RISK ASSESSMENT REPORT &

DISASTER/EMERGENCY MANAGEMENT PLAN

1.1 GENERAL

A risk assessment is simply a careful examination of what, in work/operation, could cause harm to people/employee or surrounding, so that one can weigh up whether the system/management have taken enough precautions or should do more to prevent harm. Workers and others have a right to be protected from harm caused by a failure to take reasonable control measures. Accidents and ill health can ruin lives and affect company's business too if output is lost, machinery is damaged, insurance costs increase or it have to go to court. Any company is required to assess the risks in its workplace so that it put in place a plan to control the risks.

Risk assessments include detailed quantitative and qualitative understanding of risk, its physical, social, economic and environmental factors and consequences. It is a necessary first step for any serious consideration of disaster reduction strategies. Risk assessment encompasses the systematic use of available information to determine the likelihood of certain events occurring and the magnitude of their possible consequences. As a process, it is generally agreed that it includes:

- Identifying the nature, location, intensity and probability of a threat;
- Determining the existence and degree of vulnerabilities and exposure to those threats;
- Identifying the capacities and resources available to address or manage threats; and
- Determining acceptable levels of risk.

1.2 OBJECTIVE, SCOPE & METHODOLOGY OF RISK ASSESSMENT

1.2.1 OBJECTIVE :

The key objectives of the present Hazard Identification & assessment and Risk Assessment (RA) study is to establish probable damages as a result of major hazards associated with various component of the proposed project of manmade fibre production through continuous polymerization. The primary objective of the present study is to identify major hazards & associated risks due to operations production of manmade fibre, storage & use of raw materials/chemicals, use of fuel for utilities of proposed project and to evaluate consequences of identified hazards. Lastly the object of the present study is to suggest general &effective mitigation of hazards identified, designing /updating of disaster & emergency management plan, minimum preventive and protective measures etc. to ensure safety.

1.2.2 SCOPE:

As the project is of manmade fibre the scope of the work has been determined with following details of probable hazards & associated risk:

A. Probable fire incident, mainly Pool Fire, in HSD, storage area.
B. In general, the chemicals listed above may have risk of employee health as any chemicals may have more or less health effects due to dispersion in atmosphere (as gaseous or as particulate) if not managed properly.

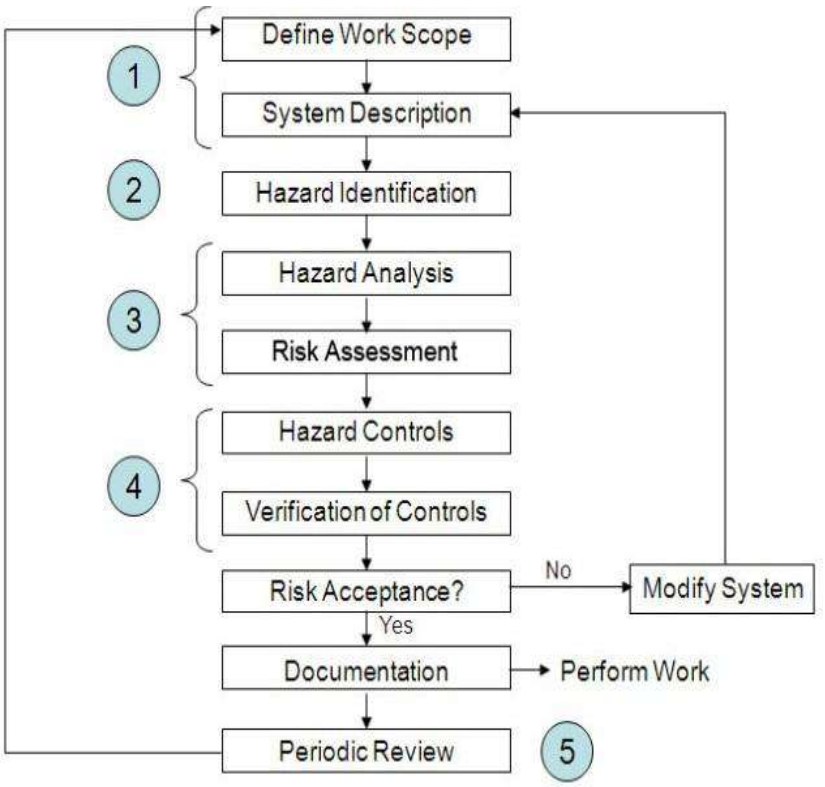
Considering the above facts of proposed project the scope of present study has been determined as described below.

The primary scope of the present study is limited to identification of major areas of hazards, Hazard identification/Identification of failure cases, Consequence analysis of probable risks / failure cases, chemical risk assessment and plant risk assessment/evaluation for proposed new project based on Continuous polymerization process. The scope of the present Risk assessment study is on the basis of the above evaluation & risk acceptability as well as preventive, protective & control measures provided in existing plant. The study of consequence analysis is to be carried out for Natural gas pipeline only.
Secondarily, the scope of study is to suggest general hazard specific minimum control, preventive & protective measures to be taken to minimize risks to maximum possible extent. As an integrated part of risk management, the scope of the present report is also to modify the existing Disaster management plan including emergency action plan by suggesting other measures to further lower the probability of risk.

1.2.3 METHODOLOGY

The procedure used for carrying out the Quantitative Risk Assessment (QRA) Study for risk management in industrial unit includes various tasks, which starts from defining scope & then system study, hazards identification & assessment, consequence analysis, risk assessment and planning of risk management system as well as emergency plan. The process is illustrated below in pictorial form for ready guide for methodologies adopted and level of various tasks associated with QRA.

Figure- 1. Flowchart of Methodology Adopted For Risk Assessment



1.3 ABOUT THE COMPANY

1.3.1 THE COMPANY

M/s. Beekaylon Synthetics Pvt. Ltd. Phase proposed to set up a new unit at Survey No.: 287/1, 284P, 289/1/3, 289/1/2, 289/2, 286/1/P, 287/2; in the Notified Industrial Zone situated at Village-Velugam of U.T. of Dadra and Nagar Haveli. this unit is proposed to manufacture "various kinds of synthetic yarns like Polyester Filament Yarns (POY, FDY, staple fibres) through continuous polymerisations, Texturized & Twisted Yarn using using Ready Yarn Of Polyester/Nylon/Acrylic, Synthetic filament yarn (polyester, nylon 6&66, Polypropylene etc.) by Melt Spinning Using Ready Polyester/Nylon Chip /Polyamide Chips/ Polypropylene Chips As Raw Materials as well as various types of Fabrics. Company will also manufacture polyester granules as intermediate products generated from continuous polymerisation of MEG & PTA for manufacturing of POY /FDY/Staple Fibres. The company has also proposed to setup unit of knitting & weaving for fabrics production". The company is already in the business of synthetic manmade fibers and operating manufacturing operation at its other unit in Masat, UT of D&NH.

The company has a wider customer base and to cater to the increased market demand and company needs to set up a new unit to cater the demand of the synthetic manmade fiber. Considering the need of additional production, Company proposes to set up a new unit for manufacturing Polyester POY/FDY/Staple Fibres & Granules through continuous polymerisations @ 432000 TPA, various types of Synthetic Filament Yarn @ 378000 TPA and various other types of manmade fibres like Texturized Yarn/Twisted Yarn/Acrylic Yarn /Covered Yarn/Spandex Yarn etc. @288000TPA. The proposed product line

also includes Winding Of Yarn/Heat Setting Of Yarn/Circular Knitting/Warping / Warp Knitting/Weaving Fabrics/Carpet Weaving/ Narrow Fabrics @ 36000 TPA and Color Master Batch Chips / granules@9000 TPA.

As the company is intended to provide high quality yarns to its clients, company has decided to set up this unit with backward integration by producing synthetic polyester yarn through continuous polymerization of MEG & PTA.

More details about the proposed project and the present EIA study are presented in subsequent paragraphs of this chapter and other chapters of the present EIA report prepared by UniStar Environment & Research Labs Pvt. Ltd. (NABET Accredited EIA consultant).

1.3.2 NUMBER OF EMPLOYEES EMPLOYED

The company will provide employment to 1353 people in different categories for operation of proposed project. The details of the proposed employment structure are presented below in tabular form.

Table 1: Details of Human Resources

Sr. No.	General	1st Shift	2nd Shift	3rd Shift	Total
Skilled	40	105	105	105	**355**
Semi-Skilled	0	140	140	140	**420**
Un-Skilled	0	190	190	190	**570**
Managerial	8	0	0	0	**8**
Total	**48**	**435**	**435**	**435**	**1353**

1.3.3 TIMING & WORKING HRS (SHIFT WISE)

The existing & proposed unit is/will be operated in with proper & adequate shift timing required to maintain smooth operations of the manufacturing process. Details of shift & shift timing are shown below.

Table 2: Details of Employee

Shift	Timing	Working Hrs./Day
General	9.00 am to 5.00 pm	8 hours
1st Shift	8.00 am to 4.00 pm	8 hours
2nd Shift	4.00 pm to 12.00 am	8 hours
3rd Shift	12.00 am to 8.00 am	8 hours

1.4 PROPOSED PROJECT & PRODUCTS

1.4.1 PRODUCTS

M/s. Beekaylon Synthetics Pvt. Ltd., Velugam has proposed to setup a new manufacturing unit for manufacturing of synthetic manmade fibres & Polyester granules through continuous polymerisation of MEG & PTA and knitting & weaving for fabric production. The proposed project involves the production of

Polyester POY/FDY/Staple Fibres & Granules @ 432000 TPA, various types of Synthetic Filament Yarn @ 378000 TPA and various other types of manmade fibres like Texturized Yarn/Twisted Yarn/Acrylic Yarn /Covered Yarn/Spandex Yarn etc. @288000TPA. The proposed product line also includes Winding Of Yarn/Heat Setting Of Yarn/Circular Knitting/Warping / Warp Knitting/Weaving Fabrics/Carpet Weaving/ Narrow Fabrics @ 36000 TPA and Colour Master Batch Chips / granules@9000 TPA..

Table 3: List of Products

Sr. No.	Name of the product	Raw Materials	Consumption Quantity	
			MT/MT	MT/Year
1.	Polyester Filament Yarn (POY/FDY) / Staple Fiber/Polyester Granules By Continuous Polymerization process using PTA and MEG @ 432000 TPA	Purified Terepthalic Acid	0.858	370656
		Mono Ethylene glycol	0.334	144288
		Antimony trioxide	0.003	1296
		Titanium Dioxide	0.030	12960
		Spin Finish oil	0.008	3456
2.	Synthetic Filament Yarn : Bulk Continuous Filament Yarn(BCF)/Partially Yarn(POY)/Fully Drawn Yarn(FDY)/Dope Dyed Yarn(DD)/Low Oriented Yarn(LOY)/Highly Oriented Yarn(HOY)/ Nylon Yarn(N6 & N66)/ Polypropylene Yarn(PP) @ 378000 TPA	Polyester/Nylon/ Polyamide/ Polypropylene/ Color master batch Chips/Granules	1.050	396900
		Spin Finish oil	0.008	3024
3.	Polyester Texturized Yarn/Draw Texturized Yarn/Air Texturized Yarn/ Polyester Twisted Yarn/Cable Yarn/Double Yarn/ Draw Twisted Yarn/Acrylic Yarn /Covered Yarn/Spandex Yarn @ 288000 TPA	Yarn Polyester / Nylon / Acrylic	0.960	276480
		Antistatic oil	0.004	1152
4.	Winding Of Yarn/Heat Setting Of Yarn/Circular Knitting/Warping / Warp Knitting/Weaving Fabrics/Carpet Weaving/ Narrow Fabrics @ 36000 TPA	Texturized Yarn/BCF/FDY	1.00	36000
5.	Color Master Batch Chips @ 9000 TPA	Colour Pigment	0.30	2700
		Waxes	0.10	900
		Polypropylene/Polyamide 6/ Polyethelene terephthalate (PET) / Polybutylene Terepthalate	0.60	5400

(Source: Documented details from Beekaylon Syntex Pvt. Ltd.Velugam)

1.4.2 COST OF PROPOSED PROJECT

Plant & Machinery, Pipeline & Fittings, Electrical Installation, Safety systems, etc. are the major heads considered in the Capital Cost Projection for the proposed new project. Environment Protection has also been considered in planning the Cost Projection, which will include Green belt development, safety systems, etc.

Table 4: Capital Cost Projection

Sr. No.	Purpose	Cost (Rs. in Crore)
1.	Land	18.00
2.	Building and Civil Works	50.00
3.	Plant & Machinery and other fittings	360.00
4.	Environmental protection measures	10.00
5.	Green Belt Development	5.00
	TOTAL :	**443.00**

1.5 PROJECT LOCATION & PROFILE OF SURROUNDING AREA

The proposed new project will be accommodated in the acquired industrial plots admeasuring 77800 m2. The plots situated in notified industrial zone have been purchased from private owner and have already transferred in the company's name. The copy of NA permission and land documents are enclosed as Annexure-VIII (A). The key plan and the site layout map showing the project site is given in the Figure no. 2.2.

The total plot area of the proposed unit is 77800.00 m2, out of which Green belt area comprises of 25890 m2. The total land to be used for construction is about 32805.00 m2. The details breakup of land requirement is as given below table no. 2. The layout of project premises /site showing the buildings & infrastructures including raw materials storage area, production area, utility area, office area, greenbelt area, internal roads and parking area etc. is shown in earlier figure of plant layout.

Figure 2: Layout plan of Project Site

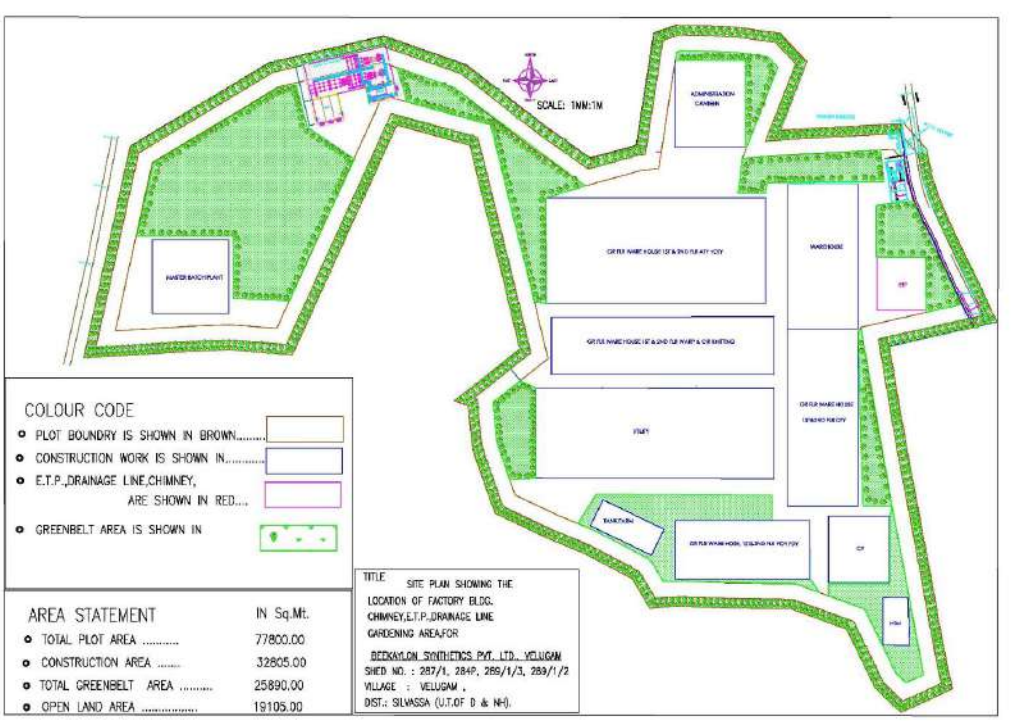
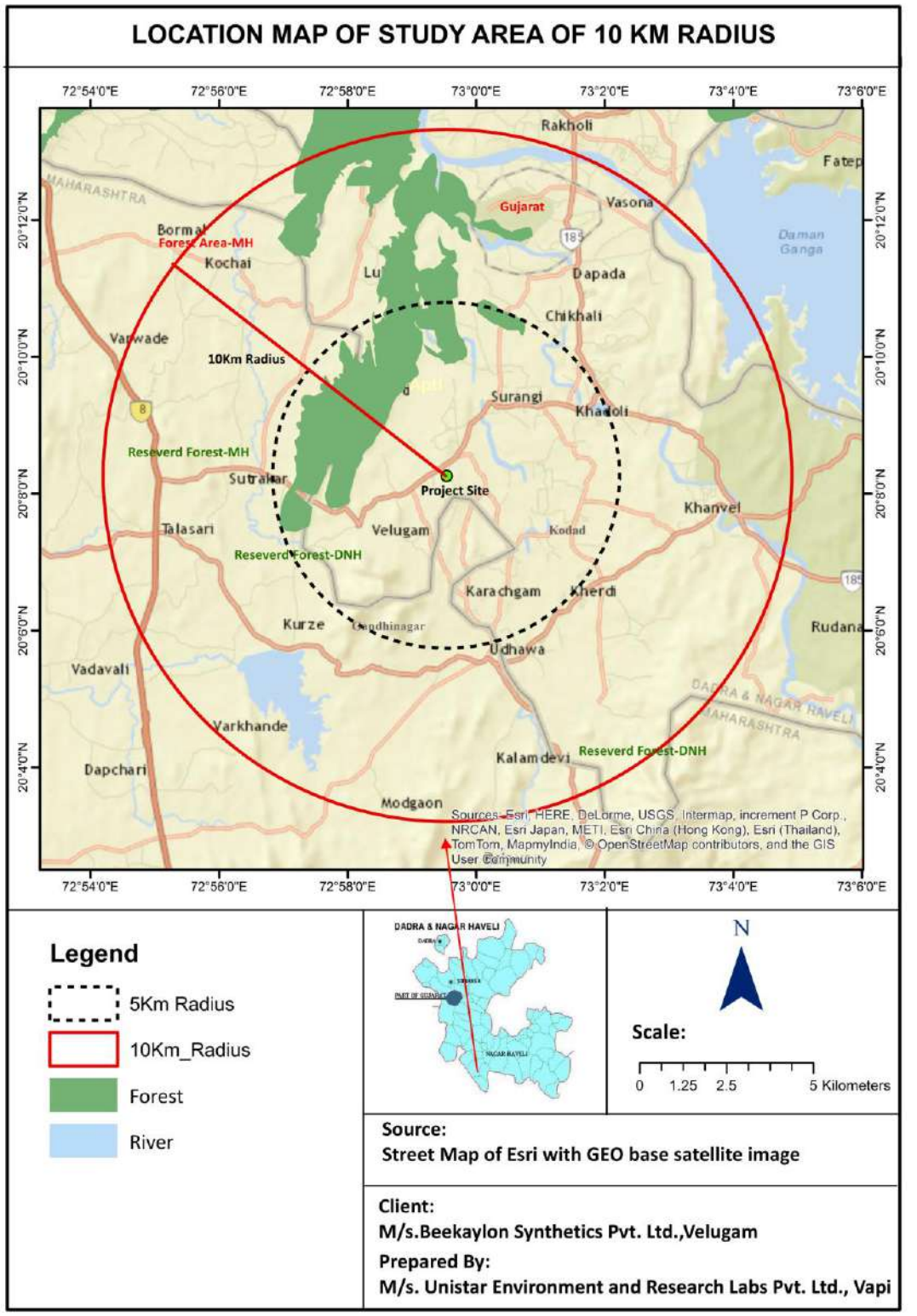


Figure 3: Map of Project Area



1.5.1 MACHINERIES & EQUIPMENT AND UTILITIES

- Plants and machineries details are presented in Annexure: IV of EIA report.

1.5.2 RAW MATERIALS

All raw materials required for manufacturing of proposed products are easily available indigenously in local market, which will be transported through road. The details of the raw material requirement are presented below.

