RISK ASSESSMENT REPORT

ON

MANUFACTURING OF SYNTHETIC ORGANICS CHEMICALS

(Category: 5(f) “B2”)

FOR

PROPOSED PROJECT

OF

M/s. CHANDN SYSTHICS AND POLYMER.

Located At,

Plot No. C-1 B/ 615, GIDC, Sarigam,

Prepared by,

EIA CONSULTANT ORGANIZATION
UNISTAR ENVIRONMENT AND RESEARCH LABS PVT. LTD. VAPI – GUJARAT
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1. Introduction

M/s. Chandan Synthetics & Polymers is a partnership firm being promoted by two partners. It has proposed a unit at Plot No. C-1 B/615, GIDC, Sarigam, Tal. Umbergaon, Dist. Valsad. Gujarat (INDIA). The company has proposed to manufacture synthetic organic chemicals at rate of 300 MT/M. It has been noticed that 2 chemicals out of 16 chemicals of proposed project are hazardous in nature as per MSIHC rules (as amended), 2000. These hazardous materials will be received in tanker load or drums by road truck/tanker and stored in either tanks provided in tank farm area or in designated areas of raw materials storage. All safety measures will be provided at design level with all required safety system for the specific chemicals to prevent the associated hazards & risks. Based on the data furnished and the study of the installation, certain hazards have been identified and their consequences are modelled mathematically using ALOHA software. Mapping of various scenario are with hazardous distances and safe distances are drawn on site plan for easy understanding of the consequences of the accident/incident.

The study indicates that possible hazards associated with the plant are confined either to the storage area or plant premises. Various hazardous scenarios have been identified for Risk Assessment and the consequences modeled. The details of present RA study have been described in the subsequent sections of this chapter under respective headings.

As the project is of the organic chemical manufacturing industry, the scope of the work has been determined with following consideration of probable hazards & associated risk:

- 2 Materials of concern are those included in schedules of MSIHC rules as hazardous substance,
- 01 raw materials are to be stored in bulk in tanks,
- 15 raw materials are to be stored in bulk in drums/cylinder in storage area,

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 related with storage & tanker unloading area only;
- Identification of failure cases in the storage area and tanker unloading activities,
- Consequence analysis of probable risks of the identified failure cases,
- The study of consequence analysis for handling & storage activities of bulk hazardous chemicals of the proposed project.

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

The processing operations & detailed plant operation hazards of chemicals & operation are not covered under the scope of the present RA study.
Table 1.1: Following raw materials have been used in industry to manufacture the products.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Chemical</th>
<th>Storage Quantity (MT)</th>
<th>Mode of storage</th>
<th>Source of Supply</th>
<th>Mode of Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vinyl Acetate Monomer</td>
<td>16.00</td>
<td>Isolated Storage Tank</td>
<td>Indigenous</td>
<td>Truck/Tanker</td>
</tr>
<tr>
<td>2</td>
<td>Poly Vinyl Alcohol</td>
<td>10.00</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>3</td>
<td>Sodium Bicarbonate</td>
<td>0.50</td>
<td>Bags</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>4</td>
<td>Sodium Lauryl Sulfate</td>
<td>0.05</td>
<td>Bags</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>5</td>
<td>Potassium per Sulphate</td>
<td>0.05</td>
<td>Bags</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>6</td>
<td>De-foaming Agent</td>
<td>0.06</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>7</td>
<td>Di-butyl Phthalate (DBP)</td>
<td>0.50</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>8</td>
<td>Octanol / Butanol</td>
<td>0.20</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>9</td>
<td>Emulsifier (Nonyl Phenol Ethoxylate)</td>
<td>0.50</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>10</td>
<td>Leveling Agent (Castor Oil)</td>
<td>0.10</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>11</td>
<td>Optical Brightener (Tinopol)</td>
<td>0.01</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>12</td>
<td>Acryl amide</td>
<td>0.50</td>
<td>Bags (Store in not above 23 °C)</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>13</td>
<td>Silicon oil</td>
<td>0.50</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>14</td>
<td>P. V. A. Emulsion</td>
<td>20.00</td>
<td>Tank</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>15</td>
<td>Synthetic Adhesives</td>
<td>5.00</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
<tr>
<td>16</td>
<td>Textile Auxiliaries</td>
<td>5.00</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Truck</td>
</tr>
</tbody>
</table>

Table 1.2: Hazardous Raw materials identified as per MSIHC Rule 2008

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Chemical</th>
<th>Max. Storage Quantity (MT)</th>
<th>Mode of storage</th>
<th>Source of Supply</th>
<th>MSIHC/MAH* Applicability</th>
<th>Mode of Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vinyl Acetate Monomer</td>
<td>16.00</td>
<td>Isolated Storage Tank</td>
<td>Indigenous</td>
<td>Yes Sch-I,Part-II,670</td>
<td>Truck/Tanker</td>
</tr>
<tr>
<td>2</td>
<td>Acryl amide</td>
<td>0.50</td>
<td>Bags (Store in not above 23 °C)</td>
<td>Indigenous</td>
<td>Yes Sch-I,Part-II,11</td>
<td>Truck</td>
</tr>
<tr>
<td>3</td>
<td>Octanol</td>
<td>0.20</td>
<td>Drum</td>
<td>Indigenous</td>
<td>Yes</td>
<td>Truck</td>
</tr>
</tbody>
</table>
2. HAZARD IDENTIFICATION AND RISK ASSESSMENT

2.1 PROBABLE HAZARDS & CONSEQUENCE ANALYSIS

Risk involves the occurrence or potential occurrence of some accident consisting of an event or sequence of events. 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 into 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.

Following Figure portrays conceptual framework of any quantitative risk analysis.

![Conceptual Activities: Hazard Study and Risk Analysis](image)

The descriptions of the subtasks of various phases involved in risk analysis are detailed below:

MCA stands for Maximum Credible Accident or in other words, an accident with maximum damage distance, which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. In practice the selection of accident scenarios for MCA analysis is carried out on the basis of engineering judgment and expertise in the field of risk analysis.
especially in accident analysis. A disastrous situation is the outcome of fire, explosion or toxic hazards in addition to other natural causes that eventually lead to loss of life, property and ecological imbalances.

MCA analysis encompasses defined techniques to identify the hazards and compute the consequent effects in terms of damage distances due to heat radiation, toxic releases, vapour cloud explosion etc. A list of probable or potential accidents of the major units in the complex arising due to use, storage and handling of the hazardous materials are examined to establish their credibility. Depending upon the effective hazardous attributes and their impact on the event, the maximum effect on the surrounding environment and the respective damage caused can be assessed.

2.2 METHODOLOGY OF MCA ANALYSIS
The MCA analysis involves ordering and ranking of various sections in terms of potential vulnerability. The input requirements for MCA analysis are:

- Operating manual
- Flow diagram and P&I diagrams
- Detailed design parameters
- Physical & chemical properties of all the chemicals
- Detailed plant layout
- Detailed area layout
- Past accident data

The following steps are involved in MCA analysis:

- Identification of potential hazardous process units, storage sections and representative failure cases from the vessels and pipelines
- Visualization of chemical release scenarios
- Consequence Analysis for computation of damage distances for the release cases through mathematical modelling.

2.3 HAZARD IDENTIFICATION
Risk assessment process rests on identification of specific hazards, hazardous areas and areas vulnerable to effects of hazardous situations in facilities involved in processing and storage of chemicals. In fact the very starting point of any such assessment is a detailed study of materials handled & their physical / chemical properties within the complex at various stages of manufacturing activity. Such a detailed account of hazardous materials provides valuable database for identifying most hazardous materials, their behavior under process conditions, and their inventory in process as well as storage and hence helps in identifying vulnerable areas within the complex. Hazardous posed by particular installation or a particular activity can be broadly classified as fire and explosive hazards and toxicity hazards. Whether a particular activity is fire and explosive hazardous or toxicity hazardous primarily depends on the materials
Figure 2.2: Flowchart for Maximum Credible Accident (MCA) Analysis

handled and their properties. It will be from the above discussion that study of various materials handled is a prerequisite from any hazard identification process to be accurate. Dow’s F&E and Toxicity indices, which make use of past experience to develop relative ranking of hazards, is used for prioritization & determination of probable hazards associated with the hazardous chemicals of the proposed project. Based on this study the hazard indices are calculated for subsequent categorization of units depending upon the degree of hazard they pose. The details of the calculated Dow’s F&E Index and Toxicity Index along with the interpretation of degree of hazards and radius of exposure are presented below in tabular form.

2.4 PROBABLE HAZARDS DUE TO RELEASE OF HAZARDOUS SUBSTANCE

As it has been described above, major hazards are associated with storage area & tanker unloading area. The cause of hazards is thus determined to be leak from storage area, storage vessel/containers through hole or connected pipeline for transfer to the plant. Hence, for further evaluation of hazards, identification of probable hazards from leakage has been studied from cause effect network diagram.
With reference to the properties and storage conditions, two primary types of incidents can occur in the storage & unloading area. These incidents are identified to be fire or toxic vapour dispersion or both. In case of fire, the raised temperature of the storage vessels/ tank or transport tanker can also under go BLEVE and will thus result in fireball & pool fire. In all case of bulk storage & unloading activities of 2 hazardous chemicals, toxic vapour dispersion has been found necessary to explore for further study. Also it has been felt necessary to assess the risk of fire scenarios for 2 flammable hazardous chemicals as identified earlier. The detail explanation of the two probable hazards with their further classification has been described in subsequent paragraphs.

2.4.1 Toxic and fire hazard

Dispersion is a term used to include moving and spreading. A dispersing vapour cloud will generally move in a downwind direction and spread (diffuse) in a crosswind and vertical direction. (Crosswind is the direction perpendicular to the wind.) A cloud of gas that is denser or heavier than air (called a heavy gas) can also spread upwind to a small extent. The dispersion can be in form of toxic vapours clouds or flammable cloud depending on the nature of risk of the dispersed cloud.

The toxic vapour cloud is the type of a vapour cloud in which the concentration of the chemicals may be harmful to human health or other living being. The toxic effects of such cloud depend on the concentration of chemical vapour in it and its toxicity. The flammable area is the part of a vapour cloud where the concentration is in the flammable range, between the Lower and Upper Explosive Limits (LEL and UEL). These limits are percentages that represent the concentration of the fuel (that is, the chemical vapour) in the air. If the chemical vapour comes into contact with an ignition source (such as a spark), it will burn only if its fuel-air concentration is between the LEL and the UEL, because that portion of the cloud is already pre-mixed to the right mixture of fuel and air for burning to occur.

2.4.2 Fire Hazards

A fire is a complex chain reaction where a fuel combines with oxygen to generate heat, smoke, and light. Most chemical fires will be triggered by one of the following ignition sources: sparks, static electricity, heat, or flames from another fire.

There are several properties that measure how readily and how easily a chemical will catch on fire. Herein after three of these properties: volatility, flash point, and flammability limits are discussed as necessary.

