable materials and these needs to be documented as SOPs. These must be made and kept updated on priority.
- Many of the raw materials used for Polyacrylamide are either toxic or flammable. It is therefore important to ensure that these materials are stored in closed, well ventilated totally safe areas. A fire alarm system (heat and smoke detection) should be provided for the storage area where the material is stored as toxic fumes arise on combustion.
- Loose drums of waste materials, often solvent laden, must be removed from the working areas and close watch kept.
- Proper Earthing needs to be provided through plug type systems or through the agitators/liquid.
- Ventilation should be provided for any enclosed are where hydrocarbon or toxic vapours may accumulate. Several such areas were noticed- these may be surveyed and tackled accordingly.
- All personnel should be trained in handling emergency situations and should be apprised of their role in handling emergency situation and to ensure adequacy of the emergency procedures simulated exercise should be carried out. Flame arrestor should be provided.
- Adequate number of caution boards highlighting the hazards of chemicals should be provided at critical locations.

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- The health & physical hazards caused due to toxic, irritant, corrosive, flammable materials. All chemicals are within Threshold Limit Value as per ACGIH.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. will be carried out regularly and its record will be maintained.
- Good housekeeping, use of PPE, Engineering controls, Enclosure processes, scrubber system, display of safety boards, SOP of loading / unloading, local exhaust ventilation, safety shower etc. are important safety measures have taken to keep these chemicals within TLV.
- Appropriate personal protective equipment will be provided & ensure the usage of them.
- Workers will be trained on safe material handling of hazardous chemicals.
- Prepare & display the safe operating procedure for hazardous chemicals storage, handling & transporting or using.
- Local Exhaust ventilation and scrubber should be installed where it is required to reduce fumes, vapours, temperature and heat stress in process and storage.
- Reduce the level of physical activity by sharing workload with other or by using mechanical means.

7.12 SUBMIT CHECKLIST IN THE FORM OF DO'S & DON'TS OF PREVENTIVE MAINTENANCE, STRENGTHENING OF HSE, MFG UTILITY STAFF FOR SAFETY RELATED MEASURES.

Table 7.15 Do's & Don'ts of Preventive Maintenance

FIRE PREVENTION			
Sr	Do's	Sr	Don'ts
1	Follow "No Smoking" Sign.	1	Do not leave any flammable material at the work area.
2	Deposit oily rags and waste combustible material in the identified containers and dispose them suitably.	2	Do not allow wild grass growth around storage of flammable chemicals and gas cylinders
3	Keep minimum inventory of flammable and combustible substances.	3	Do not obstruct accessibility to the fire fighting equipments
4	Take permission before breaking or removal of fire barrier and ensure subsequent relocation of fire barrier	4	Do not destroy the inspection tag provided with the fire equipment
5	Check periodically the operability of fire fighting systems	5	Do not misuse the firefighting equipment other than intended purpose
6	Provide earthing or bonding to prevent accumulation of static charges to tanks where flammable chemicals are stored or handled	6	Do not store the flammable material in the open container
7	Use instruments that are intrinsically safe in explosive atmosphere.	7	Do not use instruments that are not intrinsically safe in the explosive atmosphere
IN CASE OF FIRE			
Sr	Do's	Sr	Don'ts
1	On seeing fire please inform Factory Manager / EHS In charge and warn people nearby by shouting, "Fire", "Fire"	1	Do not runaway in case of fire but act on it.
2	Tell exact location and place of the occurrence clearly	2	Do not become the hindrance to the fire crew
3	Try to extinguish the fire if you are aware about the fire fighting operation.	3	Do not spread rumour in case of fire.

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4	Guide the fire crew to the correct location.	4	Do not leave place unattended if possible, till the fire crew arrive.
5	Keep the emergency escape route clear of materials	5	Do not stay there if you feel unsafe.
6	Try to remove the combustible material from the vicinity of the fire if possible.	6	Do not touch any electrical equipment under the influence of fire.
7	Cover the electrical equipment that is situated near or below the area of fire before applying water.	7	Do not use the extinguisher if not in a good condition.
HANDLING OF GAS CYLINDERS			
Sr	Do's	Sr	Don'ts
1	Use soft pad or ramp for unloading the gas cylinder and avoid knocking / impact while handling and transport.	1	Do not roll the cylinder while handling.
2	Use cylinder cap while handling and transporting the cylinder.	2	Do not use cylinder without pressure gauge.
3	Segregate inert, toxic, non-flammable & flammable cylinders during storage.	3	Do not expose the cylinders to heat and light.
4	Store 'empty' and 'full' cylinder separately, duly marked.	4	Do not change the colour of the cylinder.
5	Label the area of storage.	5	Do not strike a cylinder valve with hammer for reopening.
6	Use a cradle while shifting gas cylinder.	6	Do not transfer the gas from one cylinder to another.
7	Keep cylinders always in upright position and round bottomed cylinders horizontally.	7	Do not store the cylinder near elevator or gangways.
8	Display "No Smoking" sign at gas cylinder storage area.	8	Do not store cylinder in locker or cupboard.
9	Store flammable gas cylinders away from the gas cylinder which support combustion.	9	Do not apply force for connecting the cylinder that does not fit.
10	Use trolley for transporting and handling of gas cylinders.	10	Do not transport cylinder on bicycle or two wheeler
11	Cylinders should be kept separately chained at the place of storage and 'addition station'	11	Do not start using a gas cylinder without proper identification.
12	Valve caps should be fixed on the valve neck when not connected to 'addition banks'.	12	Do not use cylinder as rollers.
		13	Do not store gas cylinders under direct sunlight.
		14	Do not use a lifting magnet for loading or unloading of gas cylinder.
HANDLING OF CHEMICALS			
Sr	Do's	Sr	Don'ts
1	Use proper lifting tool and tackle having adequate capacity.	1	Do not use the equipment for the purpose other than its design intention.
2	Only authorized persons should operate material handling equipment.	2	Do not allow personnel to move underneath lifted load.