Table 5: Raw Material Requirement and their Source, Mode of transport & Storage

Sr.No.	Raw Material	Storage Quantity	State of RM	Means of storage	Mode of transportation
1	PTA	5000 MT	Powder	Jumbo Bags in Warehouse/Silo	Truck
2	MEG	4000 MT	Liquid	Tank	Tanker
3	Spin Finish Oil	200 MT	Liquid	Tank	Tanker/Truck
4	Antistatic oil	25 MT	Liquid	Drum	Tanker/Truck
5	Antimony trioxide	20 MT	Solid	Bags	Truck
6	Titanium Dioxide	40 MT	Solid	Bags	Truck
7	Polyester/ PP/Nylon Chips	500 MT	Granules	Jumbo Bag/ Warehouse	Truck

1.6 BRIEF DESCRIPTION OF THE PLANT OPERATION:

M/s. Beekaylon Synthetics Pvt. Ltd. proposes to setup its additional manufacturing unit for manufacturing of “MANMADE FIBER (OTHER THAN RAYON)” located at Survey No.: 287/1, 284P, 289/1/3, 289/1/2, 289/2; Village: Velugam, Union Territory of Dadra & Nagar Haveli. D&NH is logistically well connected by road and rail. The company has experienced personnel and will install state of art machinery. Company's objective is focused on high quality products, continuous innovation, R&D & solution centric customer satisfaction. For the proposed project, the company intends to procure the best available technology for manufacturing the products as listed.

With the textile & garment industry's development, more and more companies have begun to pay attention to the functional fiber’s application, especially to the differential fiber. The company produces all kinds of lusters including semi-dull, full dull and cationic. The company Supplies Dope Dyed polyester yarn with fine flexibility, good colour fastness, equal diameter and usability. Company’s products include s, Semi Dull Dope Dyed Black and Dope Dyed Colours, Cationic and Full Dull (Cot look) RW Yarns and Semi-Dull RW Yarns. Any other qualities in Semi-Dull, Full-Dull (RW, Dope Dyed Black and Dope Dyed Colours) and Micro Filaments can be manufactured as make to order requests. The detailed proposed product profile with production capacity is as mentioned in Table no. 1.0.

As per the EIA notification- 2006 as amended the proposed new project for the production of “Manmade Fiber (Other Than Rayon)” which falls under item no. “5(d) – Manmade Fiber (Other Than Rayon)“as per the EIA notification- 2006, hence required prior Environmental Clearance.

Manufacturing of "Manmade fiber other than Rayon " is covered under Category –B, but due to the applicability of General Conditions (interstate boundary with Maharastra state is 0.3 km E which is within 5 km radius) this project is categorized as Category-A and applied to MoEF&CC for obtaining Environmental Clearance.

1.7 ENVIRONMENTAL & SAFETY FACILITIES & MEASURES

1.7.1 OTHER SAFETY & EMERGENCY DETAILS:

The company has provided all basic facilities as per requirement of Factory Acts. Similar arrangement for safety & emergency management will be adopted for proposed project. The key safety & emergency facilities are listed below:

A. Employee conveyance area
B. Proper sanitation facilities
C. Medical & First Aid facilities
D. SOP for works & Operations with necessary provision for PPEs
E. Isolated storage for fuel & raw materials storage
F. Material of MOC & Storage conditions for chemicals & fuel has been determined & provided with respect to their properties and regulatory/safety recommendations to prevent any accidental release or leak.
G. Adequately planned methodologies &facilities for chemical storage & handling with SOPs
H. Technology with intrinsic safety measures
I. All hazardous area, equipment & materials etc. with relevant& required Placards
J. MSDS for all chemicals available with all concern personnel & department
K. Pre-recruitment & post recruitment health employee check up program
L. Safety induction& training to all employees
M. Fire fighting equipment &Fire Hydrant system with Fire Water Pond
N. Trained Team for Fire Fighting & First Aid
O. Emergency control room
P. Evacuation route with two assembly points& facilities
Q. Emergency management plan
R. Emergency Management team
S. Emergency warning system- Siren
T. Defined chemical risk management & waste disposal methods with SOPs
U. Regular workplace monitoring to ensure hygienic & safe conditions in all work area having/using chemicals
V. Regular training programs for safety & necessary actions as well as Mock drills

Beside these many other arrangements, facilities and measures have been adopted for managing safety in the existing plant. For proposed project, all necessary measures & facilities will be provided to prevent any risk beyond acceptable level as required/cited timely.

1.8 HAZARD IDENTIFICATION (HAZID)

Safety risk assessment is one of the functions in a Safety Management System and an important element of safety risk assessment is the identification of hazards. A hazard can be considered as a dormant potential for harm which is present in one form or another within the aviation system or its environment. This potential for harm may be in the form of a natural hazard such as terrain, or a technical hazard such as wrong runway markings.

The use of the term 'hazard' in the formal risk assessment context originated in the nuclear and chemical industries for which a wide range of different types of 'hazards' are present all of the time (e.g. nuclear material, flammable gases, toxic chemicals etc.). The 'control' of these hazards (containment, separation etc.) and the 'mitigation' of their consequences (gas detection, plant shutdown etc.) should a failure condition arise is the subject of safety risk assessment and safety risk management processes.

Hazards identification is the act of recognising the failure conditions or threats (Safety Events), which could lead to Undesirable Events and defining the characteristics of theses undesirable events in terms of their potential Safety Outcomes and of the magnitude of these safety outcomes' Consequences. This gives rise to the following definitions:

Safety Event: A condition, object, activity or event with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform prescribed function. A failure condition, causal factor, threat or precursor event which in isolation or in combination with other safety events could result in an undesirable event.

Undesirable Event: A stage in the escalation of an accident scenario where the accident will occur, unless an active recovery measure is available and is successfully used.

Outcome: A potential end point of an accident scenario which can be assigned a consequence severity.

Consequence: The degree of injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function arising from an outcome. Consequences have a magnitude.

Risk Controls (Barriers and Mitigation): A system, activity, action or procedure that is put in place to reduce the risks associated with a hazard. Mitigation may include:

- elimination of the hazard (preferred),
- reduction in the frequency of the hazard (barriers),
- reduction in the likelihood of the outcomes of the hazard (outcome mitigation),
- Reduction of the severity of the outcomes of the hazard (consequence mitigation).

A number of specific tools and techniques for hazards identification are summarised and their advantages and disadvantages noted. These tools and techniques of Hazard Identification & assessment include:

- Brainstorming
- Checklists & Audit
- Hazard and Operability Studies (HAZOPS)
- Cause effect Network
- Event Tree Analysis (ETA)
- Fault Tree Analysis (FTA)
- Failure Modes and Effects Analysis (FMEA)
- Structured What-if (SWIFT)
- Dynamic Models

1.9 SCREENING FOR PROBABLE HAZARDS

The task of identification of hazards is associated with the day-to-day operations of an organisation, or associated with changes to the operations of an organisation; the assessment of the risks associated with those hazards; and the implementation and management of measures to reduce those risks to an acceptable level (hazard removal; or the application of barriers and/or mitigations – i.e. risk control).

For the purpose of Hazard Identification & Analysis checklist, Brainstorming and Event tree analysis has been adopted. The key severity consideration assigned for the task is shown below.

1.9.1 IDENTIFICATION OF HIGH HAZARDOUS AREAS & OPERATION:

As indicated & described in section of project details; the production & storage will be practiced with enclosed system with latest safety measures. Further the area of material storage has been planned with safe distance consideration & necessary safety measures like lining of floor & provision of drain in area susceptible to hazards due to spill &leak. Adequate ventilation, fire prevention & control measures, provision of PPEs etc. are also planned and will be implemented. Besides, the probability of hazards in operation / production area is not anticipated as it will be an automated plant with control by DCS & control room. The manufacturing process will be based on closed loop process system. Manual handling or charging of raw material will also not take place or required as all transfer / charging of major raw materials in process will be done through closed system .These closed system of materials charging & production will not have higher pressure. Any kind hazardous material will not be stored in the process area as it has been provided in designated separate area with necessary isolation distance. Inherent safety system &devices of process technologies and storage will be provided. Process parameters control and interlocking will be provided and full proof safety interlocking and logics will has been confirm at design level for whole process area including all equipment having potential of hazards or operation failure. Thus the chances of hazards in the storage & production area are not anticipated. However, spill & leak in

activities of materials transportation, storage & handling may have chance of hazards due to mishap.

1.9.2 IDENTIFICATION OF VULNERABLE GROUP & FACILITIES:

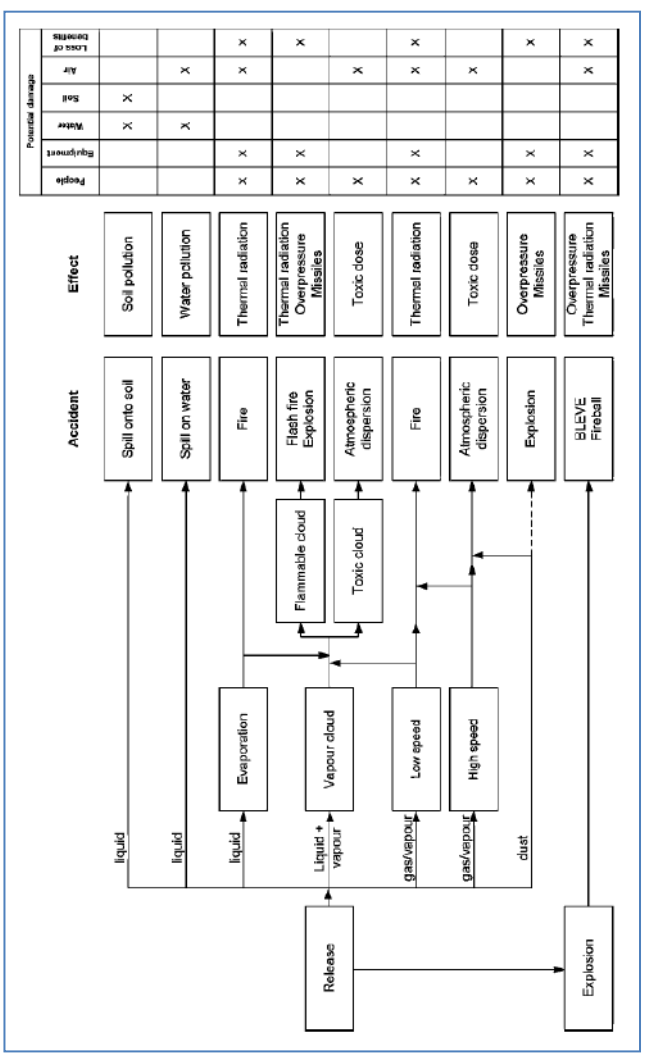
As it has been mentioned in above paragraphs, the hazardous area identified are NG skid & PRV station which will be control by restricted access to prevent any casualty up on occurrence of hazardous event. However, the effects of hazards in this area, especially fire & explosion, may occur up to an undefined distance. So the persons engaged in other area around the PRV station & Gas Skid Area are identified as the vulnerable group of people. Further, the buildings & properties around the area are identified as vulnerable facilities.

1.10 IDENTIFICATION & EVALUATION OF HAZARDS:

As it has been described above, major hazards are associated with storage area, PRV station and Gas skid area. The cause of hazards is thus determined to be leak from storage area.

Hence, for further evaluation of hazards, identification of probable hazards from leakage has been studied from cause effect network diagram. The details of identification of hazards as schematic diagram of cause & effects relation are presented below.

Figure 4: Probable route of hazards & consequences



(Image source: Evaluation of the Effects and Consequences of Major Accidents in Industrial Plants, by JoaquimCasal; Elsevier)

A. CHEMICAL HAZARDS:

There are no hazardous chemicals used in the existing manufacturing process. Also, there will be no hazardous chemicals involved in the process in the proposed new project.

Table 6: properties & the probable hazards of materials

Diesel, CAS# 68334-30-5						
Max. Storage Quantity	**Transportation**	**Storage Mode**	**Probable Hazards**			
3750 Lit/Hr.	Through Road Tanker	HSD tanks	Fire, Explosion, Toxic, Pollution			
Physical Properties						
Density / Specific Gravity	**BP**	**MP**	**Flash Point**	**Auto Igni. Point**	**LEL/UEL**	**Vapour Pressure**
0.841 at 16°C	282-338° C at Atm.	-17.7 ° F	51.67°C	177 to 329.4°C	1.3%/6.0%	2.17 mm Hg At 21 °C
Chemical Properties						
Formula	**MW**	**Stability**	**Reactive**	**Solubility**		
($C_{12}H_{24}$)*	168.00	Stable	Not Available	<1 mg/mL at 19° C		
Toxicity						
Inhalation, LC50	**Dermal, LD50**	**Oral, LD50**	**Carcinogen**	**Ecological**		
NA	NA	NA	NO	Not Available		
IDLH, mg/m^3	**Ceiling: ppm**	**TWA: ppm**	**STEL: ppm**			
Not Available	Not Available	Not Available	TEEL1: 100mg/m3 TEEL 2: 100mg/m3 TEEL 3: 500mg/m3			
PPEs &Safety Measures	**Other Specific; if any**					
Goggles or face shield, Breathing Apparatus for emergency, Fire fighting System, Fire proof Suit for Fire fighters.	Leak detection system &Alarm, Fire detection System & Alarm, Cathodic Protection to storage tank, No source of Ignition in storage area.					
Note:* Approximate Avg. formula (Ref. https://en.m.wikipedia.org/wiki/Diesel_fuel)						

(Sources: CRIS Codes, CAMEO chemical, NIOSH Chemical Database)

1.11 CONSEQUENCES ANALYSIS

The most dangerous hazards in industries associated either or all of storage, handling, transportation and production facilities are undoubtedly those associated with the loss of containment of volatile products and their subsequent dispersion &ignition. These hazards can have minor to serious consequences based on the quantity & quality of materials released in to the atmosphere/air. Hence, to determine the probable loss due to the hazards, necessary & suitable analysis are required to be done for determination of severity of consequences resulted from the hazards. Such analysis is known as Consequences analysis. Consequence analysis provides quantitative information on the risk and potential hazards that could be caused by dispersion, fire and blasts. With this information, it is possible to improve the original design,

incorporate mitigation measures, or devise hazard and management strategies to keep the risk at acceptable levels.

Toxicity of the chemical is very well know hazardous properties for almost all chemicals. Besides, numbers of chemicals used in industries are flammable, in addition their toxic and volatile properties and considered for various potential air hazards. For such chemicals, modeling is required not only for the toxic threat posed by the release of that chemical, but also the fires and/or explosions that the chemical could potentially cause. If a flammable and toxic chemical modeling for toxic gas dispersion scenario need to be run first and then other appropriate modeling for fire and explosions scenarios requires to be done. Finally, the outcome for LOC with respect to either all or any of concentration of chemical in air, level of over pressure & heat flux/radiant heat, are considered for determination of respective the threat zone based on damage potentials of LOC determined. In many situations involving a flammable and toxic chemical, the area encompassed by the toxic threat zone will be greater than the threat zones associated with fire and explosion scenarios. Hence, it is most essential requirement to evaluate all of the scenario options before developing emergency response plan.

1.12 SAFETY & CONTROL MEASURES FOR HAZARDS

The hazards from a particular operation can be significantly reduced through good design and operation of the plant. Typical techniques to minimise hazards are:

- Minimising amount of hazardous materials stored on site
- Physical protection of the more vulnerable items of equipment
- Locating bulk storages in areas away from the process in properly bunded tank farms
- Providing properly designed bunds or containment facilities for collecting large volumes of contaminated water which may be generated when fighting fires in warehouses, process equipment etc.
- Constructing items of equipment to recognised national/international codes using the correct materials of construction
- Using pressure/vacuum relief systems properly designed to relieve to a safe location
- Minimising sources of potential leak
- Maintaining good security throughout the site
- Conducting proper safety reviews (e.g. HAZOPS) at all stages during the design of the process and maintaining the necessary safety systems thereafter
- Introducing appropriate safety control measures such as engineering controls, the use of personal protective equipment and provision of emergency equipment.
- Ensuring that equipment is well maintained and tested
- Emergency shut-down procedures and shut off/isolation points need to be identified and communicated to all those concerned.

Table 7: Hazardous Raw materials identified as per MSIHC Rules 1989

Sr. No.	Name	Physical state	Storage Cap. In MT	Threshold Storage Limit as per MSIHC Rule	MSIHC Applicability
1.	**Monoethylene Glycol**	Liquid	4000	NA	Sh-I,Part-II,267
2.	**Diesel**	Liquid	20.00	NA	--
3.	**LSHS**	Liquid	20.00	NA	--

Table 8: Result of Consequences Analysis for Thermal Radiation from Pool Fire

Sr. No.	Chemical	Thermal radiation from Pool Fire (kW/m^2), Distance in Meter								
		37.5	**25.0**	**19.0**	**12.5**	**10.0**	**5.0**	**4.5**	**2.0**	**1.6**
Worst Case Scenarios: For Total Quantity Stored Quantity (Drum)										
1	**Diesel**	<10	<10	<10	<10	10	14	12	20	22
2	**LSHS**	<10	<10	<10	<10	09	13	11	18	20
MCA Scenarios: For Unit Storage Quantity (Drum)										
1	**Diesel**	<10	<10	<10	<10	<10	10	11	15	16
2	**LSHS**	<10	<10	<10	<10	<10	09	10	14	15

(Note: NA- Not Applicable)

Table 9: Result of Consequences Analysis for Flammable Area of Vapour Cloud

Sr. No.	Chemical	Flammable Vapour Cloud Dispersion, (kW/m^2), Distance in Meter			
		10% LEL	**60% LEL**	**LEL**	**UEL**
Worst Case Scenarios: For Total Quantity Stored (Drum)					
1	**Diesel (20 KL)**	<10	<10	<10	<10
2	**LSHS**	<10	<10	<10	<10
MCA Scenarios: For Unit Storage Quantity (Drum)					
1	**Diesel (200 Litter)**	<10	<10	<10	<10
2	**LSHS**	<10	<10	<10	<10

- **Consequences Analysis Data:**

SITE DATA:	ATMOSPHERIC DATA:
• Location: SILVASSA, INDIA • Building: unsheltered single storied • Time: March 1, 2018 1036 hours ST (using computer's clock)	• ATMOSPHERIC DATA: (MANUAL INPUT OF DATA) • Wind: 2.66 meters/second from NW at 3 meters • Ground Roughness: urban or forest • Cloud Cover: 5 tenths • Air Temperature: 27.20° C • Stability Class: B • No Inversion Height • Relative Humidity: 50%

5.11.1 DIESEL

CHEMICAL DATA:

- Chemical Name: Diesel
- Molecular Weight: 168.00 g/mol
- Ambient Boiling Point: 282-338°C at Atm.
- Vapor Pressure at Ambient Temperature: 2.17 mm Hg At 21 °C
- Mass Burning Rate: 0.045 m" (kg/m2-sec)
- Heat of combustion: 44,400 ΔHc,eff (kJ/kg)
- Empirical Constant: 2.1 kβ (m-1)
- Mass Burning Rate of Fuel (m"): 0.045 kg/m2-sec
- Effective Heat of Combustion of Fuel (DHc,eff):44,400 kJ/kg
- Empirical Constant (kb): 2.1 m-1
- Fuel Area or Dike Area (Adike): 25.00 m2
- Distance between Fire and Selective Target (L): 1.00 m
- Wind Speed or Velocity (uw): 3.00 m/sec2
- Ambient Air Temperature (Ta): 32.20 °C
- Gravitational Acceleration (g): 9.81 m/sec2
- Ambient Air Density (ρa): 1.16 kg/m

SOURCE STRENGTH: WORST CASE Scenarios:

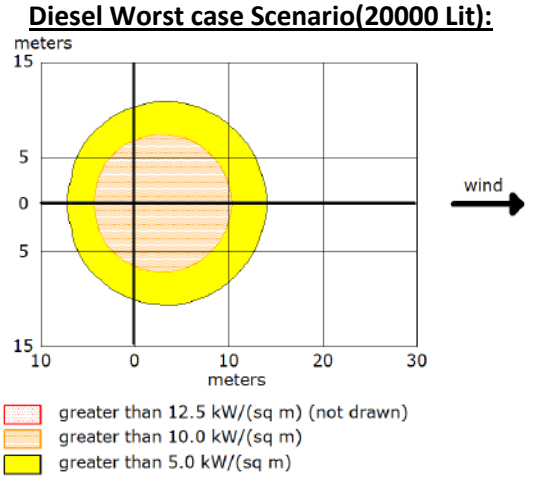
- Burning Puddle / Pool Fire
- Puddle Area: 10 square meters
  Puddle Volume: 20000 liters
- Initial Puddle Temperature: Air temperature
- Flame Length: 8 meters
- Burn Duration: ALOHA limited the duration to 1 hour
- Burn Rate: 42.1 kilograms/min
- Total Amount Burned: 2,527 kilograms

SOURCE STRENGTH: MCA Scenarios:

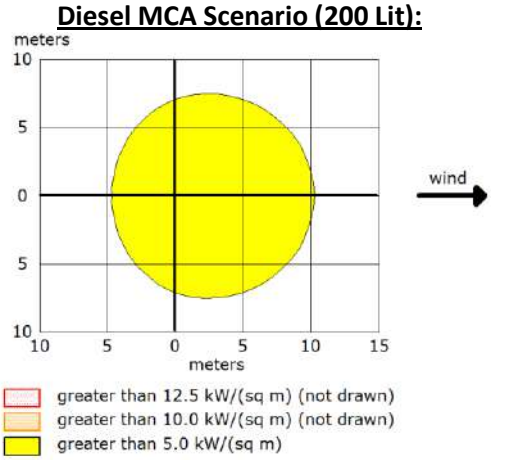
- SOURCE STRENGTH:
- Burning Puddle / Pool Fire
- Puddle Area: 5 square meters
- Puddle Volume: 200 liters
- Initial Puddle Temperature: Air temperature
- Flame Length: 6 meters
- Burn Duration: 9 minutes
- Burn Rate: 21.1 kilograms/min
- Total Amount Burned: 195 kilograms

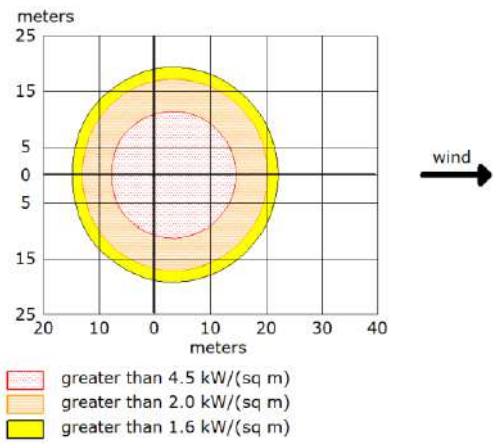
Diesel Worst Case (20000 Lit) & MCA (200 Lit): Burning Puddle / Pool Fire:

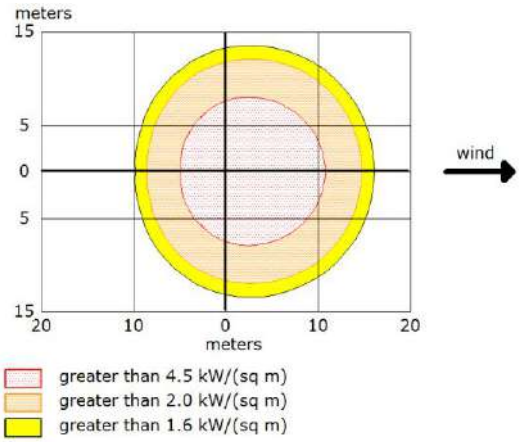
Diesel Worst case Scenario(20000 Lit):



Diesel MCA Scenario (200 Lit):







Diesel Worst Case (20,000 Lit) & MCA (200 Lit): Flammable Area of Vapor Cloud

Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

5.11.2 LSHS

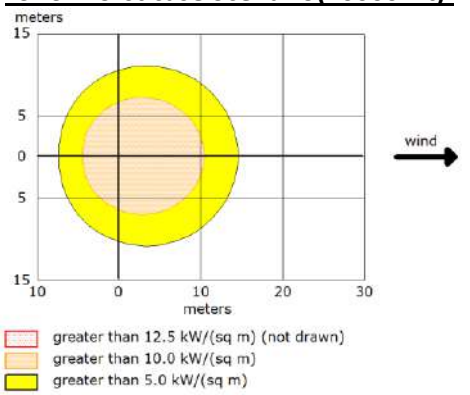
CHEMICAL DATA:

- Chemical Name: LSHS
- Molecular Weight: 190.00 g/mol
- LEL: 6000 ppm
- UEL: 60000 ppm
- Ambient Boiling Point: 341.8° C
- Vapor Pressure at Ambient Temperature: 0 atm
- Ambient Saturation Concentration: 0.0012 ppm or 1.21e-007%

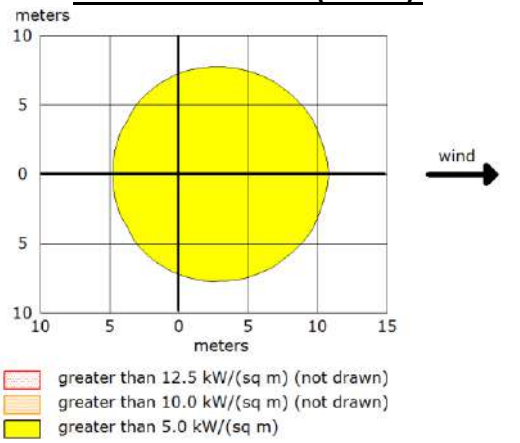
SOURCE STRENGTH: WORST CASE Scenarios:	SOURCE STRENGTH: MCA Scenarios:
• Burning Puddle / Pool Fire • Puddle Area: 10 square meters Puddle Volume: 20000 liters • Initial Puddle Temperature: Air temperature • Flame Length: 10 meters • Burn Duration: ALOHA limited the duration to 1 hour • Burn Rate: 53 kilograms/min • Total Amount Burned: 3,182 kilograms	• Burning Puddle / Pool Fire • Puddle Area: 5 square meters • Puddle Volume: 200 liters • Initial Puddle Temperature: Air temperature • Flame Length: 7 meters • Burn Duration: 6 minutes • Burn Rate: 26.5 kilograms/min • Total Amount Burned: 170 kilograms

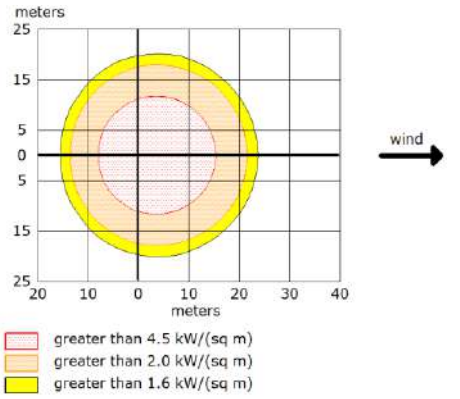
LSHS Case (20000 Lit) & MCA (200 Lit): Burning Puddle / Pool Fire:

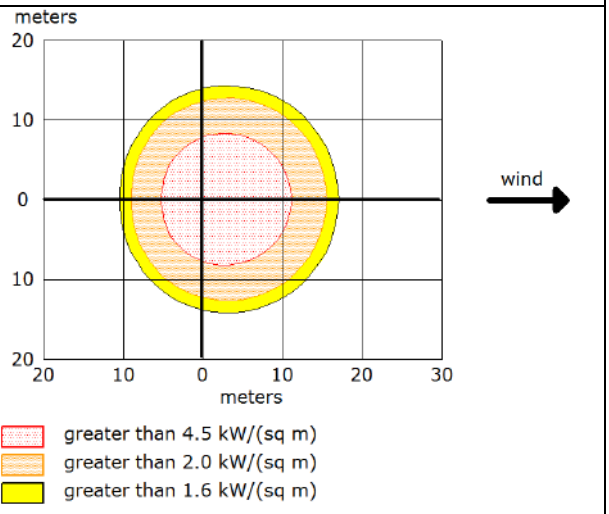
LSHS Worst case Scenario(20000 Lit):



LSHS MCA Scenario (200 Lit):







LSHS Worst Case (20,000 Lit) & MCA (200 Lit): Flammable Area of Vapor Cloud

Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

SAFETY MEASURES

From the Risk Analysis studies conducted, it is observed that by and large, the risks will be confined within the factory boundary walls in case of fire & explosion, it will create On site emergency situations for which it will require more attention and emergency preparedness to combat such situation. To minimize the consequential effects of the risk scenarios, following steps are recommended.

Plant should meet provisions of the Manufacture, storage & Import of Hazardous Chemicals Rules, 1986 & the factories Act, 1948. The existing fire hydrant system needs to be extended in new project area as per TAC/NFPA Norms. Safe operating procedure and chemical information brochure/sheets should be prepared for hazardous material handling process. All necessary PPEs & safety equipments as mentioned in chemical information table in earlier sections shall be provided and kept in updated condition. Pre-employment &post-employment Employee health check-up programs shall be properly scheduled & conducted and records of same shall be regularly maintained. Safety devices and control instruments

should be calibrated at least once in a year. Emergency management plan with necessary details & action plan shall be prepared for all hazardous chemical and made available in all areas of chemical handling, storage & use. Necessary induction & safety training schedule & procedures shall be prepared and implemented. Special training for safety, emergency requirement and emergency action plan for chemical risk shall be provided to all employees working with the chemicals or in area of chemical storage/handling /use/application.

OCCUPATIONAL HEALTH AND SAFETY

The health status of workers in the unit shall be regularly monitored under an occupational surveillance program similar to the existing practices of OHS Management. Under OHS program, all the employees are subjected to a details medical examination at the time of employment. Medical check-up shall be done considering the requirement for all chemicals of the proposed project and suggestion in RA for such check-up programs shall be followed.

Pre-employment medical examination should be performed on each new employee and post-employment medical examination should be repeated regularly throughout the term of employment. The medical histories of all employees shall be maintained in the prescribed format. Thereafter, the employees shall be subjected to medical examination on annual basis.

Figure 5: Format for Occupational health of the workers

Name		**Mr.**	
Nature of Employment		**Permanent**	
Contractor's Name (for contractual employees)			
RSMML Employee No.			
ID No.			
Sex	**Male**	**Date of Birth**	
		Age	
Designation	***Trainee***		
Department			
Height (cm)		**Weight (kg)**	
Vision: Visual Acuity **(Distant Vision) (With or without glasses)**			
Right Eye	**Equal/better than 6/12**		
Left Eye	**Equal/better than 6/12**		
Color Blindness	**No**		
Squint	**No**		
Ears: (Audiometry)			
Noise Induced Hearing Loss			
Respiratory System: A. Spirometry			
Parameters	**Measured**	**Predicted**	
FVC (liters)			
FEV1			
FEV1 / FVC%			
PEFR (liters/sec)			
MVV (liters/min)			
Conclusion			
B. Skiagram of chest			
Circulatory System			

Pulse		**Blood Pressure (mmHg)**		
ECG				
Biochemical Parameters				
A) Urine:				
Specific Gravity		**Protein (gm/l)**		
PH		**Bilirubin**		
Nitrite		**Urobilinogen**		
B) Random Blood Sugar (mg/dl)				
REMARKS				

EMERGENCY MANAGEMENT

Periodic On Site Emergency, Mock Drills should be conducted, in order to train the staff and make them mentally prepared to tackle any emergency. Emergency handling facilities should be maintained in upstanding condition at time of operation of the plant. The emergency equipments along with emergency management plan & emergency management cell shall be provided. Manual call points & alarm system for fire & toxic hazards location identification shall be provided/ installed in all identified hazardous areas within plant premises.

1.13 DISASTER MANAGEMENT & ON-SITE EMERGENCY PLAN

An onsite emergency in the industries involving hazardous processes or hazardous installations in the plant is one such situation that has potential to cause serious injury or even loss of life. It may cause extensive damage to property and serious disruption in the work area. It effects are usually, confined to factory or in several departments of factory premises. An emergency begins when operator at the plant or in charge of storage plant cannot cope up with a potentially hazardous incident, which may turn into an emergency.

1.14 PREVENTIVE MEASURES TO AVOID ANY ONSITE & OFF SITE EMERGENCY

The company is concerned about the occupational health and safety among its work force as the man power is the biggest asset to the industry. The On-site Emergency Plan is prepared and implemented for existing activities and will be modified as per proposed change in product mix and will be implemented. The Off-site Emergency Plan is available with the District Collector Office, Silvassa. The following safety measures are implemented and will be followed:

- Safety Training will be provided to the employees.
- Safety Alarm Systems are installed for use, in case of emergency.
- Emergency Control Room with emergency sirens is established.
- Assembly point is provided.
- Fire Hydrant System is installed.
- Fire Extinguishers are provided.
- Mock drills are periodically conducted and factors like response time are evaluated.
- Fire squad team is formed for handling any emergency situation & regular training of squad team will be conducted.

- First Aid Facility and training is provided.
- Personal protective gears and equipments is provided to the employees.
- Health checkups are organized at regular intervals.
- Safety / Health records and MSDS will be maintained.

1.14.1 SAFETY REGULATIONS

All applicable HSE legal regulation will be followed from initial stage of the project. And it will be maintained throughout the life of the plant. As per new regulation every approval will be taken in definite time.

1.14.2 SAFETY IN DESIGN

Most appropriate standards and codes of practice have been followed in the design and construction of the plant. Fail safe consideration: lower inventories of toxic materials, provision of safety valves, feedback controller, alarm system, relief valves, bund walls etc are provided.

1.14.3 SAFETY IN OPERATION

Following aspects will be considered during all operations:-

1. Selection of competent manpower on the basis of Qualification, Experiences etc
2. Procedure Development for Safe operation
3. Training and awareness for Occupational Health & Safety
4. Regular review and revision of procedures
5. Review of onsite activities.

1. Procedure For Safe Operations

Following guidance is available within the plant premises in consistence with the standards or practices accepted worldwide.

a) Plant Manual incorporating emergency instructions related to service failures
b) Operating instructions
c) Manuals related to shutdown, start-up and maintenance
d) Checklist and routine schedules
e) Permit to work System
f) Drawing and documents
g) Pressure vessels, hoists, lifting tackles inspections
h) Regular inspections of Boilers and storage tanks as per the legislative requirement.

2. Training And Awareness

Besides the availability of documents all the senior and junior level employees are required to undergo Fire fighting training programme conducted by External Agencies like Loss Prevention association, Mumbai. Advanced Fire fighting programme is also conducted for specific employees involved in the operations inside any confined space or excavations.

The employees are retrained / refreshed by the training programme imparted by the HSE department. A safety booklet will be issued to all new joined employees during Induction Training programme.

The training is imparted for the following:-

a) Usage of Personal protective equipments
b) First Aid
c) Basic fire fighting

Awareness programmers also conducted by the each department in terms of implementation of the standard operating procedures / work instructions w.r.t specific job profile to all newly joined employees.

Awareness programme will be imparted by HSE department for the following –

a) Work Permit System
b) Working inside the Confined Space
c) Working at height
d) Basic Safety standards
e) Fire Fighting
f) Chemical Handling
g) Loading & Unloading
h) System Procedures

Periodic Mock drills will be conducted at interval of six month to ensure that the laid down procedures and systems are effective at the time of any major emergency. And involvement of all level employees will be must.

3. Regular Review And Revision Of Procedures

Conformity to the Process controls are regularly reviewed .Alarm and trip systems are checked periodically. A Comprehensive audit system is followed to ensure safe operation of pressure vessels lifting tools and tackles, cage hoist etc. The maintenance of the Fire extinguishers and the Fire Hydrant is under the purview of External agency for periodic maintenance and review under annual maintenance contract. Also the HSE departments are involved in the day to day operation and maintenance of the Fire equipments.

Having carried out the threat perception and the evaluation of control & defensive measures the possible reasons to trigger of an emergency situation are assessed as under:

i) Structure breakdown
j) Fire
k) Gas / Chemical Leakage / Spillage
l) Any abnormal situation
m) Natural calamities etc

The Emergency in the plant is defined from the safety view as a Controllable situation which is likely to endanger the personnel working in that area. It can be mitigated either by employing the captive

resources (E.g. A bad gas leak or a fire outbreak.) or by seeking the help of external agencies (E.g. Major Fire, explosion etc). In either of the cases, the Emergency Situation shall be controlled by adopting the steps suggested and the operations manual of respective plant facing the emergency.

1.15 CLASSIFICATION OF EMERGENCY

Depending upon the magnitude of the incident the Emergencies are classified into Minor and Major Emergencies. If an Emergency can be controlled within the premises with the available captive resources – Fire fighting and First aid equipments or other available defensive measures – Such an emergency is termed as **Minor Emergency.** Hazardous incidences associated with chemicals of the proposed unit are identified as minor emergency.

While any involvement of external agencies for controlling the emergency related with **onsite & off site** Fire Brigade, Ambulance or other related services to tackle the situation within our premises would be termed as **Major Emergency**.

Emergency handling should have a thorough co–ordination and a prompt understanding of what is required at the time of incident to control the emergency situation. Pre-planned and well-exercised plan will help in combating incident and also reduce the severity.

Following are the major anticipated emergency situations

1.16 INITIATION OF MAJOR (ONSITE & OFF SITE) EMERGENCY CONTROL

The control mechanism for emergencies is developed on the following basis:-

a) Fast information relaying in assessment for potential danger and actions needed
b) Quick actions on isolations, containment for incident controlling
c) Prompt availability of support services
d) An Overall authority directly in charge of the situation for better control and coordination.

1.16.1 DECLARATION OF EMERGENCY

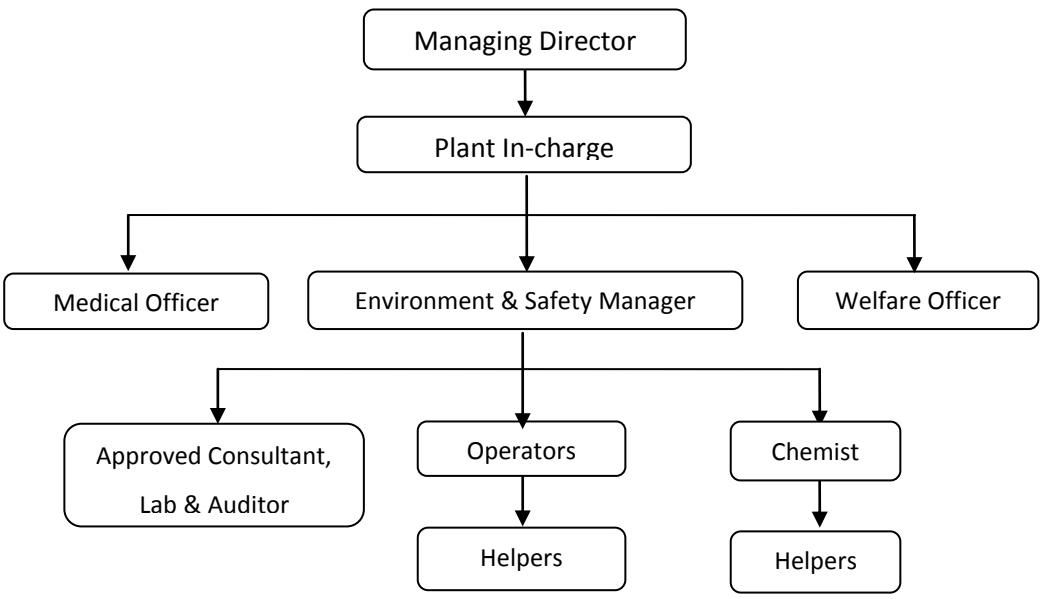
On getting direct information or on hearing the fire alarm siren, the Shift incharge of the respective department will immediately visit the spot of incident and ascertain the situation. Depending upon the severity and the potential of the incident any one of the following situations may be declared:-

a) Incident is large, severe and in the opinion of the Shift Manager cannot be controlled by utilizing the captive resources, will be declared as Major Emergency or **Red Emergency.** E*xternal support* from the Govt Agencies – Fire Brigade, Ambulance, Fire Monitors, Evacuation team etc. will be required to counter such incidents.
b) Incident is serious but can be brought under control involving own employees and captive resources will be termed as minor emergency. Though the incident will be controlled with the available Fire fighting systems inside the premises .External support may be required for the evacuation and the treatment of causalities

1.17 EMERGENCY MANAGEMENT CELL

The emergency management cell includes three level management systems. Emergency Controller is the head having the top level position and below him site incident controller will operate during emergency situation. A well trained emergency team is formulated which comes in action under guidance of site incident controller. The details of Emergency management cell with roles & responsibility of members of cell is described herein after under respective headings& illustrated as organisation diagram below.