- **Volatility** is a measure of how easily a chemical evaporates. A flammable liquid must begin to evaporate—forming a vapour above the liquid—before it can burn. The more volatile a chemical, the faster it evaporates and the quicker a flammable vapour cloud is formed.

- **The flash point** is the lowest temperature where a flammable liquid will evaporate enough to catch on fire if an ignition source is present. The lower the flash point, the easier it is for a fire to start.

- **Flammability limits**, also known as the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL), are the boundaries of the flammable area of a vapour cloud. These limits are percentages that represent the concentration of the fuel/ chemical vapour in the air. If the
chemical vapour comes into contact with an ignition source, it will burn only if its fuel-air concentration is between the LEL and the UEL. While ALOHA cannot model all the complex processes that happen in a fire (like the generation and distribution of by products), it can predict the area where the heat radiated by the fire called thermal radiation could be harmful. Thermal radiation is the primary hazard associated with fires. However, it is also important to consider the hazards associated with any secondary fires and explosions that may occur. In present study risk assessment modelling has been done for fire hazards for 2 flammable chemicals only.

2.5 HAZARD SCENARIOS SELECTED FOR CONSEQUENCE ANALYSIS

The typical diagram showing probable hazards along their sequence of occurrence & probable effects is already shown in above figure. As it has identified, only fire and hazardous vapour cloud dispersion and toxic dispersion are anticipated from the proposed project, consequences analysis has been done for fire & dispersion.
2.5.1 Fire

Most chemicals fires will be triggered by one of the following ignition sources: sparks, static electricity, heat, or flames from another fire. Additionally, if a chemical is above its auto-ignition temperature it will spontaneously catch on fire without an external ignition source. When doing modelling for fire; three type of fire are considered which are Jet Fire, Flash Fire & pool fire. Primary effects of all type of fire are same and know to be heat /thermal radiation. However, in some case secondary effects of fire are noticed in many cases which include domino effects causing secondary
fire, BLEVE & fireball. Secondary fire may also occur due to exposure of combustible or flammable materials for a particular time at particular thermal dose.

2.5.2 Dispersion

With or without both of above, i.e. fire & explosion; the dispersion of chemical in air and eventually in environment may have toxic hazards and the effects of the dispersion vary from one to other chemicals depending on the toxicity & concentration resulting in toxic effects. Generally the effects likely occur on human health is estimated through modelling for consequence analysis in form of level of concentration of chemical released in environment directly or indirectly due to fire & explosion. The level of concentration in terms of IDLH, TWA, TEEL, AEGL, ERPG etc. is used to determine the severity of consequences of dispersion.

2.5.3 Source & Models for Consequence Analysis

In line with the storage & handling details described earlier and chemical properties, following source of hazards have been selected.

➢ **Tank/Drum Source**

The Tank /Drum source option to model releases of pressurized liquids has been selected for consequences analysis. Considering the extreme probability of high temperature near storage tank of storage of some flammable chemical, BLEVEs/fireball has also been modelled. The mode of failure of tank &/or drum has been considered as below.

➢ **Type of Storage Tank /Drum Failure**

When the Tank source is used with a flammable chemical, source (tank/tanker) failure mode is required to be determined. The failure mode can be any one of the following three options:

- **Leaking Tank/Drum (Not Burning):** If a flammable chemical escapes from a tank/drum and does not immediately burn, either the chemical will go directly into the air or it may form an evaporating puddle (depending on the storage conditions). In either case, a flammable vapour cloud will form. In such case, three possible hazardous outcomes: the toxic area of the vapour cloud, the flammable area of the vapour cloud (where igniting the cloud would cause a flash fire), and the overpressure (blast force) from a vapour cloud explosion has been modelled.

- **Leaking Tank/Drum (Burning):** When a flammable liquid forms a burning puddle it is called a pool fire. Based on the storage conditions specified by the client, it has been decide to model the chemical as a pool fire only. Potential hazards associated with a pool fire include thermal radiation, smoke, and toxic by-products from the fire. As the dispersion scenarios for toxic vapour has been considered as individual scenarios for same chemicals, only pool fire in this case has been modelled.

- **BLEVE (Boiling Liquid Expanding Vapour Explosion):** When a tank containing a boiling liquid evaporating within tank fails completely, a BLEVE can occur. Some of the released chemical will burn in a fireball, while the remainder will form a pool fire. The amount of the chemical involved in the fireball and/or the pool fire depends on the conditions at the time of release.
The primary hazards associated with a BLEVE are thermal radiation, overpressure, hazardous fragments, smoke, and toxic by-products from the fire. As the BLEVE is normally not possible but considered as worst case probability in incident of fire causing temperature rise in tank, modelling has been done only for the thermal radiation hazard due to fireball. Thermal radiation of pool fire cause by BLEVE is not done as separately Pool Fire scenarios have been planned to be conducted for same chemical.

- **Levels of Concern (LOCs) for Consequences Analysis**

In modelling of consequences of a hazard, a Level of Concern (LOC) is a threshold value of a hazard (toxicity, flammability, thermal radiation, or overpressure); the LOC is usually the value above which a threat to people or property may exist.

- **Thermal Radiation Levels**

A Thermal Radiation (radiation intensity as kW/m²) Level of Concern (LOC) is a threshold level of thermal radiation, usually the level above which a hazard may exist. While modelling a fire scenario, the threshold values (measured in kilowatts per square meter and denoted as kW/m²) are considered to create the threat zones are as below.

The thermal radiation effects that people experience depend upon the length of time they are exposed to a specific thermal radiation level. Longer exposure durations, even at a lower thermal radiation level, can produce serious physiological effects. However for plotting the hazards contour three level of thermal radiation have been selected, which are 10 kW/m² indicating lethality within 60 seconds, 5 kW/m² indicating 2nd degree burn within 60 seconds and 2 kW/m² indicating pain within 60 seconds. After preparing the threat zone probable effects of other potential thermal radiation level have also been studied and tabulated.

- **Toxic Vapour & Flammable Cloud LOC**

- **IDLHs**

The National Institute of Occupational Safety and Health (NIOSH) defines an immediately dangerous to life or health condition as a situation “that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.”

- **TWA_{8hr}**

The permissible exposure limit (PEL or OSHA PEL) is a legal limit in the United States for exposure of an employee to a chemical substance or physical agent. Permissible exposure limits are established by the Occupational Safety and Health Administration (OSHA). A PEL is usually given as a time-weighted average (TWA), although some are short-term exposure limits (STEL) or ceiling limits. For chemicals, the chemical regulation is usually expressed in parts per million (ppm), or sometimes in milligrams per cubic meter (mg/m³). TWA is the average exposure over a specified period of time, usually a nominal eight hours. This means that, for limited periods, a worker may be exposed to concentrations higher than the PEL, so long as the average concentration over eight hours remains lower. A TWA limit is one that addresses the average exposure over 8 Hr. period of maximum exposure during a day of works.
✓ Flammable LOCs

In consequences modelling, a flammable Level of Concern (LOC) is a threshold concentration of fuel in the air above which a flammability hazard may exist. When the release of a flammable chemical that is not currently burning (but may catch on fire if exposed to an ignition source) is modelled, the flammable area of the vapour cloud can be predicted so that one can assess the flammability hazard. The flammable area is the part of a vapour cloud where the concentration is in the flammable range, between the Lower and Upper Explosive Limits (LEL and UEL). These limits are percentages that represent the concentration of the fuel (that is, the chemical vapour) in the air. At about 60% LEL, the flame pocket occurs. Thus with consideration the LOC has been selected as 10%LEL, 60%LEL and 100% LEL to determine the area of flammable vapour cloud.

2.5.4 Consequences Analysis for Vinyl acetate

<table>
<thead>
<tr>
<th>Chemical Data:</th>
<th>Stored Quantity: 16 MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Name</td>
<td>Vinyl acetate</td>
</tr>
<tr>
<td>Molecular Weight:</td>
<td>86.09 g/mol (Water = 1)</td>
</tr>
<tr>
<td>Specific Gravity:</td>
<td>0.9317</td>
</tr>
<tr>
<td>Ambient Boiling Point:</td>
<td>72.2°C (162°F)</td>
</tr>
<tr>
<td>Ambient Flash Point:</td>
<td>-7.8°C (18°F) [CC]</td>
</tr>
<tr>
<td>Ambient Saturation Concentration:</td>
<td>149,831 ppm or 15.0%</td>
</tr>
<tr>
<td>Vapour Pressure:</td>
<td>83 mm of Hg (@ 20°C)</td>
</tr>
<tr>
<td>Vapour Density:</td>
<td>3 (Air = 1)</td>
</tr>
<tr>
<td>Flammability Limits:</td>
<td>LOWER: 2.6% UPPER: 13.4%</td>
</tr>
<tr>
<td>Toxicity Data:</td>
<td>AEGL-1 (60 min): 6.7 ppm</td>
</tr>
<tr>
<td></td>
<td>AEGL-2 (60 min): 36 ppm</td>
</tr>
<tr>
<td></td>
<td>AEGL-3 (60 min): 180 ppm</td>
</tr>
<tr>
<td></td>
<td>LD50 (oral-rat): 2920mg/(cu m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage Data:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank Diameter:</td>
</tr>
<tr>
<td>Tank Length:</td>
</tr>
<tr>
<td>Tank Volume:</td>
</tr>
<tr>
<td>Tank contains liquid</td>
</tr>
<tr>
<td>Internal Temperature:</td>
</tr>
<tr>
<td>Tank is 87% full</td>
</tr>
<tr>
<td>Circular Opening Diameter:</td>
</tr>
<tr>
<td>Opening is 0 meters from tank bottom</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atmospheric Data:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind:</td>
</tr>
<tr>
<td>Ground Roughness:</td>
</tr>
<tr>
<td>Cloud Cover:</td>
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<td>Air Temperature:</td>
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<td>Stability Class:</td>
</tr>
<tr>
<td>No Inversion Height</td>
</tr>
<tr>
<td>Relative Humidity:</td>
</tr>
</tbody>
</table>

| OUTCOME OF SCENARIO MODELS (As Instantaneous Source) (Vinyl Acetate) |
1. Toxic dispersion of chemical (Vinyl Acetate) escaping from tank (not burning)(Leak from hole in horizontal cylindrical tank through 1” hole)

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD₅₀ (oral-rat): 2920mg/(cu m)</td>
<td>11 m</td>
<td>Life-threatening health effects or death.</td>
</tr>
</tbody>
</table>

Release Duration: ALOHA limited the duration to 1 hour
Max Average Sustained Release Rate: 19.5 kilograms/min (averaged over a minute or more)
Total Amount Released: 836 kilograms
Note: The chemical escaped as a liquid and formed an evaporating puddle.
The puddle spread to a diameter of 13.7 meters.

