BEIL Infrastructure Limited

ONSITE EMERGENCY PLAN

Update On Oct, 2019

Plot No # 9701-9716, GIDC Industrial Estate, Ankleshwar – 393 002

Dist – Bharuch, Gujarat

INDEX

ANNEXURE SECTION

CHAPTER-I

PRELIMINARY

1. INTRODUCTION OF THIS PLAN

Primarily this plan is prepared to furnish details, which may require at the time of the emergency, to delegate responsibility, to estimate the consequences in advance and to prepare ourselves to control any type of EMERGENCY. This plan is in two sections. The first section explains basic requirements as fallow.

- Definition.
- Objectives
- Hazard identification.
- Risk analysis and environmental Impact Assessment.
- Organization setup.
- Communication system.
- Action on site.
- Link with offsite emergency plan.
- Training rehearsal and record aspect.

Second section is given as Annexure Section containing useful Annexure. These annexes are designed to give specific information required during emergency. Ready information in all this Annexure will considerably save time in initiating all actions at the time of emergency. It will also be useful to Govt. for preparing the Area emergency control (Contingent) plan.

A separate chapter is given to pay attention on.

- Offsite effects of any emergency.
- The duties and functions to control it.
- Link with onsite emergency plan.

2. IDENTIFICATION OF THE FACTORY

Bharuch Enviro Infrastructure Ltd (BEIL) is a Company promoted by industries in Bharuch District with major shareholding by UPL Ltd. to handle different types of wastes generated by the neighboring industries. Drains and Temporary Storage have been provided. BEIL is operating a secured landfill for disposal of solid / hazardous wastes from member industries in the region. The site has implemented Environmental Management System Standards ISO 14001 and Occupational Health & Safety Assessment Standards OHSAS 18001. The site is in operation from 1998 and so far, more than 23 Lacs MT of solid / hazardous wastes have been collected and disposed off

The unit operates continuously in three shifts with total employees of around 300 in the factory. In every shift around 30 people are working.

Following are the details about the plant.

1. (A) Name_& Address of Factory

Bharuch Enviro Infrastructure Ltd.,

9701 - 9716, GIDC Industrial Estate,

Ankleshwar- 393 002

Dist. Bharuch,

Gujarat State

Location

- The factory is around 12 kms, away from Bharuch Town and it is towards South side.
- From Ankleshwar station, it is 6 km towards East side.

(B) Regd. Office Address

Plot No. 117-118, GIDC Estate,

Ankleshwar 393 002

Dist.: Bharuch (Gujarat)

2. Telephone Nos.

Factory : (02646) 253135 / 225228

Registered Office : (02646) 251223 / 250336

3. Full Name & Designation of the Occupier

Mr. Ashok A. Panjawani (Director)

4. Office Address & Telephone No. Of Occupier

Bharuch Enviro Infrastructure Ltd.,
9701 - 9716, GIDC Industrial Estate,
Ankleshwar- 393 002
Dist. Bharuch,
Gujarat State
Office Tel.No. : (02646) 253135, 225228
Residential Tel. No. : 9909994902

5. Working Shifts :

Shift	Male	Female	Total
General (9:00 AM To 5:30 PM)	178	20	198
First (07.00 AM To 03.00 PM)	125	0	125
Second (3:00 PM To 11:00 PM)	75	0	75
Third (11:00 PM To 7:00 AM)	65	0	65
TOTAL	443	20	463

6. Persons to be contacted first in case of emergency

Name & Designation	Place of availability	Telephone Nos	
		Office	Residence
Mr. B. D. Dalwadi	ADM	02646-253135 Ext-101	9909994959
Mr. Manoj Patel	ADM	02646-253135 Ext-115	9909994907
Mr. Atul Agrawal	Inci.office	02646-25135 Ext-202	9909994908
Mr. Omprakash Mahto	Plant Office	02646-253135 Ext-201	9099097212
Mr. M.G. Gami	Incinerator Plant	02646-253135 Ext-217	8758526894
Mr. Ashish Gurjar	HR Office	02646-253135 Ext-107	9913064336
Mr. Sathish Gaddam	QC	02646-253135 Ext-127	8238088363
Mr. Dinkar Trivedi	Old Control Room	02646-253135 Ext-238	9978996347
Mr. Sanjay S Joshi	Safety Office	02646-253135 Ext-232	7575001962

Pls. refer annexure - 1 on page no. 66

3. MAP OF THE AREA

M/s. Bharuch Enviro Infrastructure Ltd., is located at 9701 to 9716, GIDC Industrial Estate, Ankleshwar – 393 002 Dist: Bharuch, Gujarat State. It is 6 km. away from Ankleshwar Railway Station. Other chemical manufacturing units located are, on the East side Agriculture land upto Jitali, North Side Industrial Solvents & chemicals Pvt. Ltd., South Side Agriculture land, on West side small scale industries, M/s, Prerana, M/s, Dhiraj can.

Pls. refer annexure – 2 on page no. 67

4. DEFINITIONS

Various definitions on different analogy used on Onsite & off site Emergency Plan are as below:

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

A major accident is a sudden, unexpected, unplanned event, resulting from uncontrolled developments during an industrial activity, which causes, or has the potential to cause –

i. Serious adverse effect immediate or delayed (death, injuries, poisoning or hospitalization.) to a number of people inside the installation and /or to persons outside the establishment, OR

ii. Significant damage to crops, plants or animals, or significant contamination of land, water, or air, OR

iii. An emergency intervention outside the establishment (e.g.: evacuation of local population, stopping of local traffic), OR

iv. Significant changes in the process operating conditions, such as stoppage or suspension of normal work in a concerned plant for a significant period of time, OR

v. Any combination of above.

An emergency could be defined as any situation which presents a threat to safety of persons or/and property. It may require outside help also.

A major emergency occurring at a work is one that may affect several departments within it 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 malfunction of the normal operating procedures, it may also be participated by the intervention of an outside agency, such as severe electrical storm, flooding, crashed air craft or deliberate acts of arson or sabotage.