Figure 6: Emergency Management Cell



1.17.1 EMERGENCY CONTROLLER

At the start of the Emergency, the Emergency controller shall carry out the following tasks.

a) Taking a decision to take a full or partial shutdown of the plant / plants or mode of running the same
b) Need to evacuate
c) Actions pertaining to the incident controlling

During a major (**Onsite & Offsite**) emergency, difficult decisions will have to be made which may affect the whole or a substantial part of the site. The decisions will be taken in consultation with other senior managers in accordance with the standard operating procedures. Head-CP Division will assume the charges of Emergency Controller, Immediately upon his arrival on site. In his absence, HOD in situ will assume the responsibility, depending upon the location of Emergency. The Emergency Controller will operate from Time Office, to be referred as emergency control room, hereinafter. At least one deputy from Process, Utility, Security and the Administration departments will be deputed to assist the Emergency Controller. In the absence of Head-POY/FDY, the following Officers with their respective relevance to the area and location of the incident will act as the Emergency Controller.

a) Mr. Hardik C. Thakkar–HOD, Texturising and POY Division
b) Mr. Avdesh Kumar Singh– HOD, Mechanical and Utilities
c) Mr. Kiran Rugale – HOD-Packing & Dispatch Dept.
d) Mr. Arvind Singh – HOD-Security
e) Mr. S. Chatarjee – HOD-Administration

Mr. Mahesh L. Lakhavani (Director) and his full team will extend support for all the activities to be performed.

Other employees will provide the necessary support for smooth performance of the role of Emergency controller.

1.17.2 RECOMMENDED DUTIES OF EMERGENCY CONTROLLER

Immediately he is aware of the emergency, the Emergency Controller will proceed to the Emergency Control Centre. On arrival he will:

1. Put on fluorescent clothing and hard hat so that he is readily distinguishable in the emergency.
2. Relieve the Site incident controller of responsibility for overall control.
3. Ensure that the emergency services have been called in and, where required, that nearby firms have been informed. The relevant authorities for public facilities such as railways, rivers etc. must also be contacted as appropriate.
4. Inform the necessary external agencies and the details of head office of the emergency.
5. Ensure that key personnel have been called in.
6. Exercise direct operational control of those parts of the site outside the affected area.

7. Liaise with meteorological offices where weather conditions could have a strong influence on the development of the incident.
8. Direct the shutting down and evacuation of plants in consultation with the Site incident controller.
9. Ensure that casualties are receiving adequate attention. Arrange for additional help if required. Ensure that relatives are advised.
10. Liaise with the chief officers of the Fire and Police services, and Health and Safety Authorities. Provide advice of possible effects on areas outside the works.
11. Ensure personnel are accounted for.
12. Arrange traffic control on site.
13. Liaise with the media spokesperson.
14. Arrange for a chronological record of the emergency to be maintained.
15. Where the emergency is prolonged, arrange for the relief of personnel and the provision of catering facilities.
16. Control rehabilitation of the affected areas on cessation of the emergency.

1.17.3 SITE INCIDENT CONTROLLER

A part of the Operations Group, The Site incident controller will be the shift in-charge handling the shift operations, in the affected area at the time of incident. The Shift in-charge as the Site Incident Controller is available during odd hours and is also well conversant with the plant operations .The Site is divided into following areas w.r.t the process of controlling any emergency. The Site incident controller shall nominate a second site incident controller as his deputy as following.

The Shift Engineer of the plant in the nearest vicinity will act as site incident controller. All department shifts in charge will be responsible for declaring and controlling an emergency. He shall ensure safe shutdown of operations that may aggravate the emergency situation in his assessment. He shall execute his duties with the assistance of his nominated subordinates. Other departmental shift in charges on knowing about the site of incident of the emergency shall depute their trained Fire fighters and First Aiders to the affected site.

During the Working Hours (09:00 to 18:00 Hrs)

The role of incident controller will be adopted by the Shift In-charge who will evaluate the initial situation or intensity of the incident and will start taking measures as per this procedure. The presence of his superiors will be almost simultaneous during the general shift working hours. Concerned HOD or the person in situ will take over from the duties of the Site Incident Controller from shift in-charge, immediately up on his arrival.

After the Working Hours (i.e.., 18:00 Hrs and before 09:00Hrs)

The Shift In charge shall be the Site Incident controller who shall be responsible to handle emergencies. However he will ensure the transmission of information through his Second in Command, and will hand over the responsibilities of the site incident controller immediately upon the arrival of the concerned production head.

A. Recommended Duties Of Site Incident Controller

It is the duty of the Site incident controller to reach the scene of the incident as quickly as possible and assess the situation. On arrival he will:

1. Assess the scale of the emergency and decide if a major emergency does or could exist (and activate the emergency plan accordingly).
2. Direct the safe shutting down of operations and try to minimise the damage to plants, property and the environment involving the Operational team.
3. Ensure that the affected area is searched for casualties.
4. Coordinate operations on-site until the emergency services arrive and then relinquish overall incident control to the designated emergency services officer.
5. Assume duties of Emergency Controller until he is in position. In particular, ensuring that emergency services and key personnel on-site are informed of the situation.
6. Communicate continually with the Emergency Controller and inform of all developments via radio, telephone or messenger as appropriate.
7. Liase with emergency services during the incident providing information as required to the officer in charge.
8. Ensure that any evidence which may be required for further investigation is preserved.

B. Recommended Duties Of Dy. Site Incident Controller

1. Inform other departmental shift In charges about the emergency
2. Inform the Security Officer / Security Supervisor.
3. Assist the Site Incident controller in the process of handling an Emergency

1.17.4 EMERGENCY TEAM

With a purpose to exercise proper administrative control over the machinery being utilized to combat the emergency, Head of CP Division will be the Emergency Controller. There will be an Entire Emergency Control team working under him for the purpose of Management of the Emergency, which will be divided in three teams as under

a) Operations Group
b) Administrative Support Group
c) Technical Support Group

i Operations Group : This group will comprise of all the Senior & Junior Staff members of the department getting affected by the emergency .

ii Technical Support Group : will comprise of all the Senior & Junior Staff members of the Plant not affected along with the Staff of all the Support Engineering Areas viz. Mechanical, Electrical, Instrument , Civil , All the Fire Fighters , Rescuers & First Aiders.

iii Administrative Support Group : Headed by Mr. S.Chatarjee-HOD Administration, the Administrative support Group will comprise of the Staff members belonging to the following departments

Personnel

Security

Stores

Packing & despatch

Medical Officer

A. Head – Administrative Support Group

Head –Support Group shall ensure the following in coordination with Dy.Head:-

a) Station himself in the Head – Security cabin
b) Direct the Emergency team.
c) Request / arrange for external help
d) Safe evacuation, assembling, roll call
e) Transportation of the affected persons to the nearest hospital
f) Access to the documentation, reports and returns w.r.t to the emergencies.
g) Briefing the govt. official and media personnel about the emergencies.

B. Deputy Head – Support Group

Deputy Head – Support group can be any of the following:-

HOD – Personnel

HOD – Security

HOD – POY Process

HOD – Texturizing Process

HOD - HSE

HOD – Packing & Dispatch

HOD – Electrical &

HOD – Mechanical & Utility

On hearing the siren and knowing the exact location of the Incident the Site Incident controller shall visit the site affected and assess the magnitude and severity. The concerned shift in charge will declare a Major Emergency, by actuating the Emergency Wailing Siren if the situation warrants so. Simultaneously the role of Emergency team shall come into existence.

The Emergency team shall involve the following personnel during the Emergency such as Fire and Explosion.

1) Fire Fighters
2) First Aiders
3) Security Personnel shall play the following roles
    i. Assembly Officer
    ii. Record Keeper

iii. Traffic officer

C. Fire Fighters And First Aiders

Those employees well trained in the Fire fighting techniques and the systems will immediately report to the site of incident on knowing the exact location of the incident. The same is communicated by the indication panel placed at the entrance of each building or may be communicated by the site incident controller or the Security personnel. They shall also be assisted by the Site incident controller of that department / location. It is also important to inform the Fire pump house for effective and nonstop operation of the Fire Pumps.

Any injured person shall be immediately evacuated to the nearest assembly area where he will be administered the First Aid. The names of the trained Fire fighters and First Aiders are displayed at various locations for easy identifications.

D. Assembly Officer

The Security Officer shall depute a Security personnel who shall be acting as the Assembly Officer. He shall ensure that the employees are safely evacuated from the site of the incident and are assembling in the nearest Assembly Point.

E. Record Keeper

The Security officer shall depute Security personnel who shall be acting as the record keeper. He shall obtain the records – attendance data of all the departments from the personnel department and ensure proper head counting at the assembly points. He shall also include the list of visiting contractors, transporters, visitors etc.

F. Security Officer

Security Officers hall ensures the following:-

1) One guard is deputed to the nearest point for guiding the emergency vehicles
2) Instruct both gate – security personnel not to allow any vehicle inside the premises except the Emergency vehicle such as Ambulance and Fire brigade
3) Inform the Security Agency in case of more requirement of security personnel to deal with the emergency

G. Press Spokesperson

Mr. Mahesh L. Lakkhwani – Director will be responsible for the press briefing. Apart from the press briefing, he will also be responsible for leading the Support group. No other employee is authorised to share any details pertaining to the incident with the press.

H. Head - Concerned

Any emergency falling under the purview of any department, the concerned departmental head shall immediately inform their nearby departmental heads. Also he shall visit the site of incident and shall guide the site incident controller.

1.18 EMERGENCY CONTROL FACILITIES

1.18.1 EMERGENCY CONTROL CENTRE

The emergency control room shall be equipped with the following:

1) Emergency Contact & Other Important phone numbers
2) Personal protective equipments – Nose masks, helmet and torches
3) First aid materials
4) Effective communication media – phone, mobile etc
5) Plant lay out indicating the location of the Fire hydrants and extinguishers
6) Lay out showing emergency exits & storage of hazardous material storage area Transformer and Utility section, Fire Pump house exclusively.
7) Set of Safety belts, Manila rope and stretcher.

1.18.2 FIRE PUMP HOUSE

The unit will require 383.00 KLD freshwater, which will be sourced from irrigation canal (Surface water source). The industrial operation of the unit will require 351.00 KLD, whereas the domestic activities will require 32.00 KLD.

1.18.3 EMERGENCY CONTACTS

The Company has prepared a list of emergency contact numbers which includes important contacts of in-house as well as external contact persons/offices/department. The emergency contact list is tabulated in below.

Table 9: Emergency Contact Details

Sr.No	Name / Designation	Phone No.
1.	Mr. Mahesh L.Lakhwani (Director)	**9824155877**
2.	Mr. Hardik C.Thakkar (Plant Head- POY-PTY)	**9574005210**
3.	Mr. S.Chatterjee Head (Commercial)	**9824155092**
4.	Mr. Kiran Rugale (Head POY/Asst. Manager)	**9824759879**
5.	Mr. (HCGA Head)	-
6.	Mr. Gautam U.Guha (Head Texturising)	**9824155172**
7.	Mr. Avdesh Kumar Singh (Head Utility)	**9574005206**
8.	Mr. Adarsh Tiwari (Asst. V.P/Head Electrical)	**9727782434**
9.	Mr. Arvind Singh Main Gate (Security Office)	**9157434948**
10.	Police Station Silvassa	**2642033,2642057**
11.	Fire & Emergency Services, Silvassa	**2640022**
12.	Yogi Hospital – Silvassa	**2642301,2642302**

13.	Cottage Hospital – Silvassa	**2642120,2642940**
14.	Flood control Room	**2642106**
15.	Fire & Emergency Services, Alok Industries,Rakholi	**2632102/107**
16.	Fire & Emergency Services, Hindalco, Khodali	**2677024/25**
17.	Fire & Emergency Services.RIL,Khardapada	**2650705/709**
18.	Police Station ,Surangi	**2699300**
19.	Police Stations/Department	
	Police Control Room Silvassa Surangi Khanvel Rakholi Fire Station	**100** **2642033** **2699300** **2677233** **2633004** **101**
20.	Fire & Emergency Services, Silvassa	**2640022**
21.	Yogi Hospital – Silvassa	**2642301**
22.	Cottage Hospital – Silvassa	**2642120**
23.	Haria Hospital	**2426153**
24.	Ambulance	**102**
25.	Blood Banks	**0260 2640911, 0260 2640577**
	Vapi	**2430654**
	Silvassa (Red Cross)	**2640577**
26.	Flood control Room	**2642106**

Table 10: Location of fire hydrant point with hose box

Sr. No.	Area/ Plant	Nos. of Hydrant point with Hose Box
1.	Plant Areas	11 HY 11 HB
2.	R.M. Storage and Tank area	03 HY 03 HB
3.	Utility area	02 HY 02 HB
4.	Administrative Building	01 HY 01HB
5.	Laboratory Area	01 HY 01 HB

Table 11: List of Fire Extinguisher

SR. No.	Area	Type of extinguisher	Nos	Capacity
1.	Laboratory	ABC,CO2 FIRE EXTINGUISHERS	02 NOS	5 kgs, 4.5 kgs
2.	R.M. Storage and Tank Area	ABC, CO2,W/CO2, M.FOAM FIRE EXTINGUISHERS	08 NOS	5 kgs, 4.5 kgs, 9 ltrs,50 ltrs
3.	Finish Goods Area	ABC, CO2,W.CO2, M.FOAM FIRE EXTINGUISHER	08 NOS	5 kgs, 4.5 kgs, 50 ltrs,50 ltrs
4.	Production Area	ABC, CO2, M.FOAM FIRE EXTINGUISHER	26 NOS	5 kgs, 4.5 kgs,9 ltrs & 50 ltrs
5.	Utility Area	ABC, CO2, DCP FIRE EXTINGUISHERS	10 NOS	5 kgs, 4.5 kgs,10 kgs
6.	66kv Switch Yard	Co2, DCP FIRE EXTINGUISHERS, SAND BUCKETS	13 NOS	4.5 kg, 22.5 kgs,10 kgs, 10 Ltrs
7.	Office	ABC, CO2, FIRE EXTINGUISHER	02 NOS	5 kg, 4.5 kg
8.	Security office	ABC, CO2, FIRE EXTINGUISHER	02 NOS	5 kg, 4.5 kg
9.	Spare	ABC, CO2 FIRE EXTINGUISHERS	10 NOS	5 kg, 4.5 kgs

Name of five neighbour industries:

1) Next Polymer.Ltd
2) Rainbow Pigments Pvt.Ltd.
3) Jai Ambe Textiles Pvt.Ltd.
4) Time Technoplast Ltd.
5) Goel Power Control Pvt.Ltd.

1.19 EMERGENCY ACTION GUIDELINES

1.19.1 GENERAL GUIDELINES

1. No non-emergency vehicle will be allowed to enter the site.
2. The TO will ensure that roads are free for easy and rapid movement of Ambulance and Fire Engines.
3. Telephones will be used only for emergency plan communications. All incoming/outgoing call not connected with the emergency will not be permitted.
4. The AO will count heads of all people on duty (incl. Contract labour)
5. The people not connected with emergency duty who have collected at the assembly point will remain there and not be allowed near the accident site.
6. Use of lift is to strictly prohibit at the time of Emergency.
7. During emergency situation visitors will be taken care of by concerned person being visited.
8. The Tech. Director or the person nominated by Tech. Director will be responsible for reporting the emergency to the management & media.
9. After thorough checks of the affected areas and discussions with the appropriate authority, the emergency should be declared over by the EC and routine operations can be commenced.
10. A company car will be maintained for use in emergency round the clock on all the days of the year.
11. Search of personnel at certain locations like – toilets, terraces, contractor workshop and any isolated areas, areas under the work permit system shall also be checked.

A. FIRE

Sources of fire can be due to Electrical short circuits, by conduction / convection from the external sources (fire pit, communal waste disposal by open air incinerations etc), Friction or increase Vapour pressure in the transportation vehicle of flammable Liquid, sudden rise in the atmospheric temperature, volatile vapours of chemicals in contact with heat sources like hot plates or processing locations, Flames in the Welding torch, Gas stove in canteen.

Following are the possible types of Fires in an Emergency situation.

- **A class Fire** due Organic materials like Paper and Cardboard boxes. Extinguishing media – Water type fire extinguishers, sand and water.
- **B class fire** due to Light / Heavy Liquid chemical, storage and transportation, Diesel storage

tanks, Organic solvents in the lab. Extinguishing media AFFF (Aq. foam film forming media) and the Fire Monitor operated with AFFF and Fire hydrant System.

- **C class** fire due to LPG, acetylene, ammonia and Oxygen Gas cylinders used for Domestic & Industrial purposes respectively. Dry chemical Powder type fire extinguisher or CO2 extinguisher can be used to extinguish the C class Fire.
- **E class Fire** due to electricity. Preferably use CO2 and in the absence of CO2 use DCP type fire extinguisher. Electrical Panels, Transformer Yard and other electrical installations / connections are the sources of E Class Fire.

The details of fire fighting in chemical storage area are described in emergency response plan for all chemicals. The procedures of fire fighting with the suggested media, as suggested, shall be similar to the NG fire. According to the nature of an emergency situation for Natural gas pipeline & PRV Station, following steps to be taken:

B. IN CASE OF FIRE

- As soon as a fire is seen in our premises or office, break the glass of manual call point (MCP) that will give fire alarm in control room & security office or as soon as a fire is seen in our premises or office, immediately call for help.
- Alert all employees.
- Extinguish the fire by using appropriate fire extinguisher.
- Do not use DCP type fire extinguisher on computer fire, use CO_2 type.
- Use fire hydrant system available in the premises.
- Follow all instruction of 'INCASE OF FIRE' board displayed at all offices.
- If it is a major fire, call Fire Brigade.

If the fire spreads and becomes uncontrollable the office premise is evacuated the employees vacate the place by following safe escape routes marked in premises or coordinator taking charge directs the safe evacuation of the premises. Fire Brigade carries out the further fire fighting operation. The employees get assembled at safe assembly point earmarked in the premises.

- Informs the Control room and Emergency Controller in case of further help.
- In case of collapse of building, immediately inform to the control room and Emergency Controller, call fire brigade and police to control the situation, evacuation of the premises and shifting of the injured.
- If it is safe and possible, shift the important documents, files valuable data, cash etc. to safer place.
- Direct the external agencies on safe escape route. Details on fire, building plan, drawings of the buildings, nearby facilities and hazards etc.
- Ensure that the relatives of the injured persons are informed.
- The visitors are guided properly up to the place of Assembly Points by security or the employee to whom visitor has come to meet.

- The emergency exits gate made known to visitors, and in case of emergency where to assemble is informed.

C. EVACUATION OF THE PERSONS

- The decision to evacuate the persons is to be taken by the incident controller, in consultations with Emergency Controller.
- The persons to be informed about the reason for evacuation prior to evacuation as information given to them will result in safe & easy evacuation.