Model Run: Gaussian
Red: 11 meters (2920mg/(cu m))
Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

2. Thermal radiation from pool fire (Vinyl Acetate) (not burning) (Leak from hole in horizontal cylindrical tank through 1” hole)

<table>
<thead>
<tr>
<th>Heat Flux (KW/m²)</th>
<th>Distance (m)</th>
<th>Effects of Heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>14 m</td>
<td>Pain threshold</td>
</tr>
<tr>
<td>4.0</td>
<td>Less than 10 m</td>
<td>Threshold for serious injury</td>
</tr>
<tr>
<td>37.5</td>
<td>Less than 10 m</td>
<td>Fatality</td>
</tr>
</tbody>
</table>

Max Puddle Diameter: Unknown
Max Flame Length: 5 meters
Burn Duration: ALOHA limited the duration to 1 hour
Max Burn Rate: 25.9 kilograms/min
Total Amount Burned: 1,510 kilograms
Note: The chemical escaped as a liquid and formed a burning puddle.
The puddle spread to a diameter of 3.5 meters.
Threat Modeled: Thermal radiation from pool fire
Red: less than 10 meters (10.9 yards) --- (37.5 kW/(sq m))
Orange: less than 10 meters (10.9 yards) --- (4.0 kW/(sq m))
Yellow: 14 meters --- (1.6 kW/(sq m))

OUTCOME OF SCENARIO MODELS (As Instantaneous Source) (Vinyl Acetate)

3. Thermal radiation from fire ball (BLEVE Vinyl Acetate) (not burning) (Leak from hole in horizontal cylindrical tank through 1" hole)

<table>
<thead>
<tr>
<th>Heat Flux (KW/m²)</th>
<th>Distance (m)</th>
<th>Effects of Heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>424 m</td>
<td>Pain threshold</td>
</tr>
<tr>
<td>4.0</td>
<td>270 m</td>
<td>Threshold for serious injury</td>
</tr>
<tr>
<td>37.5</td>
<td>73 m</td>
<td>Fatality</td>
</tr>
</tbody>
</table>

Internal Pressure at Failure: 1.7 atmospheres
Percentage of Tank Mass in Fireball: 32.6%
Fireball Diameter: 97 meters Burn Duration: 7 seconds
Pool Fire Diameter: 54 meters Burn Duration: 1 minute Flame Length: 46 meters
THREAT ZONE:
Threat Modeled: Thermal radiation from fireball
Red   : 73 meters --- (37.5 kW/(sq m))
Orange: 270 meters --- (4.0 kW/(sq m))
Yellow: 424 meters --- (1.6 kW/(sq m))

OUTCOME OF SCENARIO MODELS (As Continuous Source) (Vinyl Acetate)

4. Toxic dispersion of chemical escaping from tank (not burning)

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2920mg/(cu m)</td>
<td>159 m</td>
<td>Life-threatening health effects or death.</td>
</tr>
</tbody>
</table>

SOURCE STRENGTH:
Direct Source: 0.27 tons/min               Source Height: 0
Release Duration: 60 minutes               Total Amount Released: 14,696 kilograms
Release Rate: 245 kilograms/min            Total Amount Released: 14,696 kilograms
THREAT ZONE:
Model Run: Heavy Gas
Red   : 159 meters --- (2920 mg/(cu m))

OUTCOME OF SCENARIO MODELS (As Continuous Source) (Vinyl Acetate)

5. Flammable Area of Vapor Cloud (not burning)

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% LEL</td>
<td>23 m</td>
<td>Possible Flame Pocket Area/Flash Fire</td>
</tr>
<tr>
<td>10% LEL</td>
<td>73 m</td>
<td>Possible Flash Fire &amp; Lower Boundary of Explosion area</td>
</tr>
</tbody>
</table>

SOURCE STRENGTH:
Direct Source: 0.27 tons/min      Source Height: 0
Release Duration: 60 minutes
Release Rate: 245 kilograms/min   Total Amount Released: 14,696 kilograms

THREAT ZONE:
Threat Modeled: Flammable Area of Vapor Cloud
Model Run: Heavy Gas
Red   : 23 meters --- (15600 ppm = 60% LEL = Flame Pockets)
Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.
Yellow: 73 meters --- (2600 ppm = 10% LEL)
### OUTCOME OF SCENARIO MODELS (As Continuous Source) (Vinyl Acetate)

6. **Overpressure (blast force) from vapor cloud explosion**

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7 atmospheres</td>
<td>LOC was never exceeded</td>
<td><img src="https://via.placeholder.com/150" alt="" /></td>
</tr>
<tr>
<td>0.04 atmospheres</td>
<td>18 m</td>
<td><img src="https://via.placeholder.com/150" alt="" /></td>
</tr>
</tbody>
</table>

**SOURCE STRENGTH:**
- Direct Source: 0.27 tons/min  
- Source Height: 0
- Release Duration: 60 minutes
- Release Rate: 245 kilograms/min
- Total Amount Released: 14,696 kilograms

**THREAT ZONE:**
- Threat Modeled: Overpressure (blast force) from vapor cloud explosion
- Type of Ignition: ignited by spark or flame
- Level of Congestion: uncongested
- Model Run: Heavy Gas
- Red: LOC was never exceeded --- (1.7 atmospheres)
- Yellow: 18 meters --- (0.04 atmospheres)
2.5.4.1 Consequences Analysis for Octanol

**INPUT DATA (As Continuous source)**

**Chemical Data:**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Octanol</th>
<th>Stored Quantity:</th>
<th>0.20 MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight:</td>
<td>130.23 g/mol</td>
<td>Ambient Boiling Point:</td>
<td>193.8° C</td>
</tr>
<tr>
<td>Ambient Saturation Concentration:</td>
<td>110 ppm or 0.011%</td>
<td>Vapour Pressure:</td>
<td>0.0089 atm</td>
</tr>
<tr>
<td>Flammability Limits</td>
<td>LOWER: 8400 ppm UPPER: 64000 ppm</td>
<td>Toxicity Data:</td>
<td>IDLH: 1400 ppm ORAL (LD50): Acute: 1790 mg/kg [Mouse].</td>
</tr>
</tbody>
</table>

**ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)**

- Wind: 3.5 meters/second from NE at 3 meters
- Ground Roughness: urban or forest
- Air Temperature: 25° C
- No Inversion Height
- Cloud Cover: 5 tenths
- Stability Class: D
- Relative Humidity: 50%

**OUTCOME OF SCENARIO MODELS (As Continuous Source) (Octanol)**

1. Toxic dispersion of chemical (Octanol) escaping from tank (not burning) (Leak from hole in horizontal cylindrical tank through 1” hole)

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
</table>
### ORAL (LD50): 2164 mg/(cu m)
- Life-threatening health effects or death.

### SOURCE STRENGTH:
- Direct Source: 3.33 kilograms/min  
  Source Height: 0
- Release Duration: 60 minutes
- Release Rate: 3.33 kilograms/min
- Total Amount Released: 200 kilograms

Model Run: Heavy Gas
- Red: 22 meters --- (2164 mg/(cu m))
- Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

### OUTCOME OF SCENARIO MODELS (As Continuous Source) (Octanol)

#### 2. Flammable Area of Vapor Cloud (not burning) (Leak from hole in horizontal cylindrical tank through 1” hole)

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% LEL</td>
<td>11 m</td>
<td>Possible Flame Pocket Area/Flash Fire</td>
</tr>
<tr>
<td>10% LEL</td>
<td>12 m</td>
<td>Possible Flash Fire &amp; Lower Boundary of Explosion area</td>
</tr>
</tbody>
</table>

### SOURCE STRENGTH:
- Direct Source: 3.33 kilograms/min  
  Source Height: 0
- Release Duration: 60 minutes
- Release Rate: 3.33 kilograms/min
- Total Amount Released: 200 kilograms

### THREAT ZONE:
- Threat Modeled: Flammable Area of Vapor Cloud
- Model Run: Heavy Gas
- Red: 11 meters --- (5040 ppm = 60% LEL = Flame Pockets)
- Yellow: 12 meters --- (840 ppm = 10% LEL)
- Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

#### 2.5.4.2 Consequences Analysis for Butanol

### INPUT DATA (As Continuous source)

#### Chemical Data:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Stored Quantity</th>
<th>Ambient Boiling Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-BUTYL ALCOHOL</td>
<td>0.20 MT</td>
<td>118.7° C</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74.12 g/mol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Saturation Concentration</td>
<td>Vapour Pressure</td>
<td>0.0089 atm</td>
</tr>
<tr>
<td>8,929 ppm or 0.89%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability Limits</td>
<td>PAC-1: 20 ppm</td>
<td>PAC-2: 50 ppm</td>
</tr>
<tr>
<td>LOWER: 17000 ppm</td>
<td>PAC-3: 8000</td>
<td></td>
</tr>
<tr>
<td>UPPER:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
113000 ppm | ppm IDLH: 1400 ppm

**ATMOSPHERIC DATA:** (MANUAL INPUT OF DATA)
- Wind: 3.5 meters/second from NE at 3 meters
- Ground Roughness: urban or forest
- Cloud Cover: 5 tenths
- Air Temperature: 25°C
- Stability Class: D
- No Inversion Height
- Relative Humidity: 50%

**OUTCOME OF SCENARIO MODELS (As Continuous Source) (Butanol)**

1. **Toxic dispersion of chemical (Butanol) escaping from tank (not burning) (Leak from hole in horizontal cylindrical tank through 1” hole)**

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400 ppm = IDLH</td>
<td>15 m</td>
<td>Life-threatening health effects or death.</td>
</tr>
</tbody>
</table>

**SOURCE STRENGTH:**
- Direct Source: 3.33 kilograms/min
- Source Height: 0
- Release Duration: 60 minutes
- Release Rate: 3.33 kilograms/min
- Total Amount Released: 200 kilograms

**THREAT ZONE:**
- Model Run: Heavy Gas
- Red: 15 meters --- (1400 ppm = IDLH)
- Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.