Emergency due to operating conditions (uncontrolled reactions, small fire, small gas leak, spill, failure of power, water, air, steam, cooling media, scrubbing media, etc.) is not considered as a major emergency. Operating instructions in the safety manual shall cover this area, though the on-site emergency plan will also be helpful.

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

1. Disaster resulting from natural phenomena likes earthquake, volcanic eruptions, storm, surges, cyclones, tropical storms, floods, landslides, forest fires, and massive insect infestation. Also in this group, violent draught which will cause a creeping disaster leading to famine, disease, and death must be included.

2. Second group includes disastrous events occasioned by man, or by man's impact on environment, such as armed conflict, industrial accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses; air sea, rail and transport accidents, air crafts crashes, collisions of vehicles carrying inflammable liquids, oil spills at sea, and dam failure.

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

Environmental pollutant defined by the same Act as any solid, liquid or any gaseous substance present in such concentration as may be or tend to be injurious to environment.

Hazardous substance is also defined by the same Act and Hazardous process is defined by Section 2(cb) of the F.A.1948.

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

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

Risk is the likelihood of an undesired event (i.e. accident, injury or death) occurring within a specific period or under specified circumstances. It may be either a frequency or

a probability depending on the circumstances.
As per example risk of death for a man aged 30 is 1x10-3 per annum and that for a man aged 60 is 1x10-3 per annum.

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

Social risk is a measure of the chances of a number of people being affected by a single event or set of events and is often presented as f/n curves (i.e. frequency v/s number of people affected).
The On-Site Emergency Plan deals with measures to prevent and controls emergency with the factory and not affecting outside public or environment.

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

The Contingent or Disaster Plan of the area will be developed by the district or local authority based on the on-site and off-site emergency plan of individual units in that area.

5. OBJECTIVES OF THE EMERGENCY PLAN

It is the policy of M/s. Bharuch Enviro Infrastructure Ltd. That each individual should be aware of and understand his role in case of fire or explosion, or toxic release of gases/material.

The purpose of the preparation of disaster control plan is to work out as much details as possible for the likely events and prepare the instructions to point out action to be taken by individuals in case of fire or explosion or toxic release in the plant and surrounding areas. This is apart from the action taken by the process personnel, which will be according to their plant emergency procedures. These instructions are general in nature; however, it must be borne in mind that instruction of this nature cannot detail every action required in every situation which may arise. The action of each individual is described to minimize confusion and speed up action.

The key objectives of Emergency Plan are:

1. To define and assess emergency, including risk and environmental impact assessment

2. To control and contain incidents.
3. To safeguard employee and people in vicinity.
4. To minimize damage to property or/and the environment.
5. To inform employees, the general public and the authority about the hazards/risks assessed, safeguards provided, residual risk if any and the role to be played by them during emergency.
6. To be ready for 'mutual aid' if need is arising to help neighboring unit. Normal jurisdiction of OEP is the own premises only, but looking to the time factor in arriving the external help or off-site plan agency, the jurisdiction must be extended outside to the extent possible in case of emergency occurring out side
7. To inform authorities and mutual aid centers to come for help.
8. To effect rescue and treatment of casualties. To count injured.
9. To identify and list any dead.
10. To inform and help relatives.
11. To secure the safe rehabilitation of affected areas and to restore normalcy.
12. To provide authoritative information to the news media.
13. To preserve records, equipments etc. and to organize investigation in to the cause of the emergency and preventive measures to stop its reoccurrence.
14. To ensure safety of works before personnel re-enter and resume work.
15. To work out a plan with all provisions to handle emergencies and to provide for emergency preparedness and the periodical rehearsal of the plan.

On site emergency plan: Statutory requirement

- **Factory Act 1948, Section 41-B (4):** It requires to draw up an Onsite Emergency Plan with detailed Disaster Control Measures for the Factory and to educate the workers employed in the factory premises.
- **Rule 13 of the Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1998:** Preparation of Onsite Emergency Plan by the occupier.

It is obligatory by Rule 15 of MSIHC-1989 on the part of an Occupier of hazardous chemicals to prepare an emergency plan and to take appropriate steps to inform the 'Do's and Don'ts' which should be adopted in the event of major accident.

CHAPTER-II

RISK & ENVIORNMENTAL IMPACT ASSESSMENT

1. FACTORY LAYOUT

Pls. refer Annexure – 3 on page no. 68

2. STORAGE HAZARDS & CONTROLS

Products & raw materials

Main process of M/s Bharuch Enviro Infrastructure Limited is to treat, store and transport hazardous waste generated by member units at TSDF. This is a nonmanufacturing Industry. No any product is produced here except heat recovered from incineration process and combustible gas has been produced by treatment of biodegradable food waste.

Core activity of the industrial unit is to protect environment by providing efficient treatment facility of industrial hazardous waste.

List of raw material

BEIL is TSDF facility of Industrial Hazardous waste; this is a nonmanufacturing Industry. No any product is produced hence no RM has been used but following RM used which is required to treat waste.

1) NaOH
2) Lime
3) Carbon; and
4) Natural Gas (as a fuel)

Pls. refer Annexure – 4 for storage hazards & controls on page no. 69

MSDS of chemicals are also provided.

Pls. refer Annexure – 5 for MSDSs on page no. 72

3. PROCESS & VESSEL HAZARDS & CONTROLS

Bharuch Enviro Infrastructure is having two main facilities first one is common hazardous waste treatment, storage and disposal facility (Landfill of Hazardous waste) and second one is Incineration (including Incinerator with heat recovery and MEE and storages of Incinerable waste) and others are drum decontamination and recycling of waste plastic.