1.19.2 CHEMICAL HAZARDS AND EMERGENCY ACTION PLAN

Following are the possible types of hazards due to chemical spill, leak & exposure of employees.

- **Environmental Contamination & Toxic Effects** due hazardous /non hazardous materials with little or more effects on biotic communities (plant, animals & human) especially engaged or exist in the area of contamination air, water & soil.
- **Fire & explosion** primary fire & explosion due to leak of NG from pipelines in gas skid area & PRV station, secondary fire due to combustion of some combustible raw materials (Spin Finish Oil and Finished products-Yarns)
- **Damage to exposed facilities & structures** due to reactive properties (like corrosive, exothermic & endothermic reaction etc.) of spilled or leaked chemicals

Focusing on these probabilities, emergency response plan for the chemicals have been formulated. The details of emergency response plan for chemical accident is described in Annexure I with respected to the physicochemical properties & probable hazards of the major identified chemicals raw materials of continuous polymerisation unit for manmade fibre production.

1.20 DECLARING NORMALCY

Soon after the process of evacuation and extinguishing or controlling an Emergency, the Emergency controller shall declare Normalcy of the situation .This shall be declared at the Emergency Assembly points after ensuring the head count. He shall brief the assembly about the occurrence, magnitude and the methods of controlling that particular emergency .An emergency siren can also be sounded for declaring the Normalcy.

1.21 PLANT START UP

The Concerned department heads shall ensure the availability of the manpower for safe start up of the process, equipment or plant. The site of incident shall be checked further for any corrective and preventive actions by the HSE department in coordination with the concerned department and shall report to the top management within 24 hours from the time of occurrence of an emergency.

Annexure-I: Safety Plans & Emergency Response Guideline (ERG)

1. Diesel (Fuel Oil)

A. General Details

- **Synonyms:** Diesel Fuel Oil
- **Density Specific Gravity:** 0.8654 @ 15 deg C/15 deg C
- **Flash Point:** 136 deg F (closed cup)
- **Autoignition Temperature:** 494 deg F
- **Viscosity:** 268 cSt @ 37.8 deg C.

B. NFPA Classification

Health: 1 (Slight)

Materials that, on exposure, would cause significant irritation, but only minor residual injury, including those requiring the use of an approved air-purifying respirator. These materials are only slightly hazardous to health and only breathing protection are needed.

Flammability: 2 (Moderate)

This degree includes materials that must be moderately heated before ignition will occur and includes Class II and IIIA combustible liquids and solids and semi-solids that readily give off ignitable vapors. Water spray may be used to extinguish fires in these materials because the materials can be cooled below their flash points.

Instability: 0 (Minimal)

This degree includes materials that are normally stable, even under fire exposure conditions, and that do not react with water. Normal fire fighting procedures may be used.

C. Hazardous Property

- FLAMMABLE LIQUIDS (Non-Polar/Water-Immiscible)
  - HIGHLY FLAMMABLE: Easily ignited by heat, sparks or flames
  - CAUTION: Very low flash point; use of water spray when fighting fire may be inefficient

D. Health Effects

0.1.1 SUMMARY OF EXPOSURE

- 0.1.1.1 ACUTE EXPOSURE
  - A) USES: Hydrocarbons are a diverse group of organic compounds that are made up of primarily carbon and hydrogen atoms. Hydrocarbons are derived from petroleum, coal tar and natural gas, as well as from plants and animals. They may be classified as aliphatic (including the paraffins, olefins, acyclic terpenes, and acetylenes) and cyclic (including the alicyclics, aromatics and cyclic terpenes). Examples range from gasoline to essential oils to solvents. They are used as fuels and solvents, and are found in many household and commercial products.
  - B) PHARMACOLOGY: Pharmacology of hydrocarbons varies according to the specific substance. Some have sites of action in the CNS, namely increasing neurotransmitter binding and potentiating nicotinic blockade by interacting with acetylcholine receptors. Others stimulate GABA A activity. Glutamate release may be stimulated or transmission inhibited, depending on the specific agent. Glycine receptor activity may be augmented with certain hydrocarbons, and hydrocarbons are used as general anesthetics. In addition, alpha-2 adrenergic receptor activation can occur.
  - C) TOXICOLOGY: Hydrocarbons are a large and diverse group of substances with toxicity varying according to specific substance and route of exposure. Pneumonitis after

aspiration is common and is the main route of injury from hydrocarbons. The exact mechanism of pulmonary toxicity is unclear but is likely due to direct toxicity to lung tissue as well as destruction of surfactant. Low viscosity, low surface tension and high volatility of a hydrocarbon (gasoline, for example, has all of these properties) increase the aspiration potential of that particular compound. Pulmonary toxicity can also occur after IV injection of hydrocarbons. Acute systemic toxicity is primarily due to CNS depression, reflecting the inhalational anesthetic effects of hydrocarbons. Inhalational abuse of hydrocarbons can cause simple asphyxiation. Chronic exposure in industrial settings or after long-term inhalational abuse can lead to chronic nervous system effects. Chlorinated hydrocarbons may cause cardiac sensitization to catecholamines, predisposing patients to cardiac dysrhythmias. Halogenated hydrocarbons may also cause hepatotoxicity, nephrotoxicity, and electrolyte disturbances. Hydrocarbons can destroy lipid bilayers and this can lead to "defatting" dermatitis following prolonged skin exposure. Capillary endothelium can be severely damaged in any organ system exposed to hydrocarbon. Hemolysis is rarely reported after hydrocarbon ingestion. Benzene is a bone marrow toxin.

- D) EPIDEMIOLOGY: Poisoning is relatively common as these products are widely available in homes and industrial settings. Populations at highest risk include children with unintentional exposure (often ingesting pleasant-smelling oils), workers with occupational exposures, and those who intentionally abuse solvents via inhalation (often referred to as "sniffing" or "huffing"). Toxicity is primarily due to aspiration, but may occur via oral, parenteral, dermal or inhalational routes depending on the substance and nature of exposure.
- E) WITH POISONING/EXPOSURE
  - 1) ACUTE EFFECTS OF INGESTION by SIMPLE PETROLEUM DISTILLATES: Low viscosity, highly volatile hydrocarbons (eg, kerosene, gasoline, liquid furniture polish) is chiefly aspiration hazards. Pulmonary damage, transient CNS depression or excitement, and secondary effects of hypoxia, infection, pneumatocele formation, and chronic lung dysfunction can occur. Cardiac complications are rare. These hydrocarbons are poorly absorbed from the gastrointestinal tract and do not cause appreciable systemic toxicity by this route unless aspiration has occurred.
  - 2) ACUTE EFFECTS OF INGESTION by CHLORINATED AND AROMATIC HYDROCARBONS: Many chlorinated, aromatic and other substituted hydrocarbons can produce systemic toxicity following ingestion. CNS, respiratory depression, dysrhythmias, gastrointestinal disturbances, and other effects may occur depending on the agent and amount ingested.
  - 3) ACUTE EFFECTS OF INHALATION: Cardiac dysrhythmias and CNS depression are major concerns of acute exposure. Straight chain hydrocarbons with few carbon atoms (eg, methane, ethane, propane gases) can cause asphyxiation if exposure occurs in poorly ventilated spaces.
    - a) INHALATIONAL ABUSE ("sniffing") of some hydrocarbons can result in sudden death, encephalopathy, residual neurological impairment, nephrotoxicity, hepatotoxicity, acid-base disturbances, and rhabdomyolysis.
  - 4) INJECTION of kerosene, naphtha, turpentine, gasoline, or hydrocarbon insecticides has resulted in febrile reactions, local tissue inflammation and systemic effects, including pulmonary edema, pneumonia, and mild CNS depression. Severe cases have resulted in multiorgan dysfunction syndrome. Injection of pressurized hydrocarbons has caused severe tissue damage.
  - 5) DERMAL/EYE: Mild to moderate eye irritation and reversible ocular injury may occur after contact with most hydrocarbons. Acute but prolonged exposure to some hydrocarbons can result in dermal burns and occasionally, systemic

effects. Frostbite can result from contact with some liquefied gases (eg, propane, methane, ethane).

- 6) TYPES OF HYDROCARBONS INCLUDE:
  - a) LOW VISCOSITY, UNSUBSTITUTED: Hydrocarbons with low viscosity (less than 100 S.U.S.), low surface tension, and high volatility are most likely to cause aspiration pneumonitis. Vapor inhalation can cause CNS depression or excitation and other effects. Examples: kerosene, mineral seal oil, gasoline, petroleum naphtha.
  - b) HIGH VISCOSITY, UNSUBSTITUTED ALIPHATIC: Hydrocarbons with high viscosity and low volatility are less likely to be aspirated after ingestion and are generally poorly absorbed from the gastrointestinal tract. Petroleum jelly may cause a mild laxative effect. Oil mist inhalation may cause lipoid pneumonia. Examples: motor oil, petroleum jelly.
  - c) TERPENES: In addition to aspiration, these tend to produce a mild CNS depression after ingestion. Examples: turpentine oil, pine oil. Pine oil cleaners may contain approximately 10% isopropyl alcohol and other additives which may contribute to the observed toxic effects.
  - d) AROMATICS: These have a high potential for CNS depression, a mild tendency to cause cardiac irritation, and little risk of aspiration. Adverse effects can result from vapor inhalation, ingestion, or skin exposure. Examples: benzene, xylene. Many polyaromatic hydrocarbons are potential carcinogens.
  - e) HALOGENATED-CHLORINATED: These can produce CNS effects, dysrhythmias, renal and hepatic effects. Aspiration is a small risk. Adverse effects can result from vapor inhalation, ingestion, or skin exposure. Examples: chloroform, carbon tetrachloride, trichloroethylene.
  - f) NOTE: Brominated hydrocarbons, fluorinated hydrocarbons, alcohols, esters, ethers, chlorinated hydrocarbon pesticides, and other hydrocarbons are covered in other managements.
- 7) MILD TO MODERATE POISONING: The primary effect seen in mild to moderate inhalational poisoning is euphoria and intoxication followed by CNS depression. This should resolve quickly with removal from the source of inhalational exposure. Patients with oral exposure usually have some gastrointestinal upset and then can develop systemic symptoms as the hydrocarbon is absorbed if a large quantity is ingested. Patients who have vomiting are at increased risk of aspiration. Aspiration may cause minimal respiratory symptoms (eg, an intermittent cough) initially but progress to severe respiratory injury. Ensure that medical staff uses personal protective equipment.
- 8) SEVERE POISONING: Severe effects may include coma and dysrhythmias. Severe pneumonitis from aspiration may require prolonged intubation. Patients that aspirate will often display a systemic inflammatory response including fever. Chlorinated hydrocarbons can cause ventricular dysrhythmias, and can cause hepatic necrosis that may progress to liver failure.
- 9) CHRONIC POISONING: Long-term or repeated exposure to certain aromatic and chlorinated hydrocarbons can result in hematologic (eg, benzene), hepatotoxic (eg, chlorinated hydrocarbons), renal (eg, chlorinated hydrocarbons), neuropsychiatric (eg, toluene), neurological (eg, n-hexane) and carcinogenic (eg, benzene, vinyl chloride) effects. Some effects have occurred primarily in chronic solvent abusers or glue sniffers (eg, neuropsychiatric, renal, and hepatic effects of toluene). Chronic or repeated exposure can result in skin irritation due to defatting of the skin. Greases, coal pitch, and cutting oils can

produce acne and folliculitis. Chlorinated aromatic hydrocarbon exposure can result in chloracne.

0.1.5 CARDIOVASCULAR

- 0.1.5.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Dysrhythmias may occur following inhalation.

0.1.6 RESPIRATORY

- 0.1.6.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Coughing, choking, tachypnea, dyspnea, cyanosis, rales, hemoptysis, pulmonary edema, pneumatoceles, lipoid pneumonia, or respiratory arrest may develop following ingestion and aspiration.
    - 2) Respiratory arrest can occur secondary to CNS depression following vapor inhalation. Intravenous injection of turpentine immediately resulted in pulmonary edema and hypoxia in 1 case.

0.1.7 NEUROLOGIC

- 0.1.7.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Mild central nervous system depression or excitation may occur after ingestion or vapor inhalation. CNS effects can occur secondary to hydrocarbon pneumonitis and hypoxia, or from additives and contaminants (aniline, heavy metals, camphor, or pesticides). Some hydrocarbons are simple asphyxiants (e.g., methane, ethane, propane gasses) which can produce CNS effects secondary to hypoxia.

0.1.8 GASTROINTESTINAL

- 0.1.8.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Nausea, vomiting, diarrhea, and abdominal pain may occur following ingestion.

0.1.9 HEPATIC

- 0.1.9.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Elevated transaminases may occasionally occur following ingestion or vapor inhalation of some hydrocarbons. Carbon tetrachloride is a potent hepatotoxin which can produce potentially fatal hepatorenal damage following ingestion, inhalation or dermal exposure.

0.1.10 GENITOURINARY

- 0.1.10.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Renal effects (acute renal tubular necrosis, proteinuria, or hematuria) occur infrequently following acute exposure to petroleum distillates and other unsubstituted hydrocarbons.
    - 2) Some studies have reported an increased risk of glomerulonephritis following long term inhalation and/or dermal exposure to various hydrocarbons. Acute renal failure and other renal effects have been reported in some chronic glue, solvent, or paint sniffers. Exposures in addition to hydrocarbons cannot be ruled out in many of these reports.
    - 3) Many halogenated hydrocarbons are nephrotoxic. Examples of potentially nephrotoxic halogenated hydrocarbons include chloroform, carbon tetrachloride, ethylene dichloride, tetrachloroethane, 1,1,1-trichloroethane, trichloroethylene (infrequently reported) and tetrachloroethylene (weakly nephrotoxic).

0.1.13 HEMATOLOGIC

- 0.1.13.1 ACUTE EXPOSURE

- A) WITH POISONING/EXPOSURE
  - 1) Disseminated intravascular coagulation, hemolytic anemia and pancytopenia have occasionally been reported following vapor inhalation, aspiration, or ingestion of hydrocarbons. Benzene is a bone marrow toxin. Chronic benzene exposure has been associated with acute leukemia.
  - 2) Contaminants or additives can cause hematologic abnormalities. Examples include aniline and nitrobenzene (methemoglobinemia).

0.1.15 MUSCULOSKELETAL

- 0.1.15.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Subcutaneous injection of paint, lacquer or other material via high pressure spray guns is a surgical emergency. High-pressure injection injuries can result in necrosis and thrombosis with amputation required in 60% to 80% of cases.
    - 2) High pressure injection of paints and solvents can cause significant tissue injury despite a relatively benign initial presentation.
    - 3) Rhabdomyolysis has occasionally been reported in chronic glue or paint sniffers and in a case of prolonged inhalational exposure to mineral spirits. Muscle necrosis, compartment syndrome and/or sterile abscess have been reported following hydrocarbon injection.

0.1.20 REPRODUCTIVE HAZARDS

- A) In a prospective study in Toronto, major congenital malformations were noted in 13 of 125 feuses of mothers exposed to organic solvents during pregnancy.

E. Laboratory Test

- Monitor vital signs and mental status.
- Blood concentrations are not readily available or useful to guide management.
- Obtain an ECG and institute continuous cardiac monitoring in patients with moderate to severe toxicity or chlorinated hydrocarbon exposure.
- Obtain CBC, basic chemistry panel, serum creatinine and liver enzymes in severe overdoses or in patients with chronic exposures.
- Monitor arterial blood gases, pulse oximetry, and pulmonary function tests and obtain chest radiograph in patients with any respiratory symptoms. NOTE: The chest radiograph may be normal early in the clinical course.
- Standard urine toxicology screen does not detect hydrocarbons.
- Monitor fluid and electrolyte status in patients with significant diarrhea and vomiting.
- Head CT should be obtained in patients with altered mental status.
- Monitor for methemoglobinemia in cyanotic patients who do not respond to supplemental oxygen, and who may have been exposed to hydrocarbons which contain nitrobenzene or aniline.

F. Treatment Overview

0.1.2 ORAL EXPOSURE

- A) MANAGEMENT OF MILD TO MODERATE TOXICITY
  - 1) Remove the patient from the source of exposure. When a patient is removed from an inhalational exposure, the symptoms should quickly resolve. Adolescents may present without symptoms after responsible adults find them abusing hydrocarbons via inhalation. Provide oxygen and symptomatic and supportive care. After assuring that the patient is medically stable, remove contaminated clothing and wash exposed skin with soap and water.
- B) MANAGEMENT OF SEVERE TOXICITY
  - 1) Orotracheal intubation for airway protection should be performed early if a patient exhibits respiratory distress. Prophylactic antibiotics and steroids are of no proven benefit in hydrocarbon pneumonitis. Animal studies suggest that artificial surfactant via or tracheal tube may be of benefit. Monitor and treat for dysrhythmias.

- C) DECONTAMINATION
  - 1) PREHOSPITAL: GI decontamination is not recommended because of the risk of aspiration. Remove contaminated clothing and wash exposed skin with soap and water.
  - 2) HOSPITAL: Studies fail to show if gastric emptying improves outcomes in patients with oral hydrocarbon ingestions. However, if a patient has ingested a large amount of a hydrocarbon that causes significant systemic toxicity shortly prior to presentation, it is reasonable to insert a small NG tube and aspirate gastric contents. Activated charcoal should NOT be used; it does not adsorb hydrocarbons well and increases the likelihood of vomiting and aspiration.
- D) AIRWAY MANAGEMENT
  - 1) Perform early in patients with severe intoxication (coma, dysrhythmias, respiratory distress).
- E) ANTIDOTE
  - 1) None.
- F) HYPERTHERMIA
  - 1) Consider antipyretics. Evaluate for secondary pneumonia and other infectious causes.
- G) COMA
  - 1) Treatment is symptomatic and supportive. Perform orotracheal intubation to protect airway. Assess oxygenation, evaluate for hypoglycemia, and consider naloxone if coingestants are possible.
- H) TACHYCARDIA
  - 1) Tachycardia may occur from a combination of agitation and catecholamine release. Treat with IV fluids and benzodiazepine sedation if agitation is prominent.
- I) DYSRHYTHMIAS
  - 1) Initiate ACLS protocols. Some solvents appear to sensitize the myocardium to catecholamines. Epinephrine and other sympathomimetics should be used with caution as ventricular dysrhythmias may be precipitated.
- J) RESPIRATORY DISTRESS
  - 1) Administer oxygen. Intubate early if patient has respiratory symptoms. Consider the use of a surfactant. Endotracheal instillation of 2 doses of 80 mL/m(
  - 2) calfactant (35 mg/mL of phospholipid suspension in saline) in infants, children, and adolescents with acute lung injury resulted in acute improvement in oxygenation and lower mortality in one study.
- K) RESPIRATORY FAILURE
  - 1) Partial liquid ventilation, high frequency jet ventilation, extracorporeal membrane oxygenation (ECMO) and high frequency chest wall oscillation have all been used with apparent success in cases of severe hydrocarbon pneumonitis.
- L) ENHANCED ELIMINATION
  - 1) Hemodialysis and hemoperfusion are not of value.
- M) PATIENT DISPOSITION
  - 1) HOME CRITERIA: Asymptomatic patients with inadvertent exposures may be monitored at home, with particular attention to the development of any respiratory symptoms. Patients who develop symptoms during home monitoring should be referred to a medical facility.
  - 2) OBSERVATION CRITERIA: Patients with deliberate ingestions and symptomatic patients should be sent to a health care facility for observation for 6 to 8 hours. Although patients can develop a delayed pneumonitis, they are unlikely to do so if they have been completely asymptomatic during that time period.
  - 3) ADMISSION CRITERIA: Patients with significant persistent central nervous system toxicity (somnolence, delirium), or respiratory symptoms of cough or tachypnea should be admitted. Patients with coma, dysrhythmias, or respiratory distress should be admitted to an intensive care setting.