2. **Flammable Area of Vapor Cloud (not burning) (Leak from hole in horizontal cylindrical tank through 1” hole)**

<table>
<thead>
<tr>
<th>Toxicity limits</th>
<th>Distance (m)</th>
<th>Effect of Toxic Dispersion</th>
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</thead>
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<td>11 m</td>
<td>Possible Flame Pocket Area/Flash Fire</td>
</tr>
<tr>
<td>10% LEL</td>
<td>12 m</td>
<td>Possible Flash Fire &amp; Lower Boundary of Explosion area</td>
</tr>
</tbody>
</table>

**SOURCE STRENGTH:**
- Direct Source: 3.33 kilograms/min
- Source Height: 0
- Release Duration: 60 minutes
- Release Rate: 3.33 kilograms/min
- Total Amount Released: 200 kilograms

**THREAT ZONE:**
- Threat Modeled: Flammable Area of Vapor Cloud
- Model Run: Heavy Gas
- Red: 11 meters --- (10200 ppm = 60% LEL = Flame Pockets)
- Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.
Yellow: 12 meters --- (1700 ppm = 10% LEL)
Note: Threat zone was not drawn because effects of near-field patchiness make dispersion predictions less reliable for short distances.
3. Emergency Response Guideline

3.1 Vinyl Acetate

- FLAMMABLE LIQUIDS (Polar/Water-Miscible/Noxious)
- HIGHLY FLAMMABLE: Easily ignited by heat, sparks, flames
- CAUTION: Very low flash point; use of water spray when fighting fire may be inefficient
- Do not use straight streams

**Property summary**

- **Molecular Formula:** C4-H6-O2
- **Molecular Weight:** 86.09
- **Density Specific Gravity:** 0.932 at 20 deg C/4 deg C
- **Vapor Density:** 3.0 (Air = 1)
- **Vapor Pressure:** 90.2 mm Hg at 20 deg C /extrapolated/
- **Flash Point:** -8 deg C, 18 deg F (closed cup); 0.5-0.9 deg C (open cup)
- **Melting Point:** -93.2 deg C
- **Boiling Point:** 72.8 deg C
- **Autoignition Temperature:** 402 deg C, 756 deg F
- **Viscosity:** 0.43 cPs at 20 deg C

**Solubilities:**

Sol in ethane, acetone, chloroform
Soluble in organic liquids > 10% in ethyl ether; > 10% in ethanol; > 10% in benzene at 20 deg C, a saturated solution of vinyl acetate in water contains 2.0-2.4 wt % vinyl acetate, whereas a saturated solution of water in vinyl acetate contains 0.9-1.0 wt % water; at 50 deg C, the solubility of vinyl acetate in water is 0.1 wt % more than at 20 deg C, but the solubility of water in vinyl acetate doubles to about 2 wt % ; 4.0 wt % in dilute (2.0 wt %) solution of sodium lauryl sulfate at 30 deg C

In water, 27 g/L at 50 deg C
In water, 20,000 mg/L at 20 deg C

**Personal protective equipments**

NIOSH approved canister or air-supplied mask, Rubber or plastic gloves should be used.
Respirator selection guide for vinyl acetate: Less than or equal to 140 mg/cu m; type C supplied-air respirator with half-mask facepiece operated in pressure-demand mode. Less than or equal to 1,400 mg/cu m; gas mask with full facepiece and chin-type organic vapor canister (maximum service life, 2 hr), gas mask will full facepiece and chest or back mounted organic vapor canister, type C supplied air respirator with full facepiece operated in positive pressure mode, self-contained breathing apparatus with full facepiece operated in positive pressure mode. Less than or equal to 14,000 mg/cu m; type C supplied-air respirator with half mask or full facepiece operated in continuous flow pressure-demand, or other positive pressure mode, type C supplied-air respirator with hood, helmet, or suit operated in continuous flow mode. Greater than 14,000 mg/cu m; self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode, combination type C supplied-air respirator with full facepiece operated in pressure demand mode with auxiliary self-contained air supply.
Wear appropriate personal protective clothing to prevent skin contact.
Wear appropriate eye protection to prevent eye contact.
Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection.
Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from anybody areas likely to be exposed].
Wear positive-pressure SCBA and protective equipment specified by references such as the DOT Emergency Response Guidebook or the CANUTEC Initial Emergency Response Guide. If special chemical protective clothing is required, consult the chemical manufacturer or specific protective clothing compatibility charts. Delay entry until trained personnel and proper protective equipment are available. Remove patient from contaminated area. Quickly remove and isolate patient's clothing, jewelry, and shoes. Gently blot excess liquids with absorbent material. Rinse patient with warm water, 30 deg C/86 deg F, if possible. Wash patient with Tincture of Green Soap or a mild liquid soap and large quantities of water.
**PRECAUTIONS FOR “CARCINOGENS”:** In chemical laboratory, gloves & gowns should always be worn, however, gloves should not be assumed to provide full protection. Carefully fitted masks or respirators may be necessary when working with particulates or gases, & disposable plastic aprons might provide additional protection.

**Chemical reactivity:**
Highly flammable, polymerizable, strong reducing agent

- **NFPA hazard classification**

![NFPA hazard 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: 3 (Serious)**
This degree includes Class IB and IC flammable liquids and materials that can be easily ignited under almost all normal temperature conditions. Water may be ineffective in controlling or extinguishing fires in such materials.
Instability: 2 (Moderate)

Materials that can undergo violent chemical changes at elevated temperatures and pressures. This also includes materials that may react violently with water or that may form potentially explosive mixtures with water. In advanced or massive fires involving these materials, fire fighting should be done from a safe distance or from a protected location.

- Emergency Response Guideline

**ERG2012**

**GUIDE 129P**

**FLAMMABLE LIQUIDS (Polar / Water-Miscible / Noxious)**

<table>
<thead>
<tr>
<th>POTENTIAL HAZARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE OR EXPLOSION</td>
</tr>
<tr>
<td>- HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.</td>
</tr>
<tr>
<td>- Vapors may form explosive mixtures with air.</td>
</tr>
<tr>
<td>- Vapors may travel to source of ignition and flash back.</td>
</tr>
<tr>
<td>- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).</td>
</tr>
<tr>
<td>- Vapor explosion hazard indoors, outdoors or in sewers.</td>
</tr>
<tr>
<td>- Those substances designated with a (P) may polymerize explosively when heated or involved in a fire.</td>
</tr>
<tr>
<td>- Runoff to sewer may create fire or explosion hazard.</td>
</tr>
<tr>
<td>- Containers may explode when heated.</td>
</tr>
<tr>
<td>- Many liquids are lighter than water.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEALTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>- May cause toxic effects if inhaled or absorbed through skin.</td>
</tr>
<tr>
<td>- Inhalation or contact with material may irritate or burn skin and eyes.</td>
</tr>
<tr>
<td>- Fire will produce irritating, corrosive and/or toxic gases.</td>
</tr>
<tr>
<td>- Vapors may cause dizziness or suffocation.</td>
</tr>
<tr>
<td>- Runoff from fire control or dilution water may cause pollution.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PUBLIC SAFETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 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.</td>
</tr>
<tr>
<td>- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.</td>
</tr>
<tr>
<td>- Keep unauthorized personnel away.</td>
</tr>
<tr>
<td>- Stay upwind.</td>
</tr>
<tr>
<td>- Keep out of low areas.</td>
</tr>
<tr>
<td>- Ventilate closed spaces before entering.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROTECTIVE CLOTHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Wear positive pressure self-contained breathing apparatus (SCBA).</td>
</tr>
<tr>
<td>- Structural firefighters' protective clothing will only provide limited protection.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EVACUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Spill</td>
</tr>
<tr>
<td>- Consider initial downwind evacuation for at least 300 meters (1000 feet).</td>
</tr>
<tr>
<td>Fire</td>
</tr>
<tr>
<td>- 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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMERGENCY RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
</tr>
<tr>
<td>- CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.</td>
</tr>
<tr>
<td>Small Fire</td>
</tr>
<tr>
<td>- Dry chemical, CO2, water spray or alcohol-resistant foam.</td>
</tr>
<tr>
<td>- Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane.</td>
</tr>
</tbody>
</table>
Large Fire
- Water spray, fog or alcohol-resistant 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 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.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

• MEDICAL TREATMENT

ORAL EXPOSURE
A) DILUTION: Immediately dilute with 4 to 8 ounces (120 to 240 mL) of water or milk (not to exceed 4 ounces/120 mL in a child).
B) EMESIS - Is NOT recommended due to irritant effects of vinyl acetate.
C) GASTRIC LAVAGE: Consider after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation. Control any seizures first.

1) CONTRAINDICATIONS: Loss of airway protective reflexes or decreased level of consciousness in unintubated patients; following ingestion of corrosives; hydrocarbons (high aspiration potential); patients at risk of hemorrhage or gastrointestinal perforation; and trivial or non-toxic ingestion.
D) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.

E) Monitor for CNS depression, respiratory irritation, cardiac dysrhythmias, and liver function changes. There is no specific treatment other than supportive care.

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.

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.

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.

- OTHER PROTECTIVE MEASURES

Avoid breathing vapors. Keep upwind. Do not handle broken packages unless wearing appropriate personal protective equipment. Wash away any material which may have contacted the body with copious amt of water or soap & water. Wear appropriate chemical protective gloves, boots and goggles.

If material not on fire & not involved in fire: Keep sparks, flames, & other sources of ignition away. Keep material out of water sources & sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel hazard. Use water spray to disperse vapors & dilute standing pools of liquid.

Keep away from sources of ignition - No smoking.

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place.

Chemical safety goggles or faces shields (8 inch minimum) with goggles in the likelihood of exposure to liquid vinyl acetate. Protective clothing including gloves, aprons, suits, and boots. The worker should immediately wash the skin when it becomes contaminated.

Work clothing that becomes wet or significantly contaminated should be removed and replaced.
Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Absorb bulk liquid with fly ash, cement powder, or commercial sorbents. Apply "universal" gelling agent to immobilize spill. Apply appropriate foam to diminish vapor and fire hazard of vinyl acetate.

Land spill - Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Water spill - Use natural barriers or oil spill control booms to limit spill travel. Use surface active agent, if approved by EPA. Inject "universal" gelling agent to solidify encircled spill and increase effectiveness of booms. If dissolved in region of 10 ppm or greater concentration, apply activated carbon at ten times the spilled amount. Remove trapped material with suction hoses. Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates.

Air spill - Apply water spray or mist to knock down vapors.

The following is extracted from ERG Guide 129: FLAMMABLE LIQUIDS (Polar / Water-Miscible / Noxious)

As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.

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.

2. Acryl amide

SUBSTANCES - TOXIC and/or CORROSIVE (Combustible)
• TOXIC; inhalation, ingestion, or skin contact with material may cause severe injury or death

Properties:
Molecular Formula: C3-H5-N-O
Molecular Weight: 71.08
Density Specific Gravity: 1.122 @ 30 deg C/4 deg C
Vapor Density: 2.45 (Air = 1)
Vapor Pressure: 0.9 Pa (7X10^-3 mm Hg) @ 25 deg C
Flash Point: 138 deg C (closed cup)
PH: 5.0-6.5 /50% aqueous solution/
Melting Point: 84.5 deg C
Boiling Point: 192.6 deg C
Autoignition Temperature: 424 deg C
Viscosity: 2.71 cP @ 25 deg C /50% aqueous solution/
Solubilities:
Solubility (g/100 ml) at 30 deg C in: methanol 155; ethanol 86.2; acetone 63.1; ethyl acetate 12.6; chloroform 2.66; benzene 0.346; heptane 0.0068
In water, 3.711X10^-2 g/L @ 20 deg C; 4.048X10^-2 g/L @ 30 deg C

• Protective equipment and clothing
Safety glasses with side shields; clean body-covering clothing; rubber gloves, boots, apron as dictated by circumstances; in absence of proper environmental control, use approved dust respirator.
Personnel protection: If contact with material is anticipated, wear appropriate chemical protective clothing. Wear appropriate chemical protective gloves, boots and goggles.
Respirator Recommendations: At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (Assigned protection factor = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(Assigned protection factor = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.
Respirator Recommendations: Escape: (Assigned protection factor = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus.
Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from
anybody areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection.

Wear appropriate eye protection to prevent eye contact.

Wear appropriate personal protective clothing to prevent skin contact.