A) LAND FILL SITE

OPERATIONAL METHODOLOGY OF TSDF

1) Waste Acceptance Criteria

- The generator should have Authorization for disposal as per Hazardous Waste (Management, Handling & Tranboundary Movement) Rules, 2008.
- At the time of taking membership, the company is doing complete analysis of solid waste and the same sample is preserved for further physical verification.
- As the dumper comes to site, it is weighed and, samples are taken from 3 different location and composite sample is made and analyzed for following quick parameters:

- pH
- PFLT test for moisture content
- Odour
- Flammability
- Compatibility
- Physical state
- LRT
- Annealing loss

Only if the sample passes through above quick tests it is allowed to enter the disposal site.

2) Manifest System

We have manifest system as per Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. Manifests are six copies in different colors. However, GPCB has introduced an online manifest system for waste acceptance. At present, the online system is being followed. (GPCB- XGN generated manifest)

3) Transportation of Hazardous Solid Waste from Generation Site to TSDF

Transportation of hazardous solid waste is done as per guidelines of CPCB. The TSDF is having approved transporter with dedicated vehicles (Hydraulic) for transportation of solid waste. All the vehicles are having the nameplate with details of company's name, address, phone no., etc. During transportation, containers are closed from all sides and covered from top.

4) Weighing and Sampling of Waste

As the dumper enters weighbridge, samples are taken from three different locations and a composite sample is made. Once the quick test is passed, truck is allowed to enter the premises. If any truck does not meet the Hazardous solid waste inlet specification, it is returned back to member industry for necessary treatment.

5) Operation of TSDF dumping area

The dumper carrying the hazardous waste is first subjected to quick tests and if it is approved by QA, the hydraulic dumpers are sent for unloading in landfill area. The operation of land filling area is cell wise.

6) Ground Water Sampling and Analysis

Provided monitoring wells at the site for ground water monitoring. There are twelve electric bore wells. Four wells at the upstream and four wells at the downstream. Three additional wells are provided at the downstream side of Phase-II (new site). The monitoring parameters are analyzed as per the guidelines given by the CPCB. Company has laboratory facility for analysis of bore well water. Monitoring is done once in Month.

7) Leachate Management System

Cell-wise leachate collection wells are provided. There are 6 number of Leachate well for closed site and 7 leachate well for the continue Phase-II. Leachate is pumped out from leachate wells to tankers and is sent to the M/s. ETL (CETP), Ankleshwar for treatment & disposal and part of it is being treated in MEE plant.

8) Gaseous Emission Management

Provided air vents at the closed portion of the land fill. We are regular monitoring of these vents for VOC & HC.

9) Closure and post closure maintenance details for closed cells including vegetative stabilization:

Provided coverage system with vegetative cover area as per CPCB criteria for Phase-I cells. The closed portion is given proper landscape.

We are providing storage shade on operational cell during monsoon period. The main operational site is kept covered by tarpaulin with separate rain water collection system during monsoon.

10) Surface Water Drainage System

The storm water drainage system is provided at the site. The surface water generated during rainy season is collected through storm water system and after filtration, recharged to ground water through water harvesting system.

11) Site Infrastructure:

(a) We have established administrative and site control office with latest equipment like computers & computerized weigh-bridge, printers, fax, Xerox machine with scanning etc.

(b) We have provided with a well-equipped laboratory. For sampling and analysis of solid wastes, air, leachate and observation borewell water, Incinerable waste. The laboratory is accredited by national Accreditation Board for Analytical Laboratory (NABL).

(c) Peripheral roads have been constructed near the Incinerable waste storage sheds.

(d) Three additional storage sheds are constructed for Incinerable wastes. At present, there are a total 10 sheds for storage of Incinerable wastes.

(e) Stabilization facility is provided for wastes that require treatment/stabilization before disposal in landfill.

(f) Green belt details:

We have developed green belt in and around our site and have planted more than 5000 trees.

12) Safety and pollution control i.e. traffic, noise, odour, litter, bird control, vermin and other pests, dust, mud on road, landfill fire control, landfill safety aspects.

- Usage of PPE's like gum boots, glove, gas mask by the person-working site.
- Avoiding manual operation. The company is using hydraulic dumpers for transportation of wastes, no manual unloading is required for wastes.

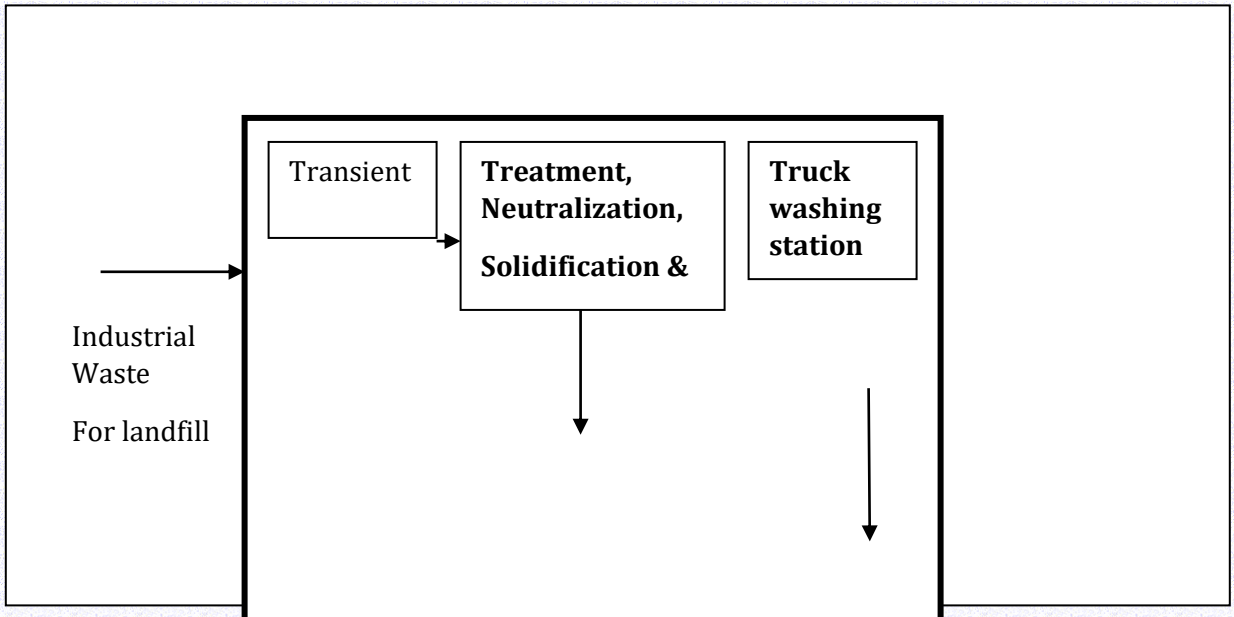
- The company is utilized bulldozers for separating and compacting the wastes
- The company is checking the ignitability and compatibility of wastes before dumping the wastes to the site it is helping in fire control and any reactivity after disposal.
- There are not many noise making equipment used at site
- The company has procured road-sweeping machine for maintaining good housekeeping of roads.
- Odour control is being done with control of the characteristics of wastes being received. Closed handling system is used.
- The used area is covered with soil, which helps in control of vermin / insect / pests etc.
- Drivers are given training for handling hazardous wastes at the disaster prevention and management centre at Ankleshwar.
- Routine inspection of vehicles is done.
- On site emergency plan is prepared.