- 4) CONSULT CRITERIA: Consult a poison center or medical toxicologist for assistance in managing patients with severe toxicity (dysrhythmias, coma or respiratory distress), or in whom the diagnosis is not clear.

- N) PITFALLS
  - 1) Failure to aggressively manage the airway can result in death. Patients with minimal respiratory symptoms may progress to severe toxicity over several hours. Patients with altered mentation should be ruled out for intracranial hemorrhage, infection, metabolic disturbance and other toxicologic causes.
- O) DIFFERENTIAL DIAGNOSIS
  - 1) Hypoglycemia, central nervous system infection, pulmonary infection, rheumatologic or endocrine etiology, other sedative poisoning (ethanol/benzodiazepine/barbiturate for example), mental illness.

0.1.3 INHALATION EXPOSURE

- A) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

0.1.4 EYE EXPOSURE

- A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.1.5 DERMAL EXPOSURE

- A) OVERVIEW
  - 1) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.
  - 2) Some chemicals can produce systemic poisoning by absorption through intact skin. Carefully observe patients with dermal exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

G. EMERGENCY ACTION GUIDELINES:

- **Fire Fighting Procedure:**
  - If material on fire or involved in fire: Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide.
- **Protective Equipment & Clothing:**
  - Wear appropriate chemical protective gloves, boots and goggles.
- **Disposal Method:**
  - SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.
- **ERPG GUIDE.:**

ERG2012
GUIDE 128
FLAMMABLE LIQUIDS (Non-Polar / Water-Immiscible)

POTENTIAL HAZARDS
FIRE OR EXPLOSION
· HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
· Vapors may form explosive mixtures with air.

· Vapors may travel to source of ignition and flash back.
· Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
· Vapor explosion hazard indoors, outdoors or in sewers.
· Those substances designated with a **(P)** may polymerize explosively when heated or involved in a fire.
· Runoff to sewer may create fire or explosion hazard.
· Containers may explode when heated.
· Many liquids are lighter than water.
· Substance may be transported hot.
· For UN3166, if Lithium ion batteries are involved, also consult GUIDE 147.
· If molten aluminum is involved, refer to GUIDE 169.

HEALTH
· Inhalation or contact with material may irritate or burn skin and eyes.
· Fire may produce irritating, corrosive and/or toxic gases.
· Vapors may cause dizziness or suffocation.
· Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

· CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
· As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
· Keep unauthorized personnel away.
· Stay upwind.
· Keep out of low areas.
· Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
· Wear positive pressure self-contained breathing apparatus (SCBA).
· Structural firefighters' protective clothing will only provide limited protection.

EVACUATION
Large Spill
· Consider initial downwind evacuation for at least 300 meters (1000 feet).
Fire
· If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

Fire
CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.
CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.
Small Fire
· Dry chemical, CO_2, water spray or regular foam.
Large Fire
· Water spray, fog or regular foam.
· Do not use straight streams.
· Move containers from fire area if you can do it without risk.
Fire involving Tanks or Car/Trailer Loads
· Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
· Cool containers with flooding quantities of water until well after fire is out.
· Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

· ALWAYS stay away from tanks engulfed in fire.
· For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

· ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
· All equipment used when handling the product must be grounded.
· Do not touch or walk through spilled material.
· Stop leak if you can do it without risk.
· Prevent entry into waterways, sewers, basements or confined areas.
· A vapor suppressing foam may be used to reduce vapors.
· Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
· Use clean non-sparking tools to collect absorbed material.

Large Spill

· Dike far ahead of liquid spill for later disposal.
· Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

· Move victim to fresh air.
· Call 911 or emergency medical service.
· Give artificial respiration if victim is not breathing.
· Administer oxygen if breathing is difficult.
· Remove and isolate contaminated clothing and shoes.
· In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
· Wash skin with soap and water.
· In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
· Keep victim warm and quiet.
· Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Annexure-II: MSDS OF HIGH SPEED DIESEL

Annexure-I: Safety Plans & Emergency Response Guideline (ERG)

1. Diesel (Fuel Oil)

A. General Details

- **Synonyms:** Diesel Fuel Oil
- **Density Specific Gravity:** 0.8654 @ 15 deg C/15 deg C
- **Flash Point:** 136 deg F (closed cup)
- **Autoignition Temperature:** 494 deg F
- **Viscosity:** 268 cSt @ 37.8 deg C.

B. NFPA Classification

Health: 1 (Slight)

Materials that, on exposure, would cause significant irritation, but only minor residual injury, including those requiring the use of an approved air-purifying respirator. These materials are only slightly hazardous to health and only breathing protection are needed.

Flammability: 2 (Moderate)

This degree includes materials that must be moderately heated before ignition will occur and includes Class II and IIIA combustible liquids and solids and semi-solids that readily give off ignitable vapors. Water spray may be used to extinguish fires in these materials because the materials can be cooled below their flash points.

Instability: 0 (Minimal)

This degree includes materials that are normally stable, even under fire exposure conditions, and that do not react with water. Normal fire fighting procedures may be used.

C. Hazardous Property

- FLAMMABLE LIQUIDS (Non-Polar/Water-Immiscible)
  - HIGHLY FLAMMABLE: Easily ignited by heat, sparks or flames
  - CAUTION: Very low flash point; use of water spray when fighting fire may be inefficient

D. Health Effects

0.1.1 SUMMARY OF EXPOSURE

- 0.1.1.1 ACUTE EXPOSURE
  - A) USES: Hydrocarbons are a diverse group of organic compounds that are made up of primarily carbon and hydrogen atoms. Hydrocarbons are derived from petroleum, coal tar and natural gas, as well as from plants and animals. They may be classified as aliphatic (including the paraffins, olefins, acyclic terpenes, and acetylenes) and cyclic (including the alicyclics, aromatics and cyclic terpenes). Examples range from gasoline to essential oils to solvents. They are used as fuels and solvents, and are found in many household and commercial products.
  - B) PHARMACOLOGY: Pharmacology of hydrocarbons varies according to the specific substance. Some have sites of action in the CNS, namely increasing neurotransmitter binding and potentiating nicotinic blockade by interacting with acetylcholine receptors. Others stimulate GABA A activity. Glutamate release may be stimulated or transmission inhibited, depending on the specific agent. Glycine receptor activity may be augmented with certain hydrocarbons, and hydrocarbons are used as general anesthetics. In addition, alpha-2 adrenergic receptor activation can occur.
  - C) TOXICOLOGY: Hydrocarbons are a large and diverse group of substances with toxicity varying according to specific substance and route of exposure. Pneumonitis after

aspiration is common and is the main route of injury from hydrocarbons. The exact mechanism of pulmonary toxicity is unclear but is likely due to direct toxicity to lung tissue as well as destruction of surfactant. Low viscosity, low surface tension and high volatility of a hydrocarbon (gasoline, for example, has all of these properties) increase the aspiration potential of that particular compound. Pulmonary toxicity can also occur after IV injection of hydrocarbons. Acute systemic toxicity is primarily due to CNS depression, reflecting the inhalational anesthetic effects of hydrocarbons. Inhalational abuse of hydrocarbons can cause simple asphyxiation. Chronic exposure in industrial settings or after long-term inhalational abuse can lead to chronic nervous system effects. Chlorinated hydrocarbons may cause cardiac sensitization to catecholamines, predisposing patients to cardiac dysrhythmias. Halogenated hydrocarbons may also cause hepatotoxicity, nephrotoxicity, and electrolyte disturbances. Hydrocarbons can destroy lipid bilayers and this can lead to "defatting" dermatitis following prolonged skin exposure. Capillary endothelium can be severely damaged in any organ system exposed to hydrocarbon. Hemolysis is rarely reported after hydrocarbon ingestion. Benzene is a bone marrow toxin.

- D) EPIDEMIOLOGY: Poisoning is relatively common as these products are widely available in homes and industrial settings. Populations at highest risk include children with unintentional exposure (often ingesting pleasant-smelling oils), workers with occupational exposures, and those who intentionally abuse solvents via inhalation (often referred to as "sniffing" or "huffing"). Toxicity is primarily due to aspiration, but may occur via oral, parenteral, dermal or inhalational routes depending on the substance and nature of exposure.
- E) WITH POISONING/EXPOSURE
  - 1) ACUTE EFFECTS OF INGESTION by SIMPLE PETROLEUM DISTILLATES: Low viscosity, highly volatile hydrocarbons (eg, kerosene, gasoline, liquid furniture polish) is chiefly aspiration hazards. Pulmonary damage, transient CNS depression or excitement, and secondary effects of hypoxia, infection, pneumatocele formation, and chronic lung dysfunction can occur. Cardiac complications are rare. These hydrocarbons are poorly absorbed from the gastrointestinal tract and do not cause appreciable systemic toxicity by this route unless aspiration has occurred.
  - 2) ACUTE EFFECTS OF INGESTION by CHLORINATED AND AROMATIC HYDROCARBONS: Many chlorinated, aromatic and other substituted hydrocarbons can produce systemic toxicity following ingestion. CNS, respiratory depression, dysrhythmias, gastrointestinal disturbances, and other effects may occur depending on the agent and amount ingested.
  - 3) ACUTE EFFECTS OF INHALATION: Cardiac dysrhythmias and CNS depression are major concerns of acute exposure. Straight chain hydrocarbons with few carbon atoms (eg, methane, ethane, propane gases) can cause asphyxiation if exposure occurs in poorly ventilated spaces.
    - a) INHALATIONAL ABUSE ("sniffing") of some hydrocarbons can result in sudden death, encephalopathy, residual neurological impairment, nephrotoxicity, hepatotoxicity, acid-base disturbances, and rhabdomyolysis.
  - 4) INJECTION of kerosene, naphtha, turpentine, gasoline, or hydrocarbon insecticides has resulted in febrile reactions, local tissue inflammation and systemic effects, including pulmonary edema, pneumonia, and mild CNS depression. Severe cases have resulted in multiorgan dysfunction syndrome. Injection of pressurized hydrocarbons has caused severe tissue damage.
  - 5) DERMAL/EYE: Mild to moderate eye irritation and reversible ocular injury may occur after contact with most hydrocarbons. Acute but prolonged exposure to some hydrocarbons can result in dermal burns and occasionally, systemic

effects. Frostbite can result from contact with some liquefied gases (eg, propane, methane, ethane).

- 6) TYPES OF HYDROCARBONS INCLUDE:
  - a) LOW VISCOSITY, UNSUBSTITUTED: Hydrocarbons with low viscosity (less than 100 S.U.S.), low surface tension, and high volatility are most likely to cause aspiration pneumonitis. Vapor inhalation can cause CNS depression or excitation and other effects. Examples: kerosene, mineral seal oil, gasoline, petroleum naphtha.
  - b) HIGH VISCOSITY, UNSUBSTITUTED ALIPHATIC: Hydrocarbons with high viscosity and low volatility are less likely to be aspirated after ingestion and are generally poorly absorbed from the gastrointestinal tract. Petroleum jelly may cause a mild laxative effect. Oil mist inhalation may cause lipoid pneumonia. Examples: motor oil, petroleum jelly.
  - c) TERPENES: In addition to aspiration, these tend to produce a mild CNS depression after ingestion. Examples: turpentine oil, pine oil. Pine oil cleaners may contain approximately 10% isopropyl alcohol and other additives which may contribute to the observed toxic effects.
  - d) AROMATICS: These have a high potential for CNS depression, a mild tendency to cause cardiac irritation, and little risk of aspiration. Adverse effects can result from vapor inhalation, ingestion, or skin exposure. Examples: benzene, xylene. Many polyaromatic hydrocarbons are potential carcinogens.
  - e) HALOGENATED-CHLORINATED: These can produce CNS effects, dysrhythmias, renal and hepatic effects. Aspiration is a small risk. Adverse effects can result from vapor inhalation, ingestion, or skin exposure. Examples: chloroform, carbon tetrachloride, trichloroethylene.
  - f) NOTE: Brominated hydrocarbons, fluorinated hydrocarbons, alcohols, esters, ethers, chlorinated hydrocarbon pesticides, and other hydrocarbons are covered in other managements.
- 7) MILD TO MODERATE POISONING: The primary effect seen in mild to moderate inhalational poisoning is euphoria and intoxication followed by CNS depression. This should resolve quickly with removal from the source of inhalational exposure. Patients with oral exposure usually have some gastrointestinal upset and then can develop systemic symptoms as the hydrocarbon is absorbed if a large quantity is ingested. Patients who have vomiting are at increased risk of aspiration. Aspiration may cause minimal respiratory symptoms (eg, an intermittent cough) initially but progress to severe respiratory injury. Ensure that medical staff uses personal protective equipment.
- 8) SEVERE POISONING: Severe effects may include coma and dysrhythmias. Severe pneumonitis from aspiration may require prolonged intubation. Patients that aspirate will often display a systemic inflammatory response including fever. Chlorinated hydrocarbons can cause ventricular dysrhythmias, and can cause hepatic necrosis that may progress to liver failure.
- 9) CHRONIC POISONING: Long-term or repeated exposure to certain aromatic and chlorinated hydrocarbons can result in hematologic (eg, benzene), hepatotoxic (eg, chlorinated hydrocarbons), renal (eg, chlorinated hydrocarbons), neuropsychiatric (eg, toluene), neurological (eg, n-hexane) and carcinogenic (eg, benzene, vinyl chloride) effects. Some effects have occurred primarily in chronic solvent abusers or glue sniffers (eg, neuropsychiatric, renal, and hepatic effects of toluene). Chronic or repeated exposure can result in skin irritation due to defatting of the skin. Greases, coal pitch, and cutting oils can

produce acne and folliculitis. Chlorinated aromatic hydrocarbon exposure can result in chloracne.

0.1.5 CARDIOVASCULAR

- 0.1.5.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Dysrhythmias may occur following inhalation.

0.1.6 RESPIRATORY

- 0.1.6.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Coughing, choking, tachypnea, dyspnea, cyanosis, rales, hemoptysis, pulmonary edema, pneumatoceles, lipoid pneumonia, or respiratory arrest may develop following ingestion and aspiration.
    - 2) Respiratory arrest can occur secondary to CNS depression following vapor inhalation. Intravenous injection of turpentine immediately resulted in pulmonary edema and hypoxia in 1 case.

0.1.7 NEUROLOGIC

- 0.1.7.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Mild central nervous system depression or excitation may occur after ingestion or vapor inhalation. CNS effects can occur secondary to hydrocarbon pneumonitis and hypoxia, or from additives and contaminants (aniline, heavy metals, camphor, or pesticides). Some hydrocarbons are simple asphyxiants (e.g., methane, ethane, propane gasses) which can produce CNS effects secondary to hypoxia.

0.1.8 GASTROINTESTINAL

- 0.1.8.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Nausea, vomiting, diarrhea, and abdominal pain may occur following ingestion.

0.1.9 HEPATIC

- 0.1.9.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Elevated transaminases may occasionally occur following ingestion or vapor inhalation of some hydrocarbons. Carbon tetrachloride is a potent hepatotoxin which can produce potentially fatal hepatorenal damage following ingestion, inhalation or dermal exposure.

0.1.10 GENITOURINARY

- 0.1.10.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Renal effects (acute renal tubular necrosis, proteinuria, or hematuria) occur infrequently following acute exposure to petroleum distillates and other unsubstituted hydrocarbons.
    - 2) Some studies have reported an increased risk of glomerulonephritis following long term inhalation and/or dermal exposure to various hydrocarbons. Acute renal failure and other renal effects have been reported in some chronic glue, solvent, or paint sniffers. Exposures in addition to hydrocarbons cannot be ruled out in many of these reports.
    - 3) Many halogenated hydrocarbons are nephrotoxic. Examples of potentially nephrotoxic halogenated hydrocarbons include chloroform, carbon tetrachloride, ethylene dichloride, tetrachloroethane, 1,1,1-trichloroethane, trichloroethylene (infrequently reported) and tetrachloroethylene (weakly nephrotoxic).

0.1.13 HEMATOLOGIC

- 0.1.13.1 ACUTE EXPOSURE

- A) WITH POISONING/EXPOSURE
  - 1) Disseminated intravascular coagulation, hemolytic anemia and pancytopenia have occasionally been reported following vapor inhalation, aspiration, or ingestion of hydrocarbons. Benzene is a bone marrow toxin. Chronic benzene exposure has been associated with acute leukemia.
  - 2) Contaminants or additives can cause hematologic abnormalities. Examples include aniline and nitrobenzene (methemoglobinemia).

0.1.15 MUSCULOSKELETAL

- 0.1.15.1 ACUTE EXPOSURE
  - A) WITH POISONING/EXPOSURE
    - 1) Subcutaneous injection of paint, lacquer or other material via high pressure spray guns is a surgical emergency. High-pressure injection injuries can result in necrosis and thrombosis with amputation required in 60% to 80% of cases.
    - 2) High pressure injection of paints and solvents can cause significant tissue injury despite a relatively benign initial presentation.
    - 3) Rhabdomyolysis has occasionally been reported in chronic glue or paint sniffers and in a case of prolonged inhalational exposure to mineral spirits. Muscle necrosis, compartment syndrome and/or sterile abscess have been reported following hydrocarbon injection.

0.1.20 REPRODUCTIVE HAZARDS

- A) In a prospective study in Toronto, major congenital malformations were noted in 13 of 125 feuses of mothers exposed to organic solvents during pregnancy.

E. Laboratory Test

- Monitor vital signs and mental status.
- Blood concentrations are not readily available or useful to guide management.
- Obtain an ECG and institute continuous cardiac monitoring in patients with moderate to severe toxicity or chlorinated hydrocarbon exposure.
- Obtain CBC, basic chemistry panel, serum creatinine and liver enzymes in severe overdoses or in patients with chronic exposures.
- Monitor arterial blood gases, pulse oximetry, and pulmonary function tests and obtain chest radiograph in patients with any respiratory symptoms. NOTE: The chest radiograph may be normal early in the clinical course.
- Standard urine toxicology screen does not detect hydrocarbons.
- Monitor fluid and electrolyte status in patients with significant diarrhea and vomiting.
- Head CT should be obtained in patients with altered mental status.
- Monitor for methemoglobinemia in cyanotic patients who do not respond to supplemental oxygen, and who may have been exposed to hydrocarbons which contain nitrobenzene or aniline.

F. Treatment Overview

0.1.2 ORAL EXPOSURE

- A) MANAGEMENT OF MILD TO MODERATE TOXICITY
  - 1) Remove the patient from the source of exposure. When a patient is removed from an inhalational exposure, the symptoms should quickly resolve. Adolescents may present without symptoms after responsible adults find them abusing hydrocarbons via inhalation. Provide oxygen and symptomatic and supportive care. After assuring that the patient is medically stable, remove contaminated clothing and wash exposed skin with soap and water.
- B) MANAGEMENT OF SEVERE TOXICITY
  - 1) Orotracheal intubation for airway protection should be performed early if a patient exhibits respiratory distress. Prophylactic antibiotics and steroids are of no proven benefit in hydrocarbon pneumonitis. Animal studies suggest that artificial surfactant via or tracheal tube may be of benefit. Monitor and treat for dysrhythmias.