Employees should be provided with and required to use impervious clothing, gloves, face-shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with acrylamide. Employees should be provided with and required to use splash-proof goggles where there is any possibility of liquid acrylamide contacting the eyes.

PRECAUTIONS FOR "CARCINOGENS": In chemical laboratory, gloves & gowns should always be worn, however, gloves should not be assumed to provide full protection. Carefully fitted masks or respirators may be necessary when working with particulates or gases, & disposable plastic aprons might provide additional protection. Wear rubber gloves, safety glasses and overalls.

The unloading station for dry acrylamide should be equipped with an exhaust hood.

- MEDICAL TREATMENT OVERVIEW

ORAL EXPOSURE

A) EMESIS NOT RECOMMENDED

1) EMESIS: Ipecac-induced emesis is not recommended because of the potential for CNS depression and seizures.

B) ACTIVATED CHARCOAL

1) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.

C) GASTRIC LAVAGE

1) GASTRIC LAVAGE: Consider after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation. Control any seizures first.

a) CONTRAINDICATIONS: Loss of airway protective reflexes or decreased level of consciousness in unintubated patients; following ingestion of corrosives; hydrocarbons (high aspiration potential); patients at risk of hemorrhage or gastrointestinal perforation; and trivial or non-toxic ingestion.

D) PYRIDOXINE

1) Pyridoxine use in humans has been reported in a case of acrylamide ingestion, but with unproven effect. In cases of high-dose exposure or in symptomatic patients, pyridoxine use should be strongly considered.
E) SEIZURES
1) SEIZURES: Administer a benzodiazepine IV; DIAZEPAM (ADULT: 5 to 10 mg, repeat every 10 to 15 min as needed. CHILD: 0.2 to 0.5 mg/kg, repeat every 5 min as needed) or LORAZEPAM (ADULT: 2 to 4 mg; CHILD: 0.05 to 0.1 mg/kg).
   a) Consider phenobarbital or propofol if seizures recur after diazepam 30 mg (adults) or 10 mg (children > 5 years).
   b) Monitor for hypotension, dysrhythmias, respiratory depression, and need for endotracheal intubation. Evaluate for hypoglycemia, electrolyte disturbances, hypoxia.

F) HYPOTENSION
1) HYPOTENSION: Infuse 10 to 20 mL/kg isotonic fluid. If hypotension persists, administer dopamine (5 to 20 mcg/kg/min) or norepinephrine (ADULT: begin infusion at 0.5 to 1 mcg/min; CHILD: begin infusion at 0.1 mcg/kg/min); titrate to desired response.

INHALATION EXPOSURE
A) Aerosolization readily occurs.
B) 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.

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.

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) Exfoliative rashes can be treated symptomatically. Thorough neurologic examination should be performed to detect peripheral neuropathies.
The following is extracted from ERG Guide 153: SUBSTANCES - TOXIC and/or CORROSIVE (Combustible)

EVACUATION

Spill
As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

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 Guideline

GUIDE 153P

SUBSTANCES - TOXIC and/or CORROSIVE (Combustible)

<table>
<thead>
<tr>
<th>POTENTIAL HAZARDS</th>
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<tbody>
<tr>
<td>HEALTH</td>
</tr>
<tr>
<td>· TOXIC; inhalation, ingestion or skin contact with material may cause severe injury or death.</td>
</tr>
<tr>
<td>· Contact with molten substance may cause severe burns to skin and eyes.</td>
</tr>
<tr>
<td>· Avoid any skin contact.</td>
</tr>
<tr>
<td>· Effects of contact or inhalation may be delayed.</td>
</tr>
<tr>
<td>· Fire may produce irritating, corrosive and/or toxic gases.</td>
</tr>
<tr>
<td>· Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>FIRE OR EXPLOSION</th>
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</thead>
<tbody>
<tr>
<td>· Combustible material: may burn but does not ignite readily.</td>
</tr>
<tr>
<td>· When heated, vapors may form explosive mixtures with air: indoors, outdoors and sewers explosion hazards.</td>
</tr>
<tr>
<td>· Those substances designated with a (P) may polymerize explosively when heated or involved in a fire.</td>
</tr>
<tr>
<td>· Contact with metals may evolve flammable hydrogen gas.</td>
</tr>
<tr>
<td>· Containers may explode when heated.</td>
</tr>
<tr>
<td>· Runoff may pollute waterways.</td>
</tr>
<tr>
<td>· Substance may be transported in a molten form.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>PUBLIC SAFETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>· 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.</td>
</tr>
<tr>
<td>· As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.</td>
</tr>
<tr>
<td>· Keep unauthorized personnel away.</td>
</tr>
<tr>
<td>· Stay upwind.</td>
</tr>
<tr>
<td>· Keep out of low areas.</td>
</tr>
<tr>
<td>· Ventilate enclosed areas.</td>
</tr>
</tbody>
</table>

| PROTECTIVE CLOTHING |
· Wear positive pressure self-contained breathing apparatus (SCBA).
· Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
· Structural firefighters’ protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

---

**EVACUATION**

**Spill**
- See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

**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**

**Small Fire**
- Dry chemical, CO2 or water spray.

**Large Fire**
- Dry chemical, CO2, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire-control water for later disposal; do not scatter the material.

**Fire involving Tanks or Car/Trailer Loads**
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- 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.

**SPILL OR LEAK**
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Do not get water inside containers.

---

**FIRST AID**
- Move victim to fresh air.
- Call emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- 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.
- For minor skin contact, avoid spreading material on unaffected skin.
- Keep victim warm and quiet.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
3. n-Butyl Alcohol

FLAMMABLE LIQUIDS (Polar/Water-Miscible/Noxious)
- HIGHLY FLAMMABLE: Easily ignited by heat, sparks, flames
- CAUTION: Very low flash point; use of water spray when fighting fire may be inefficient
- Do not use straight streams

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HHS/NIH, National Library of Medicine

- **Property summary**

Molecular Formula: C4-H10-O
Molecular Weight: 74.12
Density Specific Gravity: 0.8098 @ 20 deg C/4 deg C
Vapor Density: 2.6 (Air= 1)
Vapor Pressure: 7.0 mm Hg @ 25 deg C
Flash Point: 98 deg F, 37 deg C (closed cup)
Closed cup flash point: 28.89 degrees C
Melting Point: -89.8 deg C
Boiling Point: 117.7 deg C
Autoignition Temperature: 650 deg F (343 deg C)
Viscosity: 36.1 cP at -50.9 deg C; 5.186 cP at 0 deg C; 2.544 cP at 25 deg C; 0.533 cP at 100 deg C
Solubilities: In water, 6.32X10+4 mg/l @ 25 deg C
  - Miscible with many organic solvents
  - Very soluble in acetone; miscible with ethanol and ethyl ether
  - > 10% in benzene

**1400 ppm [Based on 10% of the lower explosion limit for safety considerations even though the relevant toxicological data indicated irreversible health effects or impairment of escape existed only at higher concentrations.]**

**NFPA Hazard Identification**

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: 3 (Serious)**  
This degree includes Class IB and IC flammable liquids and materials that can be easily ignited under almost all normal temperature conditions. Water may be ineffective in controlling or extinguishing fires in such materials.

**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.

**Fire fighting procedure**  
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 "alcohol" foam, dry chemical or carbon dioxide.

**Protective Equipments/clothing**  
Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid butyl alcohol.

Breakthrough times are less (usually significantly less) than one hour as reported by two or more testers, for natural rubber.

For neoprene, nitrile rubber, and polyvinyl chloride (PVC), the breakthrough times are greater than one hr as reported by two or more testers.

Wear appropriate chemical protective gloves, boots and goggles.

If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration), or by the National Institute for Occupational Safety and Health.

Some data (usually from immersion tests) suggesting breakthrough times greater than one hour are not likely for polyvinyl alcohol (PVA). No data for butyl rubber (butyl), neoprene/styrene butadiene rubber (neo./SBR), polyethylene (PE), chlorinated polyethylene (CPE), polyethylene (PU), styrene-butadiene (SBR) and viton.

Wear appropriate personal protective clothing to prevent skin contact.

Wear appropriate eye protection to prevent eye contact.


Recommendations for respirator selection. Condition: Emergency or planned entry into unknown concn or IDLH conditions: Respirator Class(es): Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Recommendations for respirator selection. Condition: Escape from suddenly occurring respiratory hazards: Respirator Class(es): Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus.

**Clean up methods**

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities absorb on paper towels. Evaporate in safe place (such as fume hood). Allow sufficient time for evaporating vapors to Clear hood ductwork. Burn paper in suitable location away from combustible materials.

**Treatment Overview**

0.4.2 ORAL EXPOSURE

- A) Treatment is symptomatic and supportive.
- B) Consider aspiration of gastric contents with a nasogastric tube after substantial recent (within 1 hour) ingestions.
- C) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.
- D) HYPOTENSION: Infuse 10 to 20 mL/kg isotonic fluid. If hypotension persists, administer dopamine (5 to 20 mcg/kg/min) or norepinephrine (ADULT: begin infusion at 0.5 to 1 mcg/min; CHILD: begin infusion at 0.1 mcg/kg/min); titrate to desired response.
• E) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

0.4.3 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.

• B) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

0.4.4 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.

0.4.5 DERMAL EXPOSURE

• A) OVERVIEW
  o 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.

• Emergency Response Guideline

GUIDE 129

FLAMMABLE LIQUIDS (Polar / Water-Miscible / Noxious)

<table>
<thead>
<tr>
<th>POTENTIAL HAZARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE OR EXPLOSION</td>
</tr>
<tr>
<td>• HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.</td>
</tr>
<tr>
<td>• Vapors may form explosive mixtures with air.</td>
</tr>
<tr>
<td>• Vapors may travel to source of ignition and flash back.</td>
</tr>
<tr>
<td>• Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).</td>
</tr>
<tr>
<td>• Vapor explosion hazard indoors, outdoors or in sewers.</td>
</tr>
<tr>
<td>• Those substances designated with a (P) may polymerize explosively when heated or involved in a fire.</td>
</tr>
<tr>
<td>• Runoff to sewer may create fire or explosion hazard.</td>
</tr>
<tr>
<td>• Containers may explode when heated.</td>
</tr>
<tr>
<td>• Many liquids are lighter than water.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEALTH</th>
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</thead>
<tbody>
<tr>
<td>• May cause toxic effects if inhaled or absorbed through skin.</td>
</tr>
<tr>
<td>• Inhalation or contact with material may irritate or burn skin and eyes.</td>
</tr>
<tr>
<td>• Fire will produce irritating, corrosive and/or toxic gases.</td>
</tr>
</tbody>
</table>
· 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.

Small Fire
· Dry chemical, CO2, water spray or alcohol-resistant foam.
· Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane.

Large Fire
· Water spray, fog or alcohol-resistant 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 108 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. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

### Protective Distance Map

As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.