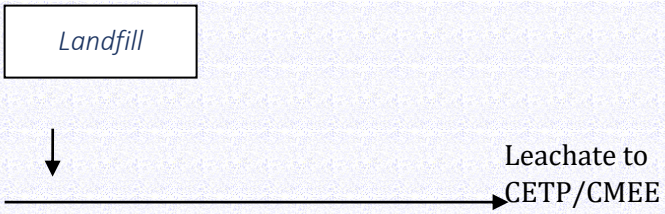
13) Closure and Post Closure Plan:

Completed landfill site has been provided top cover with vegetative cover of approx 36,360 sq.m. area. The closed portion is given proper landscape. The surface water generated during rainy season is collected through storm water system and after filtration, recharged to ground water through water harvesting system. The covered portion is maintained properly and inspected by civil engineer.

A post closure fund is allotted and is being collected from all the member industries.

Flow diagram of landfill facility





B) INCINERATION DETAILS:

The unit has set up common incineration systems in the year 2005 & 2012 respectively at the same site. The incineration systems are as rotary kiln type with post combustion chamber, Evaporative cooler, dry scrubber, bag filter, wet scrubber, ID fan. The systems can treat solid wastes/liquid waste/sludge generated by the industries.

Incinerator Plants with Heat Recovery and Evaporation system

The incineration systems are set up with same capacity and air pollution control system. In the both incinerators, additionally Heat Recovery System along with Multiple Effect Evaporation System is incorporated. The incineration plant is designed as per CPCB Guideline.

All required basic infrastructure facilities – like Storage System, Waste charging system, Fire Hydrant System, Laboratory is already available at the site. The incineration system consists of feeding system, dual burners (natural gas or liquid waste), rotary kiln, secondary combustion chamber, evaporative cooler, lime / carbon injection system, bag filter, wet scrubber, ID Fan, continuous monitoring system and chimney. Additionally, heat recovery boiler is installed, which recovers the heat from flue gas coming out from secondary combustion chamber and produced steam is taken to Multiple Effect Evaporation System. Heat Recovery Boiler is made of special material of construction to take care of corrosive environment present in the flue gas. The flue gas coming out of boiler will be cooled in the Gas Conditioning Tower with the help of water and air; and flue gas at a temperature of 200 to 250 ° C will be taken to inlet of Bag Filter prior to lime / carbon injection point. The plant can be operated either with Heat Recovery System or without Heat Recovery System as per provisions made. In case of any shut down of Multiple Effect Evaporation Plant or any problem with the Boiler, incineration plant can be in operation and evaporative cooler will take care of cooling of flue gas as per provision in the First incinerator.

The flue gas is passed through Bag Filter 720 nos. of Teflon bags for removal of Suspended Particles and lime used. Used lime collected is disposed off in secured landfill. The clear gas coming from Bag Filter is taken to Wet Scrubber which is a big tower where Caustic solution will be circulated. Here, acidic gases are removed and all parameters are within permissible limits with respect to SPM, HCL and SO_2.

There is a Mist Eliminator before ID Fan to remove condensed water. ID Fan sucks flue gas from Rotary Kiln to Chimney and provides required negative pressure in the system.

Rotary Kiln and Secondary Combustion Chamber are lined with high alumina refractory to take care of the temperature. Rotary Kiln is operated at 850 $\pm$ 50 $^{\circ}$ C and Secondary Combustion Chamber is operated at above 1100 $^{\circ}$ C temperature, with above 2 seconds gas residence time.

The concrete chimney of 45 M height is constructed to vent the cleaned flue gas. This chimney is also acid proof lined. Inside diameter of chimney is 1.84 M and 4 nos. of sampling points are provided at 22 M height. A sampling platform is also provided at 21 M height with handrails.

The chimney has been designed with a capacity considering both incinerators.

List of Equipments

- Waste feeding/charging facility;
- Rotary Kiln
- Post combustion Chamber
- Heat Recovery Boiler
- Standby Natural Gas / F.O. operated Boiler
- Evaporative cooler
- Lime and Carbon feeding system
- Bag filter
- Pneumatic conveyer with dust collector
- Wet scrubber
- Continuous Monitoring System
- ID Fan
- Chimney
- Multiple Effect Evaporation system
- Ash Handling System
- Control Panel
- Emergency Power Supply

- MCC Panel
- Fire Hydrant System; and
- Video Camera for monitoring

INCINERATORS WITH HEAT RECOVERY BOILER AND EVAPORATION SYSTEM PROCESS DISCREPTION:

Rotary Kiln

It is pre-heated to 750º C using natural gas. Its operating temperature will be 850 ± 50º C. The waste feeding is started when the temperature reaches 800º C using various types of feeding mechanisms provided. The kiln is rotating in clock-wise direction with Girth gear and drive mechanism. The vacuum to be maintained at –10 to –5 mm wc in order to take out the flue gas to chimney. The solid retention time is 90 mins. Pneumatic ceiling is provided at front end to avoid entry of air.