- C) DECONTAMINATION
  - 1) PREHOSPITAL: GI decontamination is not recommended because of the risk of aspiration. Remove contaminated clothing and wash exposed skin with soap and water.
  - 2) HOSPITAL: Studies fail to show if gastric emptying improves outcomes in patients with oral hydrocarbon ingestions. However, if a patient has ingested a large amount of a hydrocarbon that causes significant systemic toxicity shortly prior to presentation, it is reasonable to insert a small NG tube and aspirate gastric contents. Activated charcoal should NOT be used; it does not adsorb hydrocarbons well and increases the likelihood of vomiting and aspiration.
- D) AIRWAY MANAGEMENT
  - 1) Perform early in patients with severe intoxication (coma, dysrhythmias, respiratory distress).
- E) ANTIDOTE
  - 1) None.
- F) HYPERTHERMIA
  - 1) Consider antipyretics. Evaluate for secondary pneumonia and other infectious causes.
- G) COMA
  - 1) Treatment is symptomatic and supportive. Perform orotracheal intubation to protect airway. Assess oxygenation, evaluate for hypoglycemia, and consider naloxone if coingestants are possible.
- H) TACHYCARDIA
  - 1) Tachycardia may occur from a combination of agitation and catecholamine release. Treat with IV fluids and benzodiazepine sedation if agitation is prominent.
- I) DYSRHYTHMIAS
  - 1) Initiate ACLS protocols. Some solvents appear to sensitize the myocardium to catecholamines. Epinephrine and other sympathomimetics should be used with caution as ventricular dysrhythmias may be precipitated.
- J) RESPIRATORY DISTRESS
  - 1) Administer oxygen. Intubate early if patient has respiratory symptoms. Consider the use of a surfactant. Endotracheal instillation of 2 doses of 80 mL/m(
  - 2) calfactant (35 mg/mL of phospholipid suspension in saline) in infants, children, and adolescents with acute lung injury resulted in acute improvement in oxygenation and lower mortality in one study.
- K) RESPIRATORY FAILURE
  - 1) Partial liquid ventilation, high frequency jet ventilation, extracorporeal membrane oxygenation (ECMO) and high frequency chest wall oscillation have all been used with apparent success in cases of severe hydrocarbon pneumonitis.
- L) ENHANCED ELIMINATION
  - 1) Hemodialysis and hemoperfusion are not of value.
- M) PATIENT DISPOSITION
  - 1) HOME CRITERIA: Asymptomatic patients with inadvertent exposures may be monitored at home, with particular attention to the development of any respiratory symptoms. Patients who develop symptoms during home monitoring should be referred to a medical facility.
  - 2) OBSERVATION CRITERIA: Patients with deliberate ingestions and symptomatic patients should be sent to a health care facility for observation for 6 to 8 hours. Although patients can develop a delayed pneumonitis, they are unlikely to do so if they have been completely asymptomatic during that time period.
  - 3) ADMISSION CRITERIA: Patients with significant persistent central nervous system toxicity (somnolence, delirium), or respiratory symptoms of cough or tachypnea should be admitted. Patients with coma, dysrhythmias, or respiratory distress should be admitted to an intensive care setting.

- 4) CONSULT CRITERIA: Consult a poison center or medical toxicologist for assistance in managing patients with severe toxicity (dysrhythmias, coma or respiratory distress), or in whom the diagnosis is not clear.

- N) PITFALLS
  - 1) Failure to aggressively manage the airway can result in death. Patients with minimal respiratory symptoms may progress to severe toxicity over several hours. Patients with altered mentation should be ruled out for intracranial hemorrhage, infection, metabolic disturbance and other toxicologic causes.
- O) DIFFERENTIAL DIAGNOSIS
  - 1) Hypoglycemia, central nervous system infection, pulmonary infection, rheumatologic or endocrine etiology, other sedative poisoning (ethanol/benzodiazepine/barbiturate for example), mental illness.

0.1.3 INHALATION EXPOSURE

- A) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

0.1.4 EYE EXPOSURE

- A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.1.5 DERMAL EXPOSURE

- A) OVERVIEW
  - 1) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.
  - 2) Some chemicals can produce systemic poisoning by absorption through intact skin. Carefully observe patients with dermal exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

G. EMERGENCY ACTION GUIDELINES:

- **Fire Fighting Procedure:**
  - If material on fire or involved in fire: Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide.
- **Protective Equipment & Clothing:**
  - Wear appropriate chemical protective gloves, boots and goggles.
- **Disposal Method:**
  - SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.
- **ERPG GUIDE.:**

ERG2012
GUIDE 128
FLAMMABLE LIQUIDS (Non-Polar / Water-Immiscible)

POTENTIAL HAZARDS
FIRE OR EXPLOSION
· HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
· Vapors may form explosive mixtures with air.

· Vapors may travel to source of ignition and flash back.
· Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
· Vapor explosion hazard indoors, outdoors or in sewers.
· Those substances designated with a **(P)** may polymerize explosively when heated or involved in a fire.
· Runoff to sewer may create fire or explosion hazard.
· Containers may explode when heated.
· Many liquids are lighter than water.
· Substance may be transported hot.
· For UN3166, if Lithium ion batteries are involved, also consult GUIDE 147.
· If molten aluminum is involved, refer to GUIDE 169.

HEALTH
· Inhalation or contact with material may irritate or burn skin and eyes.
· Fire may produce irritating, corrosive and/or toxic gases.
· Vapors may cause dizziness or suffocation.
· Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

· CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
· As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
· Keep unauthorized personnel away.
· Stay upwind.
· Keep out of low areas.
· Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
· Wear positive pressure self-contained breathing apparatus (SCBA).
· Structural firefighters' protective clothing will only provide limited protection.

EVACUATION
Large Spill
· Consider initial downwind evacuation for at least 300 meters (1000 feet).
Fire
· If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

Fire
CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.
CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.
Small Fire
· Dry chemical, CO_2, water spray or regular foam.
Large Fire
· Water spray, fog or regular foam.
· Do not use straight streams.
· Move containers from fire area if you can do it without risk.
Fire involving Tanks or Car/Trailer Loads
· Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
· Cool containers with flooding quantities of water until well after fire is out.
· Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

· ALWAYS stay away from tanks engulfed in fire.
· For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

· ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
· All equipment used when handling the product must be grounded.
· Do not touch or walk through spilled material.
· Stop leak if you can do it without risk.
· Prevent entry into waterways, sewers, basements or confined areas.
· A vapor suppressing foam may be used to reduce vapors.
· Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
· Use clean non-sparking tools to collect absorbed material.

Large Spill

· Dike far ahead of liquid spill for later disposal.
· Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

· Move victim to fresh air.
· Call 911 or emergency medical service.
· Give artificial respiration if victim is not breathing.
· Administer oxygen if breathing is difficult.
· Remove and isolate contaminated clothing and shoes.
· In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
· Wash skin with soap and water.
· In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
· Keep victim warm and quiet.
· Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

2. Monoethylene glycol:

A. General Details

- **Synonyms:** 1,2-Dihydroxyethane ,1,2-Ethandiol, 2-Hydroxyethanol , Ethane-1,2-diol ,Ethylene Alcohol ,Ethylene Dihydrate ,Fridex ,Glycol, Monoethylene Glycol.
- **Molecular Formula:** C2-H6-O2
- **Molecular Weight:** 62.07

B. NFPA Classification

Health: 2 (Moderate)

Materials that, on intense or continued (but not chronic) exposure, could cause temporary incapacitation or possible residual injury, including those requiring the use of respiratory protective equipment that has an independent air supply. These materials are hazardous to health, but areas may be entered freely if personnel are provided with full-face mask self-contained breathing apparatus that provides complete eye protection.

Flammability: 1 (Slight)

This degree includes materials that must be preheated before ignition will occur, such as Class IIIB combustible liquids and solids and semi-solids whose flash point exceeds 200 deg F (93.4 deg C), as well as most ordinary combustible materials. Water may cause frothing if it sinks below the surface of the burning liquid and turns to steam. However, a water fog that is gently applied to the surface of the liquid will cause frothing that will extinguish the fire.

Instability: 0 (Minimal)

This degree includes materials that are normally stable, even under fire exposure conditions, and that do not react with water. Normal fire fighting procedures may be used.

C. Hazardous Property

- SUBSTANCES - TOXIC (Non-combustible)
  - Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin

D. Storage Condition

- Temperature: Ambient

E. Exposure Limits

- **IDLH:**
- **TLV:** Ceiling Limit: 100 mg/cu m (Aerosol only).
- **OSHA Standard:** Vacated 1989 OSHA PEL Ceiling value 50 ppm (125 mg/cu m) is still enforced in some states.

F. Health Effects

0.1.1 SUMMARY OF EXPOSURE

- A) USES: Primarily used as an engine coolant (eg, antifreeze used in car radiators).
- B) PHARMACOLOGY: No medical use.

- C) TOXICOLOGY: Primary concern is the severe metabolic acidosis and nephrotoxicity from metabolites. Metabolized by alcohol dehydrogenase (ADH) to glycoaldehyde and then by aldehyde dehydrogenase to glycolic acid. Glycolic acid is metabolized by lactate dehydrogenase or glycolic acid oxidase to glyoxylic acid which can be metabolized to oxalic acid. Specifically, oxalic acid metabolite complexes with calcium to form calcium oxalate crystals in the renal tubules that can lead to acute renal failure. Other intermediate metabolites are believed to be nephrotoxic as well. May have CNS effects believed mediated through GABA receptors.
- D) EPIDEMIOLOGY: There are thousands of exposures and several deaths every year reported to poison centers. Inadvertent pediatric ingestions rarely develop severe toxicity.
- E) WITH POISONING/EXPOSURE
    - 1) MILD TO MODERATE TOXICITY: Initially, ethylene glycol ingestion may cause intoxication similar to ethanol with CNS depression, nystagmus, ataxia, and somnolence. Nausea and vomiting are also fairly common. If ethylene glycol metabolism is blocked early, there may be no other clinical manifestations.
    - 2) SEVERE TOXICITY: If ethylene glycol metabolism is not blocked early after a significant ingestion, patients develop increasing CNS depression (coma, hypotonia, hyporeflexia, eventually cerebral edema), anion gap metabolic acidosis (often severe, arterial pH < 7.0 is common with severe ingestion), and renal failure. Seizures are common with severe toxicity, but usually not prolonged. Mild to moderate tachycardia is common, Kussmaul respirations develop with increasing acidosis, hypotension is rare. Hypocalcemia may result from precipitation of calcium oxalate crystals, which can (rarely) lead to cardiac dysrhythmias. In addition, there are reports of cranial nerve abnormalities developing 1 to 2 weeks post exposure in patients with severe intoxication, which may be secondary to calcium oxalate crystal formation in the brain.

0.1.3 VITAL SIGNS

- A) WITH POISONING/EXPOSURE
    - 1) Hypothermia has been reported.

0.1.4 HEENT

- A) WITH POISONING/EXPOSURE
    - 1) Facial paralysis, nystagmus, strabismus, ophthalmoplegias, papilledema, mydriasis, retinal injury, and eye and throat irritation may occur.

0.1.5 CARDIOVASCULAR

- A) WITH POISONING/EXPOSURE
    - 1) Cardiogenic pulmonary edema, cyanosis, cardiomegaly, myocarditis, and death may occur.

0.1.6 RESPIRATORY

- A) WITH POISONING/EXPOSURE
    - 1) Tachypnea, respiratory irritation, and adult respiratory distress syndrome have been reported following exposure to ethylene glycol.

0.1.7 NEUROLOGIC

- A) WITH POISONING/EXPOSURE
    - 1) CNS depression, seizures, coma, cerebral edema, cranial nerve deficits, and delayed neurologic sequelae may be seen following ethylene glycol exposures.

0.1.8 GASTROINTESTINAL

- A) WITH POISONING/EXPOSURE
    - 1) Nausea and vomiting are frequent early findings.

0.1.10 GENITOURINARY

- A) WITH POISONING/EXPOSURE
  - 1) Classic pathologic findings include acute tubular necrosis and presence of calcium oxalate crystals in the kidneys.
  - 2) The most uniform serious manifestation of poisoning is renal failure, with hematuria and proteinuria commonly seen.

0.1.11 ACID-BASE

- A) WITH POISONING/EXPOSURE
  - 1) Metabolic acidosis with an elevated anion gap is characteristic. However, a normal anion gap does not preclude a diagnosis of ethylene glycol toxicity.

0.1.12 FLUID-ELECTROLYTE

- A) WITH POISONING/EXPOSURE
  - 1) Hypocalcemia may occur.

0.1.13 HEMATOLOGIC

- A) WITH POISONING/EXPOSURE
  - 1) Pancytopenia, lymphocytosis, disseminated intravascular coagulation, and leukocytosis have been reported.

0.1.14 DERMATOLOGIC

- A) WITH POISONING/EXPOSURE
  - 1) Ethylene glycol does not significantly irritate the skin. Slight maceration of the skin may result from very severe, prolonged exposures. Cyanosis may occur 12 hours or longer post-ingestion.

0.1.15 MUSCULOSKELETAL

- A) WITH POISONING/EXPOSURE
  - 1) Myalgia and elevated CPK levels have been reported.

0.1.20 REPRODUCTIVE

- A) Exposures to glycols have resulted in teratogenicity, specifically craniofacial and neural tube closure defects and skeletal dysplasia in animal studies.

0.1.21 CARCINOGENICITY

- A) No data regarding carcinogenic effects in humans was found at the time of this review.

G. Laboratory Test

- Obtain metabolic panel (serum electrolytes, including calcium), BUN and creatinine on all patients with a history of ingestion.
- Obtain blood ethanol and ethylene glycol concentration, if available. Can consider a measured serum osmolality level if ethylene glycol concentration is not available.
- Patients with significant toxicity should have arterial blood gas.
- Obtain urinalysis with microscopy for calcium oxalate crystals. Hematuria and proteinuria are also common. Monitor urine output.

H. Treatment Overview

0.1.2 ORAL/PARENTERAL EXPOSURE

- A) MANAGEMENT OF MILD TO MODERATE TOXICITY
  - 1) Monitor serum electrolytes, renal function and ethylene glycol concentration. A peak ethylene glycol concentration < 20 mg/dL is commonly considered nontoxic. If the serum ethylene glycol concentration is >20 mg/dL, or there is a metabolic acidosis, or a history of a potentially toxic ingestion and ethylene glycol

concentration is not rapidly available, administer an alcohol dehydrogenase inhibitor (either ethanol or fomepizole). In patients who present early after ingestion (before the development of metabolic acidosis), no further treatment may be required.

- B) MANAGEMENT OF SEVERE TOXICITY
  - 1) CNS depression may require intubation; adequate minute ventilation must be insured to prevent abrupt worsening of acidemia. Alcohol-induced vasodilation and vomiting may lead to hypotension requiring fluid resuscitation. Alcohol dehydrogenase (ADH) inhibition is the most specific treatment for patients with severe ethylene glycol toxicity. Blockade (using ethanol or fomepizole) allows for excretion of ethylene glycol without formation of toxic metabolites (ADH has a much higher affinity for ethanol or fomepizole than for ethylene glycol). In patients who present late with metabolic acidosis and for most patients with very high ethylene glycol concentrations, hemodialysis will be necessary after ADH inhibition. Hemodialysis is the most definitive therapy for ethylene glycol poisoning as it clears both ethylene glycol and its toxic metabolites from the blood and corrects any resulting metabolic acidosis. Indications for hemodialysis include metabolic acidosis (serum pH < 7.2), signs of end-organ toxicity (eg, seizures and coma), and renal failure. Thiamine and pyridoxine are also administered to encourage metabolism of ethylene glycol to less toxic metabolites.
- C) DECONTAMINATION
  - 1) PREHOSPITAL: No ipecac or prehospital activated charcoal; no utility for therapy. If there is a dermal or eye exposure, it would be reasonable for simple decontamination with water at home.
  - 2) HOSPITAL: Activated charcoal has no utility for ethylene glycol poisonings. Since ethylene glycol is a liquid, gastric lavage and whole bowel irrigation have no place in management. One could consider simple nasogastric tube aspiration for recent large ingestions, if the airway is protected.
- D) AIRWAY MANAGEMENT
  - 1) Intubation may be indicated if the patient's mental status is so depressed they cannot protect their airway. The ventilator should be adjusted to assure that the patient is able to maintain any respiratory compensation for the metabolic acidosis. Failure to maintain ventilation can result in a dramatic fall in pH and cardiovascular collapse.
- E) ANTIDOTE
  - 1) Treat patients with either ethanol or fomepizole to block production of the toxic metabolites of ethylene glycol. Indications include: a serum ethylene glycol concentration greater than 20 mg/dL; history of ethylene glycol ingestion with an osmolar gap greater than 10 mOsm/L (not accounted by ethanol or other alcohols); or a history or strong clinical suspicion of ethylene glycol ingestion and 2 of the following: serum bicarbonate less than 20 mEq/L, an arterial pH less than 7.3, or presence of oxalate crystals in the urine.
    - a) ETHANOL vs FOMEPIZOLE: Fomepizole is easier to use clinically, requires less monitoring, does not cause CNS depression or hypoglycemia, and may obviate the need for dialysis in some patients. Ethanol requires continuous administration and frequent monitoring of serum ethanol and glucose levels, and may cause CNS depression and hypoglycemia (especially in children). The drug cost associated with ethanol use is generally much

lower than with fomepizole; however, other costs associated with ethanol use (continuous intravenous infusion, hourly blood draws and ethanol levels, possibly greater use of hemodialysis) may make the costs more comparable.

- b) ETHANOL: Ethanol is given to maintain a serum ethanol concentration of 100 to 150 mg/dL. This can be accomplished by using a 5% to 10% ethanol solution administered intravenously through a central line. Intravenous therapy dosing, which is preferred, is 0.8 g/kg as a loading dose (8 mL/kg of 10% ethanol) administered over 20 to 60 minutes as tolerated, followed by an infusion rate of 80 to 150 mg/kg/hr (for 10% ethanol, 0.8 to 1.3 mL/kg/hr for a non-drinker; 1.5 mL/kg/hr for a chronic alcoholic). During hemodialysis, either add ethanol to the dialysate to achieve 100 mg/dL concentration or increase the rate of infusion during dialysis (for 10% ethanol, 2.5 to 3.5 mL/kg/hr). Oral ethanol may be used as a temporizing measure until intravenous ethanol or fomepizole can be obtained, but it is more difficult to achieve the desired stable ethanol concentration. The loading dose is 0.8 grams/kg (4 mL/kg of 20% {40 proof}) ethanol diluted in juice administered orally or via a nasogastric tube. Maintenance dose is 80 to 150 mg/kg/hour (of 20% {40 proof}) ethanol; 0.4 to 0.7 mL/kg/hour for a non-drinker; 0.8 mL/kg/hour for a chronic alcoholic). Concentrations greater than 30% (60 proof) ethanol should be diluted. For both modalities, blood ethanol levels must be monitored hourly and adjusted accordingly, and both require patient monitoring in an ICU setting.
- c) FOMEPIZOLE: Fomepizole is administered as a 15 mg/kg loading dose, followed by four bolus doses of 10 mg/kg every 12 hours. If therapy is needed beyond this 48 hour period, the dose is then increased to 15 mg/kg every 12 hours for as long as necessary. Fomepizole is also effectively removed by hemodialysis; therefore, doses should be repeated following each round of hemodialysis. In selected patients (those who present early, without metabolic acidosis or renal failure) hemodialysis may be avoided by use of intravenous fomepizole. In patients with high ethylene glycol concentrations, who are treated with fomepizole alone, several days may be required before ethylene glycol is eliminated by the kidneys; hemodialysis may be indicated.
- d) THIAMINE: Administer 100 mg intravenously daily to stimulate the conversion of glyoxylate to alpha-hydroxy-beta-ketoadipate, a nontoxic metabolite.
- e) PYRIDOXINE: Administer 100 mg intravenously daily, to allow adequate stores of cofactor necessary for the conversion of glyoxylate to nontoxic glycine.

- F) SEIZURES
  - 1) Administer intravenous benzodiazepines, barbiturates.
- G) ENHANCED ELIMINATION
  - 1) Hemodialysis is the definitive therapy for patients poisoned by toxic alcohols as it clears both the parent alcohol and the toxic metabolites from the blood. In addition, it corrects metabolic acidosis, electrolyte abnormalities, and maintains fluid balance. Indications for hemodialysis include: metabolic acidosis (pH <7.