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3	Each tool, tackle or equipment should have identification number and safe working load marked on it.	3	Do not load the equipment above its safe working load.
4	Assess weight of the material, distance to be carried, and hazards etc before lifting the load.	4	Do not use makeshift arrangement for lifting the material.
5	Store the lifting tools and tackles at its designated place.	5	Do not use defective tool and tackles.
6	Inspect and test all the lifting tools and tackles regularly as per Atomic Energy Rules.	6	Do not use altered or repaired lifting equipment without inspection and test.
7	Wear safety boots with metal toe while handling of materials.	7	Do not drag chains, ropes or cables etc on the floor.
8	When placing a sling of a load, ensure all Sharp corners are covered with pad or soft material.	8	Keep the tools & tackles free from adverse effect of atmosphere by applying suitable protective coating.
9	Bend knees, keep back straight, keep the load close to the body and lift the load.	9	Do not hold the load with tip of the fingers, grasp the load firmly with palm.
HOUSE KEEPING			
Sr	Do's	Sr	Don'ts
1	Assign places for everything and maintain things at its assigned place.	1	Do not leave combustible materials in the work area.
2	Clean the area after completion of work.	2	Do not smoke in the area of work
3	Use aisle space free for personnel and material movement.	3	Do not allow dustbin to overflow
4	Ensure adequate illumination and ventilation for the job.	4	Do not generate extra waste
5	Drop paper, plastic, glass, metal and bio-medical waste in a separate bin kept for this purpose.	5	Do not disturb the safety equipments from assigned location
6	Know the emergency equipments where Emergency equipments like first aid box, SCBA, fire fighting equipment, are kept.	6	Do not block emergency switches and on / Off switches of the equipment by storing of materials in front of work
7	Arrest all type of spills such as water, oil, gas, etc. and clean up the area immediately	7	Do not leave cleaning agent like acetone, Isopropyl alcohol, kerosene etc. at the work area after completion of work
8	Material and equipment needed for future usage are to be tagged and arranged in order.	8	Do not block fire exit point by storing materials or by means
9	Assign a periodicity for the documents to be weeded out and follow it scrupulously	9	Do not leave a spillage unattended
10	Ensure exits are indicated/ Painted for use during emergency.		
WORK IN CONFINED SPACE			
Sr	Do's	Sr	Don'ts
1	Isolate, drain, wash, dry and purge for a sufficient time to ensure safe atmosphere inside.	1	Do not work without supervision in a confined space.

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2	Obtain a safety work permit and follow the instruction provided in the permit.	2	Do not work if you are medically unfit.
3	Purge the confined space and ensure continuous ventilation on the area	3	Do not smoke in the confined space.
4	Ensure continuous communication with the person standing outside	4	Do not enter in to confined space, if the oxygen concentration is less than 19%
5	Use non-sparking tools in explosive environment	5	Do not enter in to confined space without checking for presence of toxic, explosive or asphyxiating gases.
6	Keep all manholes open and the lowest drain point open.	6	Do not rely on closed valves for isolation. The isolation should be supplemented by suitable banking.
7	The man entering into the tank should be supplied with a safety belt and lifeline, the free end of which is held by a person standing outside.	7	Do not use equipment of voltage more than 24V inside a confined space. Do not take large quantity of cleaning chemicals in to the tank than the required quantity of chemicals for a day work.
8	Get clearance from the competent person before entering in the confined space.	8	Do not encourage more than one type of work at a time in the confined space.
9	Number of persons entering and leaving the confined space should be counted and tallied.	9	Do not carry matches / lighter in to the confined area.
10	Put up a danger board as "men working in the tank"		
11	Use SCBA, if the oxygen concentration is less than 19%.		
WORK AT HEIGHT			
Sr	Do's	Sr	Don'ts
1	When any person has to work at height from where he is likely to fall, provision shall be made by fencing or otherwise, to ensure the safety of the person so working.	1	Don't work at unguarded height if you are physically / mentally unfit.
2	Safe means of excess and platform should be ensured for working at height.	2	Do not allow two jobs, one above the other simultaneously.
3	keep tools in a safe bag / toolkit	3	Don't tie safety belt at lower elevation than the working level of person.
4	Use safety belt and safety helmet while working in unguarded area at height.	4	Do not keep loose material on the platform.
5	When person are working at height, warn people below through display of caution board and cordon off the area if necessary.	5	Do not drop material from higher elevation.
6	Entry to areas above the false ceiling should be controlled through work permits.	6	Do not use pipe line and equipment as means of approach to work spot.
7	Ropes, slings, or bucket used for carrying materials to or from an elevated place should be inspected	7	Do not work at height without taking valid safety permit.