**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.

### 1-Octanol

**Chemical Formula:** C₈H₁₇OH

**Toxicological Data on Ingredients:** 1-Octanol: ORAL (LD₅₀): Acute: 1790 mg/kg [Mouse].

**First Aid Measures**

**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

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

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Ingestion:**
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Fire and Explosion Data**

- **Flammability of the Product:** Combustible.
- **Auto-Ignition Temperature:** 270°C (518°F)
- **Flash Points:**
  - CLOSED CUP: 81.1°C (178°F). (TAG)
- **Flammable Limits:**
  - LOWER: 1.1%  
  - UPPER: 7.4%
- **Products of Combustion:** These products are carbon oxides (CO, CO2).
- **Fire Hazards in Presence of Various Substances:** Not available.
- **Explosion Hazards in Presence of Various Substances:**
  - Risks of explosion of the product in presence of mechanical impact: Not available.
  - Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**

- **SMALL FIRE:** Use DRY chemical powder.  
- **LARGE FIRE:** Use water spray, fog or foam. Do not use water jet.

**Hazards Identification**

- **Potential Acute Health Effects:**
  - Very hazardous in case of eye contact (irritant), of ingestion.Hazardous in case of skin contact (irritant), of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.
- **Potential Chronic Health Effects:**
  - CARCINOGENIC EFFECTS: Not available.  
  - MUTAGENIC EFFECTS: Not available.  
  - TERATOGENIC EFFECTS: Not available.  
  - DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

**Accidental Release Measures**

- **Small Spill:** Absorb with an inert material and put the spilled material in an appropriate waste disposal.
- **Large Spill:**
  - Combustible material. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

**Handling and Storage**

- **Precautions:**
  - Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.
Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Exposure Controls/Personal Protection

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

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Physical and Chemical Properties

Physical state and appearance: Liquid.
Molecular Weight: 130.23 g/mole
pH (1% soln/water): Not applicable.
Boiling Point: 194.5°C (382.1°F)
Melting Point: -16.5°C (2.3°F)
Critical Temperature: Not available.
Specific Gravity: 0.827 (Water = 1)
Vapor Density: 4.5 (Air = 1)
Odor Threshold: 0.1 ppm
Solubility: Insoluble in cold water.

Stability and Reactivity Data

Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Not available.
Incompatibility with various substances: Not available.
Corrosivity: Non-corrosive in presence of glass.
Polymerization: No.

Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.
Toxicity to Animals: Acute oral toxicity (LD50): 1790 mg/kg [Mouse].
Chronic Effects on Humans: Not available.
Other Toxic Effects on Humans:
Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of inhalation.

NFPA hazard identification:
National Fire Protection Association (U.S.A.):
Health: 1
Flammability: 2
Reactivity: 0
Specific hazard:
Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.
4. DISASTER MANAGEMENT PLAN

4.1 INTRODUCTION
A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life. Disasters can be divided into two main groups:

(a) Man Made Disasters
Malafide intentions such as sabotage, riots, industrial unrest, air attack etc. resulting into industrial accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, other structural collapses, air, sea, rail and road transport accidents, aircraft crashes, collisions of vehicles carrying inflammable liquids, oil spills at sea etc. will required State/National level resources to combat it.

(b) Natural Calamities
Disasters resulting from natural phenomena like earthquakes, volcanic eruption, storm, surges, cyclones, tropical storms, floods, landslides, forest fires and massive insect infestation. Also in this group, violent draught which will cause a creeping disaster leading to famine, disease and death must be included. These types of disasters are not under the purview of this plan.

Any kind of disaster can result in emergency situation in plant area. Depending on the type & place of the emergency, it can be classified in two categories:

(a) On Site Emergency
Emergency due to conditions (uncontrolled reaction, small fire, small gas leak, spill, failure of power, water, air, steam, cooling media, scrubbing media etc.) and which can be locally handled by plant personnel alone (without outside help) is not considered as major emergency. Line of actions to tackle such emergencies should be as per the onsite plan.

(b) Off Site Emergency
A major emergency occurring at work is one that may affect several departments within and / or may cause serious injuries, loss of life, extensive damage to property or serious disruption outside the works. It will require the use of outside resources to handle it effectively. Usually the result of a malfunction or the normal operating procedures, it may also be precipitated by the intervention of an outside agency or natural calamity such as a severe storm, flooding, crashed aircraft or deliberate acts of person or sabotage.

4.2 MAJOR ON–SITE EMERGENCY
The identification of maximum onsite credible accidents due to Toxic and flammable material may arise from:

(1) A slow intermittent release through a leaking relief valve.
(2) A fire or mechanical damage is threatened on installation containing toxic and flammable material, over pressurization or plant failure.
(3) Due to spillage of toxic chemicals.
(4) A major accident may occur due to sudden release of large quantity of toxic and flammable substances, as it would form large toxic cloud or vapor cloud. Although the probability of such an event occurring is extremely low.

4.6 TRANSPORTATION EMERGENCY FOR HAZARDOUS CHEMICALS
The rapid growth of industries in India has boosted the transportation of hazardous chemical by road. This has in turn given birth to transportation emergency. When the carriers of the hazardous substances gets involved in accident it leads to disastrous consequences, maybe due to fire, explosion or toxic spillage resulting in damage of property, environment pollution and sometimes even loss of human life on both the sides of the transportation route. For handling and minimizing such emergency following survey is undertaken.
The routes of transportation by road for hazardous chemicals are identified and restricted, so that the least populated area is affected during emergency.

Population survey on both sides of the proposed transportation routes up to 500mm is undertaken so that the approximate number of people likely to be affected can be identified beforehand. Accordingly necessary evacuation and medical preparedness can be planned during the time of emergency.

4.7 FACTORS TO BE CONSIDERED DURING EVACUATION REQUIRED DUE TO CHEMICAL HAZARDS SPILLAGE

(i) The Dangerous Goods
- Degree of health hazard
- Amount involved.
- Containment /control of release.
- Rate of vapour movement.

(ii) The Population Threatened
- Location
- Number of people
- Time to evacuate or protect in place
- Ability to control evacuation or protection in place
- Building types and availability
- Special institutions or populations e.g. nursing homes, hospitals, etc.

(iii) Weather conditions
- Effect on vapour and cloud movement
- Potential for change
- Effect on evacuation or protection in-place.

4.8 ON SITE EMERGENCY MANAGEMENT PLAN

This emergency management plan specially deals with “On-site emergency” i.e. with respect to accidents that may take place in the industry and their effects are confined to the factory premises, involving only the people working in the factory.

4.8.4 Fire – Emergency Control Management

- Any person who notices fire will immediately inform through phone or massager to:
  - Main gate
  - Concerned supervisor/shift incharge
  - HOD (Security and firefighting)
- Concerned supervisor will switch off electricity near the place of fire.
- Use suitable firefighting equipment placed at various locations. Fire extinguishers will be provided in all area, information of the fire extinguishers will be shown on plant layout drawing and provided to all department & concern personal.
- Use fire hydrant provided in the plant properly as per suitability under guidance & supervision of site in charge.
- Main gate will send ambulance to the accident site and inform Chief Medical Officer.
- Security and firefighting personnel will rush to the site along with necessary equipment and cordon off the area. They will not allow unauthorized persons to enter in the area of fire.
- Security and firefighting personnel and other personnel will start using suitable firefighting equipment to extinguish fire.
- HOD Utility will ensure smooth supply of water.
- HOD will arrange to remove any stored material that is likely to come in contact with fire and may catch fire.
- HOD will arrange to dispose burnt material as waste as per waste disposal of that department and take appropriate action for mitigation of environmental impacts.
Table 4.1: Location of fire hydrant point with hose box

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Area / Plant</th>
<th>Nos. Of Hydrant point with hose box</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant Areas and Utility area</td>
<td>01</td>
</tr>
<tr>
<td>2</td>
<td>R.M. Storage and Tank area</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Administrative Building</td>
<td>01</td>
</tr>
</tbody>
</table>

Table 4.2: List of Fire Extinguisher

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Area</th>
<th>Type of Extinguisher</th>
<th>Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R.M. Storage &amp; Tank Area</td>
<td>Dry powder</td>
<td>05</td>
</tr>
<tr>
<td>2</td>
<td>Shed</td>
<td>Dry powder</td>
<td>02</td>
</tr>
<tr>
<td>3</td>
<td>Office</td>
<td>Dry powder</td>
<td>02</td>
</tr>
<tr>
<td>4</td>
<td>Security Office</td>
<td>Dry powder</td>
<td>04</td>
</tr>
<tr>
<td>5</td>
<td>Spare</td>
<td>Dry powder</td>
<td>02</td>
</tr>
</tbody>
</table>

Emergency Control Procedure for Hazardous Chemicals

- In case of any major incident in chemical storage &/or transfer/handling system, immediately inform through phone or messenger to:
  - Main gate
  - Concerned supervisor / shift in charge
  - HOD (Security & Fire Fighting)
- Main gate will inform ambulance to send at the accident site and inform to Medical Officer.
- Security and firefighting personnel will rush to the site along with necessary equipment and cordon off the area. They will not allow unauthorized persons too near to the accident site.
- The emergency management team will follow the methods established in line with the guidelines of “Chemical Emergency Response Guide” as prepared separately for all chemicals.
- If any person is injured or affected in incident, provide first aid or shift him to dispensary, if required.
- If there is fire following leak/spill, follow procedure for mitigation of fire.
- If there is spillage of hazardous chemical following fire &/or dispersion, HOD arrange to collect the material, clean the area and dispose it accordingly after treatment as per the methods established in line with the guidelines of “Chemical Emergency Response Guide” as prepared separately for all chemicals.
- HOD will arrange to transfer spilled material and take appropriate action for mitigation of environmental Impacts as per the waste disposal plan and regulatory guidelines.
- Effluent treatment plant will take necessary action to treat the effluent arising out of the emergency control /management activities effluent.