    - 2) unresponsive to therapy; renal failure; ethylene glycol concentration of 50 mg/dL or more (unless patient is receiving fomepizole and is asymptomatic with normal arterial pH); deteriorating vital signs despite supportive care; electrolyte abnormalities not responding to conventional therapy. Many patients will require multiple courses of hemodialysis to clear ethylene glycol, and dosing of ethanol and fomepizole must be increased during hemodialysis.
- H) PATIENT DISPOSITION
    - 1) HOME CRITERIA: A recent consensus guideline recommends that children with an observed lick, sip or taste ingestion or a known accidental ingestion of less than 10 mL in an adult can be monitored at home. All other exposures, including unwitnessed exposures, should be referred to a health care facility.
    - 2) OBSERVATION CRITERIA: Patient exposures that do not meet criteria for home management or any patient with symptoms should be sent to a health care facility. Patients who have no acidosis, normal renal function and a nontoxic ethylene glycol concentration may be discharged. If it is not possible to measure ethylene glycol concentrations, it is reasonable to observe patients who have undetectable serum ethanol concentrations for a minimum of 8 hours. During this period, the serum pH, bicarbonate and creatinine should be monitored every 2 hours. If the patient has no symptoms, no metabolic acidosis and normal renal function after 8 to 12 hours of observation, the risk of significant ethylene glycol toxicity is very low.
    - 3) ADMIT CRITERIA: Any patient showing definitive signs of ethylene glycol poisoning (worsening renal function, metabolic acidosis, etc.) should be admitted to the hospital. Patients who have co-ingested ethanol will likely require admission if serum ethylene glycol concentrations cannot be measured, as these patients may not develop toxicity for more than 12 hours after presentation. Any patient receiving ethanol therapy requires an ICU admission. Any patient that is otherwise well and receiving fomepizole therapy should be safe in a less monitored setting (may require monitoring for suicide risk).
    - 4) CONSULT CRITERIA: Consult your local poison center for any ethylene glycol exposure, especially those requiring antidote treatment, hemodialysis, or if the history is unclear.
- I) PITFALLS
    - 1) A normal osmolar gap does NOT rule out a significant ethylene glycol exposure. The Wood's lamp testing of urine for fluorescence to confirm or eliminate ethylene glycol exposure is NOT reliable. Laboratory and clinical findings change during the course of toxicity. Early in the course of severe poisonings, ethylene glycol concentration (and usually osmolar gap) are high, anion gap is low, and signs and symptoms are limited to inebriation and GI irritation. Late in the course of severe intoxication, severe anion gap acidosis is present along with severe CNS depression, renal insufficiency and calcium oxalate crystalluria, but ethylene glycol concentration and osmolar gap may be low.
- J) TOXICOKINETICS
    - 1) Ethylene glycol has a half-life of 3 to 5 hours via metabolism by ADH (zero-order kinetics). In the setting of ADH blockade, elimination is entirely renal with a half-life of approximately 17 hours. Ethylene is well absorbed orally and is not protein bound, with a volume of distribution of about 0.8 L/kg.
- K) DIFFERENTIAL DIAGNOSIS

- 1) CNS depression: Other toxic alcohols, benzodiazepines, opiates/opioids, antipsychotic medications, etc.
- 2) Elevated anion gap metabolic acidosis: Ketones, uremia, lactic acidosis, other toxins (iron, methanol, etc.), or alcoholic ketoacidosis.
- 3) Renal injury: Other nephrotoxic drugs (eg, NSAIDs, aminoglycoside antibiotics), dehydration, etc.

0.1.3 INHALATION EXPOSURE

- A) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

0.1.4 EYE EXPOSURE

- A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.1.5 DERMAL EXPOSURE

- A) OVERVIEW
  - 1) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.

I. EMERGENCY ACTION GUIDELINES:

- **Fire Fighting Procedure:**
  - If material on fire or involved in fire: Extinguish fire using agent suitable for type of surrounding fire. (Material itself does not burn or burns with difficulty.) Use "alcohol" foam, dry chemical or carbon dioxide. Keep run-off water out of sewers and water sources.
- **Protective Equipment & Clothing:**
  - Breakthrough times greater than one hour reported by (normally) two or more testers for natural rubber (nat Rub), neoprene (neop), nitrile rubber (nitrile), polyethlene (PE), and polyvinyl chloride (PVC). Some data suggesting breakthrough times of approximately an hour or more for neoprene/natural rubber (Neop/Nat Rub) and polyvinyl alcohol (PVA). No data for butyl rubber (Butyl) Neoprene/styrene-butadiene (Neop/SBR), nitrile rubber/polyvinyl chloride (Nitrile/PVC), chlorinated polyethylene (CPE), polyurethane (PU), styrene-butadiene rubber (SBR), and viton.
  - Wear appropriate personal protective clothing to prevent skin contact.
  - Wear appropriate eye protection to prevent eye contact.

- **Cleanup Method:**
  - Environmental considerations: Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. /SRP: If time permits, pits, ponds, lagoons, soak holes, or holding areas should be sealed with an impermeable flexible membrane liner./ Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Absorb bulk liquid with fly ash, cement powder, or commercial sorbents.
  - Environmental considerations: Air spill: Apply water spray or mist to knock down vapors.

- Environmental considerations: Water spill: Use natural barriers or oil spill control booms to limit spill travel. Remove trapped material with suction hoses.

- **Disposal Method:**
  - The most favorable course of action is to use an alternative chemical product with less inherent propensity for occupational exposure or environmental contamination. Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's impact on air quality; potential migration in soil or water; effects on animal, aquatic, and plant life; and conformance with environmental and public health regulations.

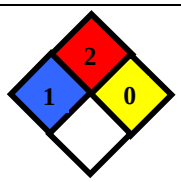
Annexure-II: MSDS OF HIGH SPEED DIESEL

MATERIAL SAFETY DATA SHEET

HIGH SPEED DIESEL

Section 1 – Chemical Product and Company Identification

Chemical Name :	High Speed Diesel
Chemical Formula :	Complex mixture of hydrocarbons
CAS Number :	
Synonyms :	Diesel, Gas oil, High Flash HSD (HF HSD)
General Use :	Motor Fuel and in Defence aircrafts
Manufacture's Name :	Bharat Petroleum Corporation Limited
Address :	Refinery, Mahul, Chembur, Mumbai 400074
Telephone Number for Info :	25533888 /25533999 / 25524888 / 25524999
MSDS No. :	
Date Prepared :	June 2011
Revision # :	2



NFPA 704 (Sec 16)

Section 2 – Composition / Information on Ingredients

Composition :	Complex mixture of hydrocarbons
Hazardous Components :	
ACIGH TLV TWA :	Not listed

There are two basic types of HSD depending on the flash points - the Normal HSD and the High Flash HSD

Section 3 – Hazards Identification

Primary Entry Routes :	Ingestion, inhalation, skin and eyes
Acute Effects :	Inhalation can cause dizziness, headache and nausea, depresses central nervous system and has an anesthetic effect. Breathing of liquid droplets may lead to chemical pneumonia. Ingestion can lead to nausea, diarrhea and affect central nervous system. Skin irritant. Prolonged contact can result in skin drying and dermatitis. Eye irritant.
Carcinogenicity :	Not listed as carcinogenic
Chronic Effects :	No data available

Section 4 – First Aid Measures

Eyes :	Flush with water for 15 min. Get medical attention.
Skin :	Wash with warm water & soap.
Inhalation :	Remove to fresh air. Consult a physician if irritation persists.
Ingestion :	Do not induce vomiting. Do not give liquids. Get medical help at once.

Section 5 – Fire Fighting Measures

Flash Point :	>35 ^{o}C and > 66 ^{o}C for HF HSD
Flash Point Method :	Abel / Pensky Marten
Auto ignition Temperature :	230 ^{o}C to 250 ^{o}C (highly variable)
LEL :	0.5%
UEL :	5.0%
Flammability Classification:	Flammable
Extinguishing Media :	Foam, Dry Chemical Powder, CO2
Unusual Fire or Explosion Hazards :	Heat produces vapours and can cause violent rupture of containers.
Hazardous Combustion Products :	Carbon di oxide, carbon mono oxide, benzene
Fire-Fighting Instructions :	Small fires can be extinguished by hand held extinguishers. Major fires may require withdrawal and allowing the tank to burn. Fire fighters should wear self breathing apparatus while fighting fire.

Section 6 – Accidental Release Measures

Small Spills :	Shut off leaks without risk. Absorb on sand or earth.
Containment :	Prevent spillage from entering drains or water sources
Cleanup :	After spills wash area with soap and water preventing runoff from entering drains.

Section 7 – Handling and Storage

Handling Precautions :	Do not use/store near heat/open flame. Use gumboots, gloves while handling the product. Do not inhale. Stay upwind while handling the product. Product should never be used to remove oil or grease from skin. It should not be siphoned by mouth. It should be stored in closed containers away from heat & source of ignition. Avoid contact with skin and eyes. Wash thoroughly after handling
Storage Requirements :	Do not use/store near heat/open flame/water/acids

Section 8 – Exposure Controls / Personal Protection

Engineering Controls :	Provide proper ventilation for environment to be below TWA
Respiratory Protection :	Use respiratory protection if ventilation is improper
Protective Clothing / Equipment :	Use face shield, PVC gloves, safety boots while handling. Contaminated clothing to be immediately removed

Section 9 – Protection Physical and Chemical Properties

Physical State :	Liquid
Appearance and Odour :	Straw yellow or dark yellow liquid. Characteristic hydrocarbon like odour
Vapor Pressure :	0.5 mm of HG AT 38 ^{O}C (RVP)
Specific Gravity :	0.82 to 0.86 gm/ cc
Water Solubility :	Insoluble
Boiling Point :	110 ^{o}C to 375 ^{o}C

Freezing Point :	< 15 ^{o}C
Vapour Density :	3 to 5 (Air = 1)
Sulphur Content :	50 ppm(BS-IV) to 350(BS-III) ppm and < 0.2% for HF HSD

Section 10 – Stability and Reactivity

Stability :	Chemically stable.
Chemical Incompatibilities :	Incompatible with oxidizing agents & chlorine. Reacts vigorously with oxidising materials.
Conditions to Avoid :	
Hazardous Decomposition Products :	Carbon di oxide, carbon mono oxide

Section 11 – Toxicological Information

ACIGH TLV TWA :	Data not available
Toxicity Data :	Data not available
Acute Inhalation Effects :	

Section 12 – Ecological Information

Prevent spillage from entering drains or water sources. After spills wash area with soap and water preventing runoff from entering drains. Can burn with lot of heat producing CO2 and CO.

Section 13 – Disposal Considerations

Disposal :	Seal all the waste in vapour tight plastic bags for eventual disposal or incineration.

Section 14 – Transport Information

Shipping Name :	High Speed Diesel, High Flash Diesel

Section 15 – Regulatory Information

Non - Toxic/Flammable Substance

Section 16 – Other Information

Technology, Process Safety Section

Disclaimer: This M.S.D.S and the information it contains is offered to you in good faith as accurate. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents.

OILS, FUEL: 4

OFR

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
No. 4 Residual fuel oil	Oily liquid Floats on water.	Dark	Lube or fuel oil odor

Keep people away. Avoid contact with liquid.
Shut off ignition sources and call fire department.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	Combustible. Extinguish with dry chemical, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Effect of low concentrations on aquatic life is unknown. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Skim
Chemical and Physical Treatment: Burn; Absorb
Clean shore line
Salvage waterfowl

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: 33; Miscellaneous Hydrocarbon Mixtures
2.2 Formula: Not applicable
2.3 IMO/UN Designation: 3.3/1223
2.4 DOT ID No.: 1993
2.5 CAS Registry No.: Currently not available
2.6 NAERG Guide No.: 128
2.7 Standard Industrial Trade Classification: 33440

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
3.2 Symptoms Following Exposure: INGESTION: gastrointestinal irritation. ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure.
3.3 Treatment of Exposure: INGESTION: do NOT lavage or induce vomiting. ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays; consider prophylactic antibioticregime if condition warrants. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
3.4 TLV-TWA: Notice of intended change: Not listed.
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Currently not available
3.10 Vapor (Gas) Irritant Characteristics: None
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
3.12 Odor Threshold: Currently not available
3.13 IDLH Value: Not listed.
3.14 OSHA PEL-TWA: Not listed.
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: >130°F C.C.
4.2 Flammable Limits in Air: 1.0%-5%
4.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Water may be ineffective.
4.5 Special Hazards of Combustion Products: Not pertinent
4.6 Behavior in Fire: Not pertinent
4.7 Auto Ignition Temperature: 505°F
4.8 Electrical Hazards: Not pertinent
4.9 Burning Rate: 4 mm/min.
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: Not pertinent.
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): Not pertinent.
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile: Not listed

7. SHIPPING INFORMATION

7.1 Grades of Purity: Commercial
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Open (flame arrester)
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: Currently not available
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Flammable liquid
8.2 49 CFR Class: 3
8.3 49 CFR Package Group: III
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	0
Flammability (Red).....	2
Instability (Yellow).....	0

8.6 EPA Reportable Quantity: Not listed.
8.7 EPA Pollution Category: Not listed.
8.8 RCRA Waste Number: Not listed
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: Not pertinent
9.3 Boiling Point at 1 atm: 214 to >1092°F = 101 to >588°C = 374 to 861°K
9.4 Freezing Point: –20 to +15°F = –29 to –9°C = 244 to 264°K
9.5 Critical Temperature: Not pertinent
9.6 Critical Pressure: Not pertinent
9.7 Specific Gravity: 0.904 at 15°C (liquid)
9.8 Liquid Surface Tension: Currently not available
9.9 Liquid Water Interfacial Tension: Currently not available
9.10 Vapor (Gas) Specific Gravity: Not pertinent
9.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
9.12 Latent Heat of Vaporization: Not pertinent
9.13 Heat of Combustion: –17,460 Btu/lb = –9,700 cal/g = -406.1×10^5 J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

OILS, FUEL: 4

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
50	56.180	50	0.460	35	0.908	100	14.500
52	56.180	52	0.461	40	0.908		
54	56.180	54	0.462	45	0.908		
56	56.180	56	0.463	50	0.908		
58	56.180	58	0.464	55	0.908		
60	56.180	60	0.465	60	0.908		
62	56.180	62	0.466	65	0.908		
64	56.180	64	0.467	70	0.908		
66	56.180	66	0.468	75	0.908		
68	56.180	68	0.469	80	0.908		
70	56.180	70	0.470	85	0.908		
72	56.180	72	0.471	90	0.908		
74	56.180	74	0.472	95	0.908		
76	56.180	76	0.473	100	0.908		
78	56.180	78	0.474	105	0.908		
80	56.180	80	0.475	110	0.908		
82	56.180	82	0.476	115	0.908		
84	56.180	84	0.477	120	0.908		
		86	0.478	125	0.908		
		88	0.479				
		90	0.480				
		92	0.481				
		94	0.482				
		96	0.483				
		98	0.484				
		100	0.485				

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I	70	0.042		N		N
	N	75	0.049		O		O
	S	80	0.057		T		T
	O	85	0.065				
	L	90	0.076		P		P
	U	95	0.087		E		E
	B	100	0.100		R		R
	L	105	0.114		T		T
	E	110	0.131		I		I
		115	0.149		N		N
		120	0.170		E		E
		125	0.193		N		N
		130	0.218		T		T
		135	0.247				
		140	0.279				
		145	0.314				
		150	0.352				
		155	0.395				
		160	0.443				
		165	0.495				
		170	0.552				
		175	0.615				
		180	0.683				
		185	0.758				
		190	0.841				
		195	0.930				

Central Pollution Control Board
Ministry of Environment & Forests, Govt of India, Parivesh Bhawan, East Arjun Nagar, Delhi - 110032

MATERIAL SAFETY DATA SHEETS

267 **Ethylene glycol**

1. CHEMICAL IDENTITY

Chemical Name : Ethylene glycol

Chemical Classification: Toxic **Trade Name :**

Synonyms: 1,2-Ethanediol, Ethane-1,2-diol, Glycol, Monoethylene glycol, Ethylene dihydrate, Zerex

Formula : C2H6O2 **CAS No:** 107-21-1 **UN No:** 3082

Regulated Identification

Shipping Name : Hazardous substance, liquid **Hazchem Code :** 3Z

Codes / Label : Class 9, Toxic **Hazardous Waste ID No :** 5

HAZARDOUS INGREDIENTS	C.A.S. No.	HAZARDOUS INGREDIENTS	C.A.S. No.
1 Ethylene glycol	107-21-1	3	
2		4	

2. PHYSICAL / CHEMICAL DATA

Boiling Pt. °C: 197.3 **Physical State:** Liquid **Appearance:** Clear, colorless, syrupy, liquid.

Melting Pt °C: -13 **Vapour Pressure @ 35°C mmHg:** 0.092 mm Hg @ 25 deg **Odour:** Odourless.

Vapour Density(Air =1): 2.14 **Solubility in water at 30°C g/100ml:** Miscible **Others:** Miscible with lower aliphatic alcohols, glycerol, acetic acid.

Specific Gravity (Water =1): 1.1135 g/cu cm @ 20 deg C **pH :**

3. FIRE / EXPLOSION HAZARD DATA

Flammability : **LEL:** 3.2 **Flash Point °C in OC:** 111

TDG Flammability: **UEL:** 21.6 **Flash Point °C in CC:**

Autoignition Temperature °C : 400

Explosion sensitivity to impact:

Explosion sensitivity to static Electricity:

Hazardous Combustion Products :

Hazardous Polymerization :

Combustible Liquid: **Explosive Material:** **Corrosive Material**

Flammable Material: **Oxidiser :** **Others:**

Pyrophoric Material: **Organic Peroxide :**

4. REACTIVITY DATA

Chemical Stability : Stable at room temperature in closed containers under normal storage and handling conditions.

Incompatibility with other material : Chlorosulfonic acid, dimethyl terephthalate, oleum, phosphorus pentasulfide, silvered-copper wire, sodium hydroxide, sulfuric acid, titanium butoxide. Causes ignition at room temperature with chromium trioxide, potassium permanganate, and sodium peroxide.

Reactivity :

Hazardous Reaction Products : Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

5. HEALTH HAZARD DATA

Routes of entry: Inhalation, Ingestion, Skin and Eyes

Effects of Exposure / Symptoms:

Inhalation : May cause respiratory tract irritation. Heated or misted substance may cause headache, irregular eye movements, and possible coma. Ingestion : May cause nausea and vomiting. Toxicity follows 3-stage progression. (1) involves central nervous system effects including paralysis of eye muscles, convulsions, and coma. Metabolic acidosis and cerebral swelling may also occur. (2) involves cardiopulmonary system with symptoms of hypertension, rapid heart beat, and possible cardiac failure. (3) involves severe kidney abnormalities including possible renal failure. Skin : May cause skin irritation. Low hazard for usual industrial handling. Eye : May cause moderate eye irritation.

Emergency Treatment :

Inhalation: Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Skin: Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

Eyes: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

LD50 (oral-rat) mg/kg:	**STEL:**
LC50 (rat) mg/kg:	**Odour Threshold:**
Permissible Exposure Limit:	**TLV (ACGIH) :**

NFPA Hazard Signals	**Health**	**Flammability**	**Reactivity**	**Special**
	1	1	0	

6. PREVENTIVE MEASURES

Personal Protective Equipment : Wear appropriate eye protection and protective clothing to prevent skin and eye contact.

Handling : Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Ground and bond containers when transferring material. Avoid contact with skin and eyes. Avoid ingestion and inhalation.

Storage : Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances.

Precautions :

7. EMERGENCY / FIRST AID MEASURES

FIRE:

Fire Extinguishing Media :

Special Procedure :

Unusual Hazards :

EXPOSURE: First Aid Measures:

Inhalation: Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Skin: Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

Eyes: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Antidotes / Dosages:

SPILLS :

Steps To Be Taken : Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Remove all sources of ignition. Provide ventilation.

Waste Disposal Method:

8. ADDITIONAL INFORMATION / REFERENCES

9. MANUFACTURERS / SUPPLIERS DATA

NAME OF FIRM :

MAILING ADDRESS :

TELEPHONE / TELEX NOS :

TELEGRAPHIC ADDRESS :

OTHERS :

Contact person in Emergency :

Local Bodies involved :

Standard Packing :

Trem Card Details / Ref :

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