Post-Combustion Chambers

In the post-combustion chamber temperature is maintained above 1100°C as per CPCB guidelines and the gas retention time is above 2 Seconds. The natural gas is used as auxiliary fuel to maintain the temperature. The high calorific value waste can also be injected to maintain temp. The aqueous waste spray also helps in maintaining heat load. The ash from the kiln as well as the post combustion chamber is collected in the submerged ash conveyor at the bottom of this chamber. The negative pressure inside the chamber is –10 to –15 mm wc. The entire volatile organic compound is thermally degraded in this chamber. An emergency vent is provided on the top of this chamber.

On the Top of this chamber two out let duct lines are provided. One is directly connected with main Evaporative cooler and the second one is for diverting the hot flue gases to waste heat recovery boiler.

Waste Heat Recovery Boiler

The flue gas from Post combustion chamber enters at Temperature of 1100º C in waste heat recovery Boiler and convert the water in to steam by heat transfer. Out let Temperature of flue gas from Heat Recovery Boiler will be 400º C.

The steam generated from Heat Recovery Boiler is used to operate Evaporation system.

Gas Conditioning Tower of Waste Heat Recovery Boiler

The function of this chamber is to cool the gas coming from waste heat recovery boiler from 400º C to 220º C with the water sprays provided

Evaporative Cooler of Incinerator plant:

When the heat recovery Boiler will not be under operation the Evaporative Cooler of Incineration plant will be taken in the line to cool the flue gas coming from secondary combustion chamber. The flue gas will enter with a temperature more than 1100 º C. To cool the flue gas water spray will be utilized. The atomized water particles absorb the heat of flue gas and get evaporated inside the chamber with considerable drop in the Temperature. The pressure in this chamber will be –50 to – 20 mm wc.

Lime and carbon injection system:

The purpose of the system is for the dry scrubbing of the flue gas coming from the combustion chamber. The lime and carbon are stored in separate feed hoppers and is injected in to the main flue gas line through Powder Handling Automation Lime and Carbon feeding system. This is a completely closed system and prevents dusting.

Bag filter

The Bag Filter is having approximately 700 nos. of Teflon Bags. The cooled gas from the evaporative cooler or from Gas Conditioning Tower of Heat Recovery System, after injection of Lime / Carbon, enters in to the Bag Filter chamber. The bag filters operate on the principle of pulse jet. Pneumatically operated valve controls the pulse jet operations. The deposited used lime is discharged in the dust collection system. The dust free flue gas goes to wet scrubbing system.

Considering the material of construction of the bags i.e. Teflon, proper care is taken to maintain the temperature less than 250 Deg C at the inlet of Bag Filter. The pressure drop across the bag filter is controlled by avoiding deposit of lime on the bags.

Wet Scrubber

The function of the Wet Scrubber is to remove remaining acidity from the flue gas. Caustic solution is circulated in the scrubber. This scrubber is made of FRP+FRV and is having packing. Before entering the wet scrubber, with the scrubber solution, the flue gas is cooled from 200 Deg. C to 80 Deg. C. The scrubbed solution is partly evaporated or it is sent to CETP for treatment and disposal or treated in Evaporation System and generated condensate send to CETP for treatment and disposal

ID Fan and chimney

ID Fan will provide required vacuum in the entire incineration system. The discharge of ID Fan is connected to the chimney. The new chimney is made of concrete with 45 M height. Sampling points are provided at 22 M height.

Submerged Ash Conveyor

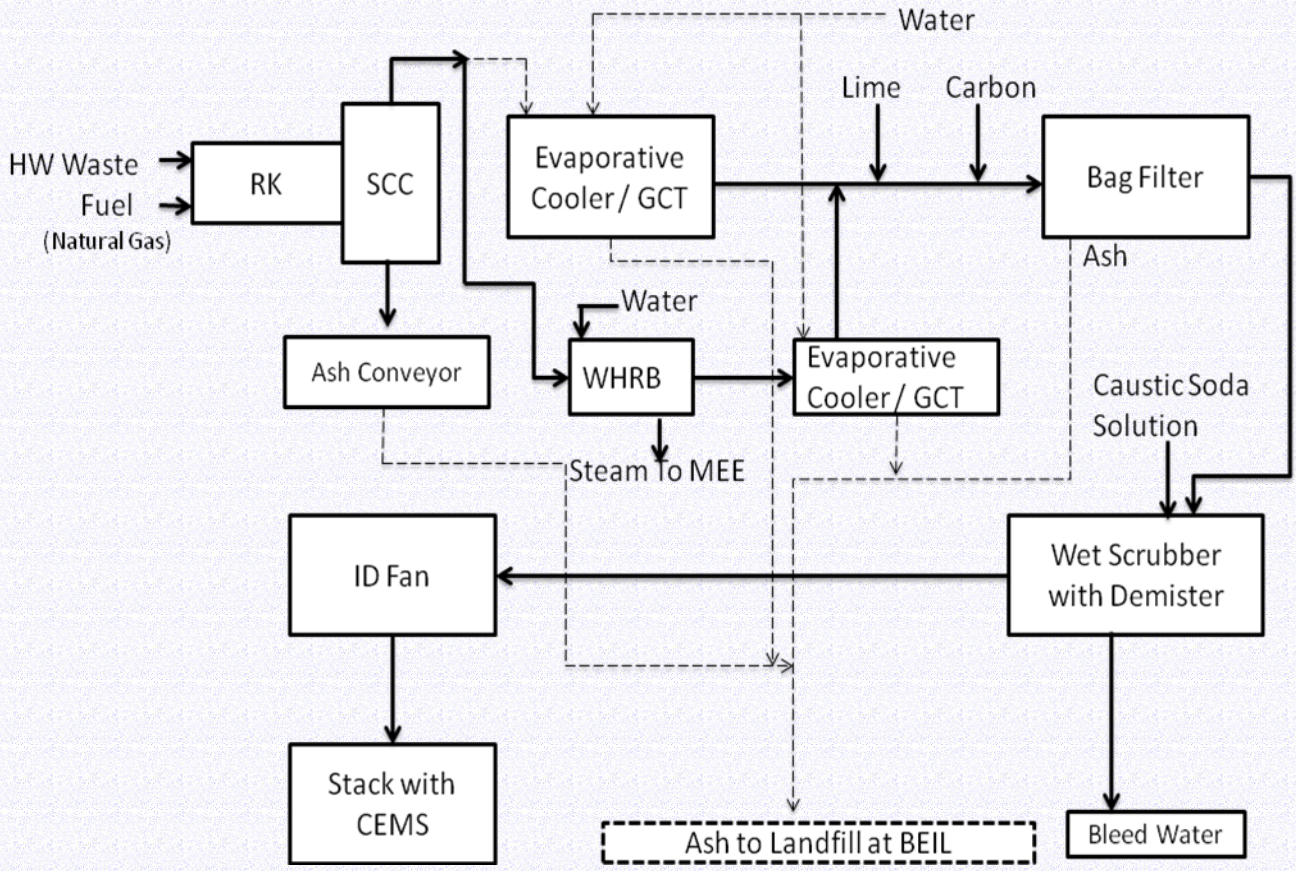
The ash generated from the incineration system is collected in the submerged ash conveyer. The collected ash is disposed off in the landfill.