4.8.5 Control Room

The security office, at main gate, will be the control room that is manned 24 hours. The control room will be headed by Manager- Security, assisted by HOD (Personnel) and Safety Officer. The following facilities are available in the control room:

- Layout of the plant
- Emergency Contact List
- Maximum number of people working at a time and assembly points
- Population around the plant
- Internal and external telephones with telephone directory
- Public address system
• Torch lights
• List of dispensaries and registered medical practitioners around the plant
• Area map of surrounding villages
• Nominal roll of employees
• Note pads and pencils to record message received and instruction to be passed through runners
• The methods established in line with the guidelines of “Chemical Emergency Response Guide”
• “Chemical Emergency Response Guide”
• A copy of Emergency Plan
• List of emergency control committee, emergency crew, medical staff, transportation staff, and security and firefighting staff
• First aid box, jiggery, and peppermint
• Sitting arrangement

4.8.6 Emergency Contact List
During emergency, any person facing incident or any person aware of incident or any person seeking information for emergency contact details will use the following list.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name / Designation</th>
<th>Contact</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. Vedprakash Sudhakar Mishra Managing Partner</td>
<td>Direct Line</td>
<td>0260-2780005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 09377000488</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mr. Rajesh Parekh (Plant Manager &amp; Safety In-charge)</td>
<td>Direct Line</td>
<td>0260-2780005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 9324289816</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mr. Vedprakash Sudhakar Mishra (Chemist) Plant operator</td>
<td>Direct Line</td>
<td>0260-2780005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 09377000488</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mr. Shravankumar Yadav (Incharge-Maintenance)</td>
<td>Direct Line</td>
<td>0260-2780005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home -</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 7878745373</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mr. Sanjiv Joshi (EXECUTIVE- Adm./P&amp;A/HR)</td>
<td>Direct Line</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 9223343955</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mr. Subhash Yadav (Security In-charge)</td>
<td>Direct Line</td>
<td>0260-2780005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercom --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home --</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile 9328264150</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Local Crisis Control Room, Sarigam</td>
<td></td>
<td>0260-278139</td>
</tr>
<tr>
<td>8</td>
<td>Fire Services, Sarigam</td>
<td></td>
<td>0260-2780222</td>
</tr>
<tr>
<td>8</td>
<td>Common Fire Service Contact, Hot Dial</td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>8</td>
<td>Police Stations/control room:</td>
<td></td>
<td>0260-2780933</td>
</tr>
</tbody>
</table>
### 4.8.7 Assembling Point

During emergency, one emergency assembling point is provided inside near main gate area/ security cabin. The person will move opposite to wind direction (facing direction from which wind is blowing) and away from the source of chemical leakage. When possible and space is available, person will move into left & right direction of the wind direction and finally will reach to the assembly point. Wind direction may be known by seeing direction of windsocks located at different points in the mill and direction of stack smoke.

### 4.8.8 Warning Signal

In case of emergency, people will be informed by raising siren. Manager Security/Manager P&A are authorized to raise siren. Siren will be blown intermittently for 5 minutes and will be treated as declaration of major emergency. Siren will be located at turbine house of power block.

### 4.8.9 Emergency Ending

The emergency will be declared ended when the source of gas emission has been effectively isolated and gas clouds dispersed. This will be done by on – site incident controller. Siren will be blown intermittently for 2 minutes to declare emergency end.

### 4.8.10 Emergency Control Committee (ECC)

The emergency control committee will comprise of the following members.

- Managing Partner/Units Head - Main Controller
- General Manager – On-site Incident Controller(Leader)
- Production Manager – Dy. On-site Incident (Jn. Leader)
- Manager (EHS)- On-Site Instructor
- Maintenance Manager
- Manager (P&A, Admin)
- HOD (Laboratory)
- In-charge/Manager (Godown)
- Manager (Commercial)
- In-charge/Manager (Security)
- Safety Officer
4.8.11 Responsibilities of Persons Involved

A. Works Main Controller

Either or Both of Managing Director & Unit Head will be works main controller. He/they will take care of on-site emergency plan. As soon as he/she is informed of emergency, he/she will:

- Assume responsibilities for overall main control.
- Ensure that members mentioned called in.
- Maintain a speculative continuous review of possible development and assess these to determine most probable cause of events.
- Arrange to maintain chronological record of emergency.
- Issue authorized statements to news media and inform head office.
- Inform outside emergency services including fire, police, hospitals, District Magistrate.

B. On-Site Incident Controller & Dy. On-Site Incident Controller

Either of General Manager or Manager Production will be the on-site incident controller. When General Manager is assigned duty of On-site Incident Controller the Manager Production will act as Dy. On-site Incident controller. In other case, when General Manager is not available, Dy. On-Site Incident controller will act as On-site Incident Controller. As soon as he/she is informed of emergency, he/she will proceed to the site. On arrival he/she will:

- Assess the scale of emergency and decide if a major emergency exists or likely to exist and declare it.
- Direct all operation for controlling and stopping chemical leakage with the following priorities:
  - Secure safety of personnel
  - Minimum damage to plant and machinery
- Direct rescue operation
- Ensure that affected area is searched for causalities
- Ensure that all non-essential workers in affected area leave the place (direct them to go to the assembly point as per wind direction)
- Report developments to works main controller
- Keep record to preserve evidences to facilitate any subsequent enquiry

C. Communication and Advisory Team

This team will consist of manager/head of various departments of the company.
D. **Emergency Security Controller**
   He will be the senior most security person located at main gate office. He will take care of security of the plant and also guide outside government agencies.

E. **Medical Officer**
   Medical officer will be a doctor / trained compounder at occupational health center / dispensary of plant / first aid center.

F. **Worker**
   - Workers /employee of A/B/C shift having duty in following area/department will not leave their place of work without instruction by On-site Incident Controller &/or Dy. On-site Incident Controller &/or HOD of respective area/department:
     - Boiler operation
     - Tank Farm Area
     - Water supply
     - Electrical Dept.
     - Logistic/transportation
   - Persons of any department instructed specifically not to leave the plant by shift in-charge/ shift supervisor
   - Shift workers will see that leakage in any tank is contained and eliminated under guidance of their supervisor/shift in-charge
   - Shift workers are strictly subjected to follow the manual of Chemicals while working in the area having hazardous chemicals. All workers will work with hazardous chemicals only under guidance /supervision of their supervisor / shift in-charge
   - Shift workers (Water Supply) will ensure water supply to colony and plant. In no case water supply to the colony will be cut off.
   - Shift workers (Electrical) will ensure power to water supply, colony, and plant. In no case power is to be switched off. They will also ensure cut-off of power in the area where power supply required to be stopped.
   - Boiler attendants and operators will ensure that their plants are stopped in orderly manner without any damage.
   - In-charge of transportation will ensure that their vehicles are parked in proper area to avoid blockage on road and all vehicles are in ready condition for evacuation operations in case of evacuation is required.
   - Other shift workers specifically instructed not to leave the plant, will perform the following function:
     - Act as extra first aiders to deal with casualties
     - Transport equipment, if any, to the incident
     - Remove vehicles away from the risk areas
     - Act as runners in case of communication difficulties
     - Any other work directed by senior person present at that location
   - All other workers, except those mentioned above, will leave their work place after stopping their plant properly to avoid damage.
   - After completing the above-mentioned/assigned works, all workers will leave their place immediately.

G. **Communication System**
   Following communication system will be followed:
   - Control room and place of incidence: Telephone/Mobile/Messenger/Internal Network/Internet
Between two control teams: Telephone/Messenger/Walky-talky/Mobile/Internal Network
For general communication is all area: Mike/Speaker equipped with microphone further, public address system is provided at control room.

H. Safety Appliances
All safety appliances as required to combat the emergency as suggested in “Chemical Safety measures/MSDS” will be made available in plant. All plant area will have suitable safety equipment like; fire extinguisher, self-contained breather, mask, goggles, safety suit, hydrant etc. as required.

I. Check – Up Schedule
For handling of hazardous materials, standard procedures shall be followed. Further, regular check-up shall be done to ensure safety. Guidelines for such check-up are given below:

<table>
<thead>
<tr>
<th>Particular</th>
<th>Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage in Hazardous Chemicals Tanks/Drum/Container/Pipelines</td>
<td>Daily</td>
<td>Manager (Production)</td>
</tr>
<tr>
<td>Temperature, Pressure &amp; Groundings</td>
<td>Daily</td>
<td>Manager (Production)</td>
</tr>
<tr>
<td>Storage &amp; handling of materials as per standard procedure</td>
<td>Daily</td>
<td>Manager (Production &amp; EHS)</td>
</tr>
<tr>
<td>Pump, Motors &amp; Valves for operation</td>
<td>Weekly</td>
<td>Manager (Maintenance)</td>
</tr>
<tr>
<td>Availability &amp; Conditions and use of Safety appliances</td>
<td>Weekly</td>
<td>Manager (EHS&amp;/or HR)</td>
</tr>
<tr>
<td>First aid box, peppermint, antidotes, vaccines and medicines</td>
<td>Weekly</td>
<td>Manager (Production&amp;/or HR)</td>
</tr>
<tr>
<td>Fitting and fixtures</td>
<td>Monthly</td>
<td>Manager (Maintenance)</td>
</tr>
<tr>
<td>Recalibration of pressure gauge &amp; flow meters</td>
<td>Monthly</td>
<td>HOD (Instrumentation)</td>
</tr>
<tr>
<td>Siren</td>
<td>Daily</td>
<td>HOD (Electrical)</td>
</tr>
<tr>
<td>Mock drill for Chemical leakage &amp; Fire</td>
<td>Half yearly</td>
<td>Manager (Production)</td>
</tr>
<tr>
<td>Medical check – up</td>
<td>Half yearly</td>
<td>Manager (HR/P&amp;A)</td>
</tr>
<tr>
<td>Testing of hoist, ropes, and sling</td>
<td>Yearly</td>
<td>Manager (Maintenance)</td>
</tr>
<tr>
<td>Pipeline and fitting replacement</td>
<td>Once in 4 yrs.</td>
<td>Manager (Maintenance)</td>
</tr>
</tbody>
</table>

J. Training
To educate employees, their families, and inhabitants in surrounding villages regarding precautions to be adopted and information system in case of hazardous chemical leak and also to train a group of employees in methods and procedures to prevent and/or to contain such leak is highly essential and is provided as under:

- Training and holding regular mock drills in dealing with hazardous chemical leak to employees working in hazardous chemical handling area, production plant & other areas.
- Training and holding mock drill in dealing with hazardous chemical leak and familiarization with terrain to fire and security staff.
- General safety instructions to protect individual from effects of chemicals are also propagated through safety exhibitions. Further, these instructions are displayed and distributed in English, Hindi, and Gujarati.

K. Medical Facility
The company shall have occupational health center/ dispensary for medical treatment. A full time/contracted MBBS, MD doctor shall be in charge of the center. Further, many hospitals are located nearby area / villages. To provide first aid to the affected person first aid box will be provided in the company. First aid box will be regularly checked.
L. Mutual Aid

While necessary facilities shall be made available and shall be updated from time to time, sometimes, it may be necessary to seek external assistance; it may be from the neighboring factories or from the State Government as the case may be. Upon inception of operation of the company following company of KASEZ will be contacted to establish the mutual facilities for emergency management.

- Gelkaps sports pvt Ltd, (South)- plot no.265 to 267
- Strands Textile Mills Pvt Ltd (North)- Plot No.370 to 371.
- Praj Industries Ltd (west)- plot No.307 to 314
- Flamingo Multi Pore (East)- plot no.384
- Sun Look (East)- plot no.385

M. Mock Drill

In spite of detailed training, it may be necessary to try out whether, the Onsite Emergency Plan work out and will there be any difficulties in execution of such plan. In order to evaluate the plan and see whether the plan meets the objectives of the Onsite Emergency Plan, occasional mock drills are contemplated. Before undertaking the drill, it would be very much necessary to give adequate training to all staff members and also information about possible mock drill. After few pre-informed mock drills, few UN-informed mock drills would be taken. All this is to familiarize the employees with the concept and procedures and to see their response. These scheduled and unscheduled mock drills would be conducted during shift change, public holidays, in night shift etc. To improve preparedness once in 6 months and performance is evaluated.