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	before use.		
8	Work at height should be performed in good day light, preferably when strong winds not existing.	8	Do not use damaged rope for lifting material to higher elevations.
9	Ensure that the persons employed to work at height are medically fit.	9	Do not work without protection near overhead line or uninstalled bus bars.
10	Obtain height pass/safety work permit for working on unguarded height.	10	Do not work without protection near high pressure / steam line.
		11	Do not use portable ladder as platform or platform support.
		12	Do not use cable tray as portable ladder.
MATERIAL HANDLING			
Sr	Do's	Sr	Don'ts
1	Use proper lifting tool and tackle having adequate capacity.	1	Do not use the equipment for the purpose other than its design intention.
2	Only authorized persons should operate material handling equipment	2	Do not allow personnel to move underneath lifted load.
3	Each tool, tackle or equipment should have identification number and safe working load marked on it.	3	Do not load the equipment above its safe working load.
4	Assess weight of the material, distance to be carried, and hazard etc before lifting the load.	4	Do not use makeshift arrangement for lifting the material.
5	Store the lifting tools and tackles at its designated place.	5	Do not use defective tool and tackles.
6	Wear safety boots with metal toe while handling material.	6	Do not use altered or repaired lifting equipment without inspection and test.
7	Inspect and test all lifting tools and tackles regularly as per factories Act.	7	Do not drag chains, ropes, or cables etc on the floor.
8	When placing a sling on a load, ensure all sharp corners are covered with pad or soft material.	8	Keep the tools and tackles free from adverse effect of atmosphere by applying suitable protective coating.
9	Whenever possible, mechanical material handling shall be adopted.	9	The angle between the leg of two leg sling should not exceed 90 degree.
10	While lifting a load physically, keep the load as possible to the body with feet properly placed for body balance.	10	Do not allow male and female adult to lift a load manually higher than 55 kgs and 30 kgs. Respectively.
11	Bend knees, keep back straight, keep the load close to the body and lift the load.	11	Do not hold the load with tip of the fingers; grasp the load firmly with palm.
		12	Never carry a glass sheet with bare hands.

7.13 DISASTER MANAGEMENT PLAN

- External natural events that are likely to affect plant safety and operation – like earthquakes, floods, extreme winds, landslides, soil liquefaction etc.
- External man made events that are likely to affect plant safety and operation
- Events within the plant due to hazardous chemicals used in the plant operation that may affect the public and the environment.

7.13.1 NATURAL DISASTER**Earthquake Hazard, Flood Hazard, Cyclone Hazard, Landslide Hazard**

The unit is located in Western India. It can be seen that the project site falls under zone which is not much likely to get any earthquake hazard, flood hazard, cyclone hazard. However, all precautionary measures have been considered while designing the engineering of the facility to meet any such events. Codes and regulations will be applied for PEB, Stochres, Civil equipments etc.

7.13.2 EMERGENCY CONTROL PLAN

Factory Manger Office will be declared as an emergency control center. Emergency control center is facilities with:

- Address and Telephone numbers of the factory Inspectorate, Gujarat Pollution Control Board, Police, Fire Brigade, Hospitals.
- List of employee with address, telephone number, blood group etc
- Material Safety Data Sheets of all chemicals handled.

7.13.3 ENGINEERING/OPERATION & MAINTENANCE

- Ensure the safety of the remaining part of the plant.
- Take necessary steps for plant shutdown in site controller.
- Ensure that an operator is immediately available at the water pump house for fire fighting.
- Mobilizing with necessary tools and tackles to handle any repair work on emergency basis.

7.14 SOCIAL IMPACT ASSESSMENT, R&R ACTION PLANS

The proposed project will have a positive impact on the social and economic conditions of the people of the region in terms of direct and indirect employment, skill diversification, infrastructure development, business development etc.

The proposed unit is located in indsutrail land, so the will be no direct impact on Rehabilitation and Resettlement.