Multiple Effect Evaporation system:

The Multiple Effect Evaporation System having 3 stages with striper and centrifuge have capacity of 15TPH. Steam generated from Heat Recovery Boiler is taken for evaporation. The system can evaporate effluent with high dissolved solids and the salt can be collected from the last stage.

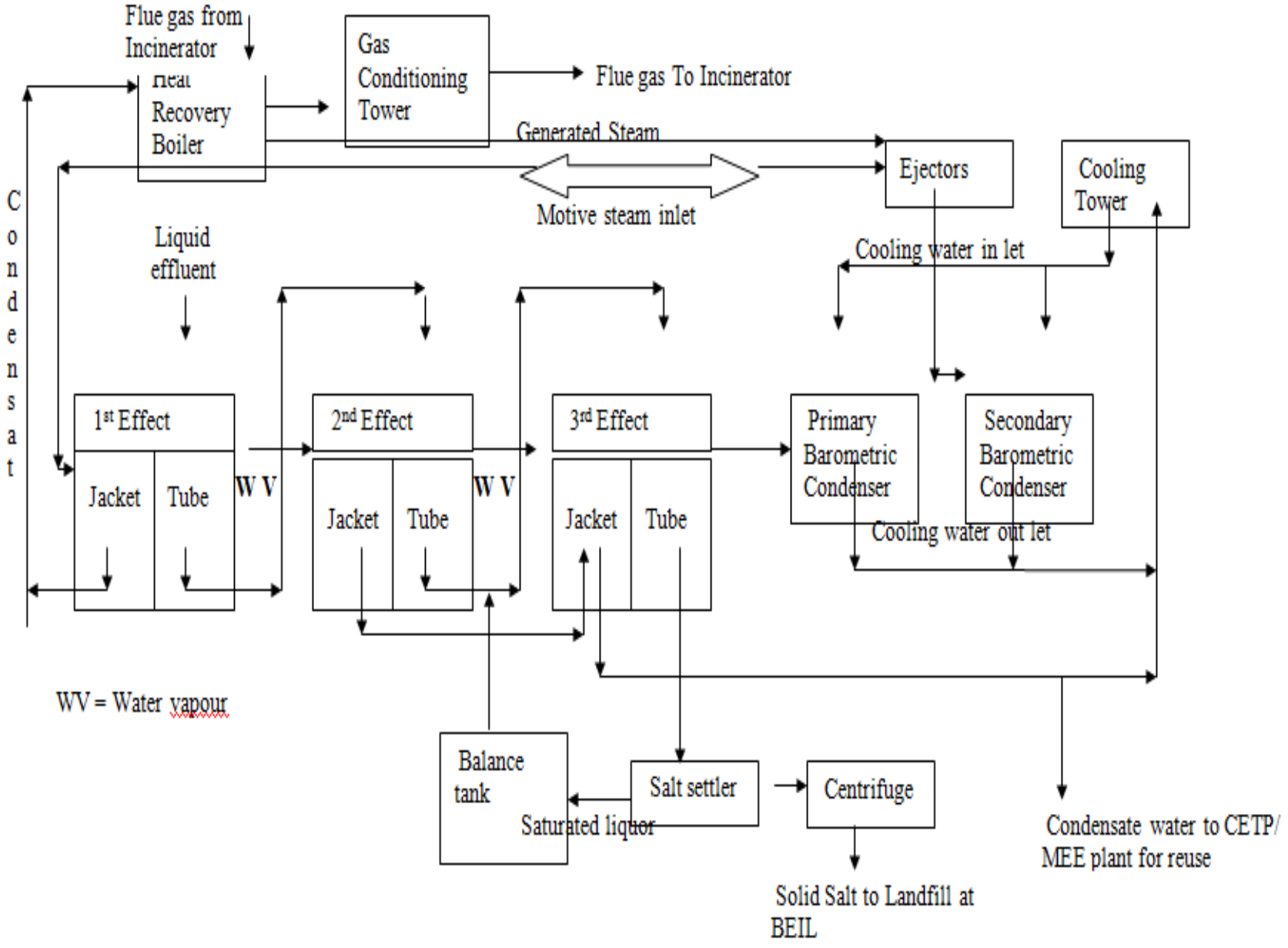
A stand-by Boiler is also arranged for availability of steam when the incineration plant is not in operation or any other maintenance problem. This will help in better operation of the MEE System.