4.9 OFF – SITE EMERGENCY MANAGEMENT PLAN

The off-site emergency plan prepared herein will deal with those incidents, identified in the on-site plan, which have the potential to affect adversely the persons or the environment outside the boundary of the premises. Whenever such an emergency occurs, there is a great need to control and isolate the danger, and to minimize the adverse effect to the greatest extent possible. This plan has been drawn up with a view to mobilize resources and integrate with State Contingency Plan for an effective system of command and control in combating the emergency.

The off-site plan is the tool for co-ordination of existing services and their readiness, as far as possible, for the hazards and problems, which may arise in an incident. The information for the off-site emergency plan such as site Data, Toxic Cloud Dispersion distances, Role of Factory Management, External Support Services, Transportation Emergencies etc. is furnished.

Thus in brief the two main purposes of the off-site emergency plan are:

- To provide the local/district authorities, Police, Fire Brigade, Doctors, surrounding industries and public, the basic information of risk assessment and to appraise them of the consequences and the protection/prevention measures and control plans and to seek their help to communicate with the public in case of a major emergency.
- To assist the State Authorities (GSDMA, Collectors etc.) for preparing the off-site emergency (Contingent) plan for the district or particular area and to organize rehearsal from time to and initiate corrective actions based on the lessons learnt.

A. Central Control Room (CCR)

The central control room is the place under the control of chairman of local crisis plan (LCP) committee, where the operations to handle the emergency are directed and co-ordinated. It is the Centre of Resources Mobilisation, Information & Media Communication.

B. Fire & Rescue Wing

The control of fire is normally the role of the fire commandant, till the controller of team of local disaster management authority come on site. He may also have a similar role for other type of incident like
explosions, toxic release and collapse of structure where rescue work is to be carried out in scientific and systematic way. He has to ensure mobilization of all the fire services, and other requirements to achieve the target. He will liaise with other coordinator and feed the information regarding incident to the scene of fire or to the site.

**PHASE 1: During Normal Circumstances Fire & Rescue Wing Should Carry Out and Get Prepared During Normal Period**

1. Identify hazard potential areas.
2. Knowledge of approach roads & escape routes.
3. Provision adequate water supply and knowledge of other sources of water supply.
4. Arrangement of adequate type of firefighting equipment.
5. Provision of well-trained manpower.
6. Arrangement for pulling out manpower and resources from various units, without loss of time.
7. Provisions of required quantity of fire extinguishing chemicals & their easy procurements, also with mutual aid system.
8. Proper & efficient communication system, preferably wireless, on single channel.
9. Adequacy of specialized rescue team, with specific equipment.
10. Maintaining the standard firefighting equipment and store in working condition to meet call at any time.
12. Knowledge of chemicals and their properties and types of fire extinguishing media to be sued.
13. To arrange the training for fire crews and rescue team for evacuating purpose.
14. Incident involving chemical emergency/ toxic gas release, situation shall be handled by wearing self-contained breathing apparatus, along with protective clothing.
15. Fire commander shall keep ready a special jacket, to wear during emergency for identification. Proper co-ordination is required with police for the quick movement of fire fighting vehicles.
16. To know about the arrangement to keep open railway level crossing for quick movement of fire fighting vehicles I required with railway authority.

**PHASE 2: During Emergency**

1. For identification of fire-commander shall wear a special jackets or identification.
2. Immediately after receiving the message from Local Control Room (LCR), the Fire Commandant shall activate/mobilize the crew to order from nearby Fire Station & rush to the site under intimation to LCR.
3. The fire commandant, before ordering, will ensure the type of fire-extinguishing media required and approximate quality on getting information about the scene of fire or the units.
4. At the site of incident, the Fire Commandant will thoroughly observe and inspect and survey the site for the use of fire media, and will start functioning accordingly, till the emergency is controlled in all respect, with constant touch with LCR, giving the details and adopted controlling procedures.
5. Fire commandant will act as Incident controller at site. All the agencies shall report to him at site.
6. Further, in case of more help required, he will report to LCR accordingly with specific and clear instructions for such help.
7. For the suspect trapped personnel, in case of toxic gas leakage and major fire, rescue operation will be carried out as instructed by LCR on the advice of experts using necessary respiratory protection system.

**PHASE 3: After Emergency**

1. Incident controller will give the details about the incident to LCR also, for further actions, if required.
2. After “ALL OK SIREN” the necessary precautionary measures will be put in practice.
3. Work of removal of debris, removal of trapped persons or removal of dead bodies or other work as per scenarios & instructions will be carried out.
4. Incident Controller will assess the total damage and will give clear report about the scene to the chairman of LCG.
5. Incident controller will assess the adequacy of the work carried out and lacuna in the actions and find out the improvement to be required.

C. Warning, Evacuation & Traffic Control Wing

**Role:**
Formal duties of the Police Authority during emergency include protecting life and property and controlling traffic movement. Further, police have to control and evacuate unnecessary public, to cordon off area of incident and ensure free movement of vehicles involved in relief operations.

**Functions:**
1. Control and regulations of traffic within the area of incident.
2. Assist the fire-fighting wing by cordonning off the affected area and help the fire-fighting wing by supplementing fire-fighting personnel to the extent possible.
3. Assist the medical & evacuation personnel to work without any hindrance and help the medical department in evacuating casualties.
4. Prevent unauthorized entry into the affected area.
5. To control general law & order situation.

**During Normal Circumstances:**
1. To develop control point and communication system.
2. To plan clear chain of command and control for controlling traffic at accident site.
3. To decide assembly point, shelter points etc. keeping in view the wind direction.
4. To arrange necessary equipment for warning the population.
5. To prepare procedure to regular traffic and diversion of traffic on approach road to accident prone industrial pockets.
6. To keep co-operation with all emergency services and Control Room.
7. To arrange training for police staff.
8. To gain knowledge of risk hazards and identify accident-prone areas.
9. To decide strategy to pull out resources.
10. To issue passes to persons expected on duty, transport services and others.
11. To communicate about transfer of officer, charge in address with telephone number to the LCG for updating the information.
12. To decide procedure to maintain records.
13. To lay down the scheme of wireless network for smooth flow of information to various agencies for containing the emergency.

**During Emergency:**
1. On getting information about the emergency, from incident place or from the chairman of LCG and DySP, start functioning of control room at the incident place.
2. Arrangement should be made to maintain law and order in strict manner at the incident place and nearby.
3. Arrangement to control unwanted traffic and to divert unwanted traffic via safe route.
4. To post senior police officers near the mishap site.
5. Immediate and continuous announcement to make awareness about emergency among surrounding population.
6. Cordon the area so that area will not be crowded or blocked by unwanted people.
7. To keep the road clear and to see smooth flow of traffic.
8. To work in consultation with CCR and report the details of real position of each place.
9. To keep and carry out evacuation and remove trapped persons. Moreover, to ensure protection of property in evacuated areas.
10. To divert the person to first air port, casualty receptions center and base hospital according to the situation.

11. To ensure that there is no interruption in the performance of tasks allotted to other emergency services.

12. Communicate the surrounding public instructing them to leave the area and move to the shelters and other safe place as decided, in case of release of toxic gas, the clear instruction should be communicated by wireless set/walkie-talkie through mobile vehicles, who should also wear the protective equipment like self-breathing apparatus.

**After Emergency:**

1. The evacuated areas (industrial and residential) should be securely protected till the rehabilitation is completed.

2. The place of incident should be preserved from evidence and theft point of view.

3. After getting clearance from LCR, traffic should be resorted in the control way.

After the report of activities carried out during and after the emergency should be submitted to the Chairman of LCG.

**D. Actions For Emergencies Involving Road Tankers Carrying Hazardous Chemicals**

In recent years, India has witnessed rapid growth in transportation of hazardous chemicals by road. Major road accidents have clearly demonstrated that hazardous chemical carries, when involved in accidents, can cause disastrous consequences like fire, explosion & spillage resulting in loss of life and property besides environmental pollution. Such accidents demand immediate availability of essential information to take appropriate counter measures.

The products of chemical industry vary enormously in their types, property and degree of hazard, ranging from explosives to plaster board. These are transported as solids, liquids in a wide range of temperatures and pressures.

Realizing the dangers, the new Motor vehicles Act 1988 has been introduced in India by imposing permit conditions for vehicles carrying hazardous substances. Under this new act, every motor vehicle carrying hazardous substances should comply with certain regulations:

(i) **Role of Transport Crew**

1. Motor vehicle carrying hazardous substance should have the emergency information panel which provides details in the event of emergency. It indicates the Correct technical name of the substance being transported, it’s UN – Number, Hazchem Code and UN Hazard class label. The panel also provides for contact telephone number in an emergency, as also specialist advice.

2. The driver of the vehicles should possess related Tremcard from the respective suppliers and to be kept on the vehicles.

3. To maintain the vehicles, accessories, protective clothing and other equipment in good conditions.

4. In case of mishap, the driver should be reported, immediately, to the nearest police station.

5. At the time of mishap, the helper/ cleaner/ driver who-so-ever remain present should handover ‘Tremcard’ or written information about the contained chemicals to the emergency services.

(ii) **Role of CCR**

On the receipt of an incident/mishap report, the Central Control Room will ensure that the emergency services have been summoned through Fire Officer of the company, till the fire controller of LCG comes at site and will obtain the specialist advice & inform the expert to remain on telephone, if any assistance is needed.

A manufacturer’s/ trader’s/ supplier’s specialist advice should normally be sought if deemed necessary after the situation has been assessed by the Emergency Services. This procedure may, however, be varied according to the situation and advice by experts.

(ii) **Methodology**

Policy based on the knowledge of immediate danger area does the action for initial cordonning.
(iii) Evacuation

1. Determination the extent of evacuation required in consultation with the emergency commander.
2. Residents should be advised to travel slowly and cautiously and not to burden themselves with unnecessary baggage.
3. Ensure that buses/trucks/vehicles are properly lined up at various pick up points. Responsible officer should be posted at these points to supervise loading and dispatch of buses/vehicles.
4. Ensure that drivers of buses/vehicles/trucks are given clear instruction about route and their destination.
5. Make proper security arrangement to look after houses and property in their absence, in other words, chances of theft etc. should be minimized during the period when the residents are away.
6. Get in touch with Div. Manager (Railway) & / or Local State Transport Manager to arrange the evacuation by railway or bus if required.
7. Ensure that battery/diesel operated floodlights are ready to be made functional in case there should be need for the same.
8. Decide in consultation with emergency commander for return of residents.

Register should be maintained giving evacuation and other details with time.

If evacuation is required, it is carried out as guided in the “Chemical Emergency Response Guidelines” table of isolation and protective action distances.

Before Evacuation the following factors are also to be considered.

The Dangerous Goods
- Degree of health hazard
- Amount involved
- Containment /control of release
- Rate of vapor movement

The Population Threatened
- Location
- Number of people
- Time to evacuate or protect in place
- Ability to control evacuation or protection in place
- Building types and availability
- Special institutions or populations e.g. nursing homes, hospitals, etc.

Weather conditions
- Effect on vapor and cloud movement
- Potential for change
- Effect on evacuation or protection in-place.
Figure: Evacuation Plan in Emergency