Incineration plants with Heat Recovery Boiler



Multi Effect Evaporation Plant Flow Diagram

Flow Diagram Multiple Effect Evaporation



a) Blending Procedure of Mix liquid waste / Solid waste for co-processing for Cement Industries:

BEIL is Treatment storage and disposal facility of Hazardous waste. TSDF is receiving the waste generated from the member Industries for Secured landfill disposal, incineration and Evaporation.

The waste received for Incineration is first analyzed by our Laboratory and on the base of the analysis the storage is being decided. BEIL has storage facility for Incinerable waste as per CPCB guideline. The waste is segregated on the Physical state, chemical characteristics, Calorific value, Reactivity and P^H.

Considering the fact that incineration of the hazardous waste in the Common incinerator facility provides an environment friendly solution but not the best option. In the current scenario of energy crisis, co- processing of the combustible waste in a cement plant is one of the better option from Energy recovery point of view as well as better option to help reduced the CO2 emission

Accordingly, BEIL collects the waste liquid and solid from various waste streams / waste generators, blend the liquid / solid waste, which is suitable for co processing and send it to Ambuja Cements limited in compliance with CPCB / GPCB guidelines.

As per the "Guideline on Co-Processing in cement/power/steel Industries" published by central pollution control Board (Ministry of Environment & Forest, Govt. of India, New Delhi), February – 2010, Trial Run for co-processing of waste mix liquid and Solid of BEIL, Ankleshwar was carried out at Ambuja Cement.

Pollution Control Board has been granted permission for co-processing of mix liquid & solid waste of Bharuch Enviro Infrastructure Limited at m/s Ambuja cement.

BEIL has developed facility for preparation of Mixing / blending of the waste.

To send the liquid waste for co-processing first waste menu will be decided on the base of chemical properties, Compatibility, reactivity, flammability and corrosively. The selected waste liquid will be transferred to the charging tanks from drums. Then the liquid waste is taken to the storage tank, which is having humanizer for proper mixing of the liquid waste. Pumps are provided at the tank for loading of the tankers to send it to cement industries for co-processing. This is a complete close system and Fire hydrant system is provided around the area.

b) Plastic waste recycling

PROCESS DESCRIPTION

1. Plastic waste recycling plant

To recycle the plastic waste, steps is being taken as under:

1. Collection of plastic waste.
2. Segregation of plastic waste.
3. Cleaning / Washing & drying of Plastic Waste.
4. Cutting / Sizing of Plastic waste.
5. Agglomeration / Densification of plastic waste.
6. Making granules in the extruder machine

1. Plastic waste for use in RDF/selling

To reuse the plastic waste as RDF/selling, following steps are as under.

1. Segregation of plastic waste.
2. Cleaning/Washing & drying of Plastic Waste.
3. Cutting / Sizing of Plastic waste.
4. Packing of sized Plastic Waste

Collection of Plastic Waste

We are receiving approx. 800 MT per annum of Plastic Waste from member industries in form of plastic packing material, which are disposed in secured landfilling. We had taken trials for recycling of the plastic packing material received at our site. We took trials to make granules out of this waste plastic. The granules we got are marketable and are saleable. Following processes were undertaken at machinery manufacturer's site to process the plastic.

Segregation of plastic waste

We segregate the plastic waste based on the LDPE (transparent plastic bags) Low Density Polyethylene and HDPE (wovensex material bags) High-density polyethylene

Cutting / Sizing of Plastic waste

The cleaned plastics waste is then required to be properly sized so that those may be fed into the extruders for processing and palletizing. The sizing operation depends on the type and shape of the waste plastics. During this process, attention is required to separate any powdery material from the sized / chipped plastics. For LDPE/HDPE (plastic bags) plastic waste, this sizing is important to feed sized material into the extruder to make granules.

Cleaning / Washing & Drying of Plastic Waste

Cleaning / Washing of plastic waste depends on the contamination in the waste. Generally industrial waste does not need to clean like domestic waste, but if needed we can follow the cleaning method as per below.

First of all, wash the plastic waste by normal water which removes the dust and soil particles then followed by detergent / caustic (1%) solution which removes the contamination which was not removed by simple water and finally by hot water to remove the detergent & caustic from the surface of plastic waste.

After washing its need to dry in the sunlight in open space or passing the waste from the hot air in the drier.

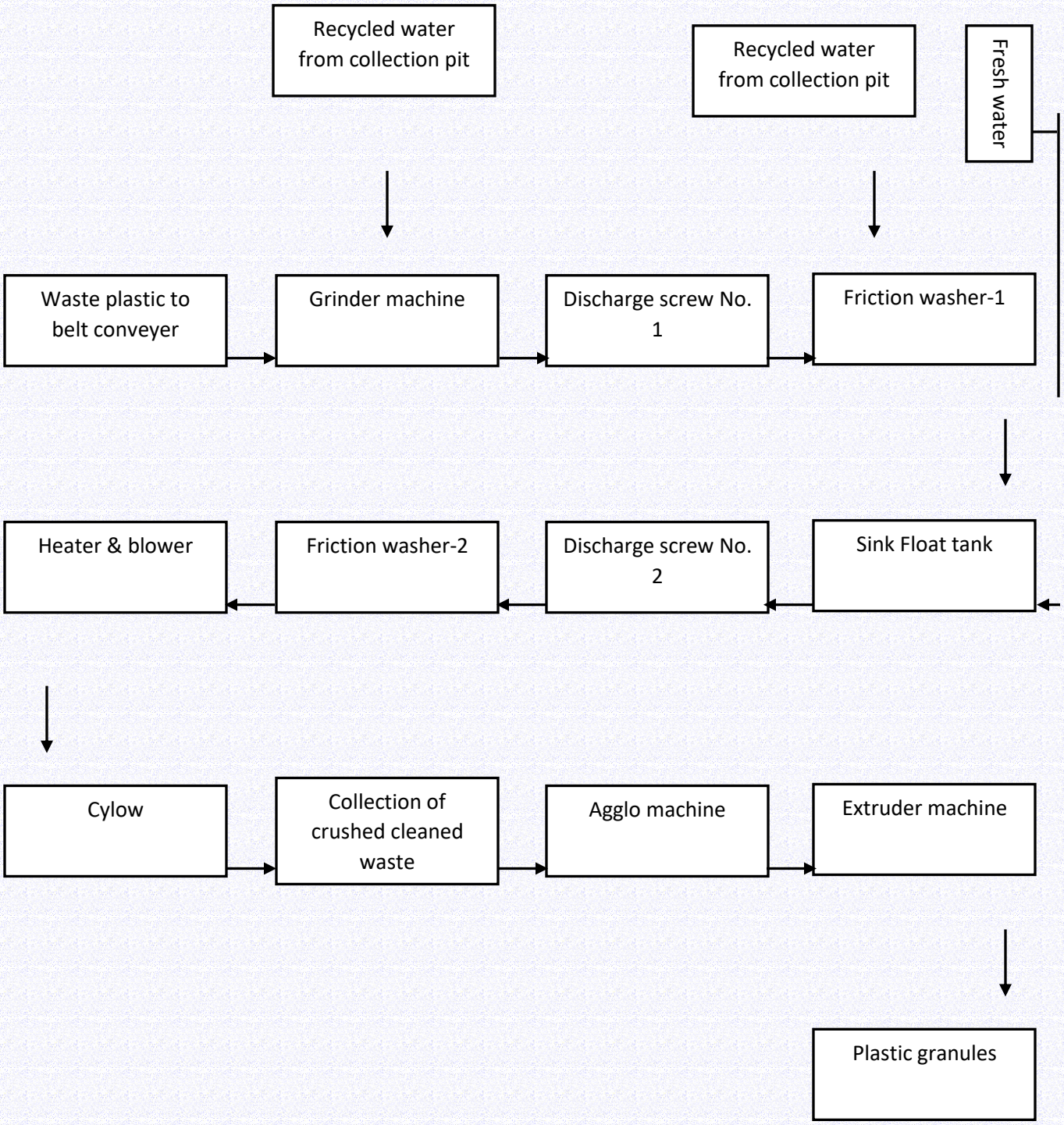
Agglomeration of Plastics

During the production agglomerated continuously with the PALLMANN Plast-Agglomerator into free-flowing granules.

Making granules in the extruder machine

After proper sizing of the waste plastic, now it is ready to enter into the extruder machine where the plastic waste is melted and come out with the granules of the plastic. That granules can be packed and is ready for the sale.

Process Flow Diagram for processing of Plastic Waste



c) Drum Decontamination Facility

The Member Industries send their Incinerable waste to BEIL for Incineration in drums and tankers. The tankers are directly unloaded to the storage tanks. The drums are charged in to the reactors after confirmation of Compatibility test; empty drums are shifted to empty drum storage area.

BEIL has developed the drums decontamination facility with high spray nozzle system. Drums are washed inside by using caustic solution, sodium hypochlorite, fresh water etc. as per the characteristics of the waste. The outside surface is also cleaned by fresh water

The decontaminated drums are tested, approved & sold to authorized scrap dealer.

The waste water generate during decontamination is being incinerated

Pls. refer Annexure – 6 on page no. 104

4. OTHER HAZARDS & CONTROLS

Pls. refer Annexure – 7 on page no. 106

5. TRADE WASTE DISPOSAL

BEIL generates incineration ash from both incinerator plants & Salt from MEE plant and dispose it in landfill site – BEIL.

Waste water generates from incineration plant, drum washing facility, Plastic Processing plant & laboratory and treat in MEE plant. MEE plant condensate water send to common effluent treatment plant (ETL) for further treatment.

Pls. refer Annexure – 8 on page no. 108

6. RECORD OF PAST INCIDENTS

A fire was taken place at hazardous waste storage shed no. 7. BEIL has taken sufficient steps to stop its reoccurrence. BEIL has provided total 10 nos. of storage sheds with impervious floor with leachate collection system. All the sheds are covered with water sprinkler system. Smoke & heat detectors are provided in all the sheds. Fire hydrant system and portable fire extinguishers are also provided.

Pls. refer Annexure – 9 on page no. 109

7. RISK ASSESSMENT

1. The following maximum credible accident scenarios may occur in a hazardous waste landfill (TSDF).

1. Slop Failure of landfill
2. Water accumulation at landfill due to heavy rain

1. <u>Slop failure of Landfill</u>

Precaution is always better than cure. To mitigate the slope failure during designing and operation of BEIL landfill the Stability analysis criteria are considered and are as follow.

Stability Analysis of Slope:

Fc = c/(yd*HSn)

The Fc shall be more than 1.5.

In each case for BEIL Landfill the Fc is @ 4

Settlement of landfill base on soft soil.

Settlement = (CcH/(1+eo))*log10(Po+ΔP)/Po)

For, ΔP 24.98 the settlement is 216mm and for ΔP 22.90 the settlement is 205mm

Geomembrane Stability: Tensile Stress under self-weight

Design Ratio shall be more than 10

For BEIL it is 11.72

Geomembrane Stability: Tensile Stress under waste down – drag during filling.

Design ratio shall be more than 10

For Landfill for BEIL it is 963.70

Stability of soil over Geomembrane.

A. Sliding of soil over Geomembrane F.O.S. shall be more than 1.5 for landfill of BEIL it is 1.513

B. Tensile Force in Geomembrane: design Ratio shall be more than 2.2 for BEIL landfill it is 2.2

Vehicle or Ramp or Slop:

(Static) F.O.S. is 5.29 (Shall be more than 3)

(Dynamic F.O.S. is 4.93 (shall be more than 3)

Wheel loading

Design Ratio is 5 (shall be more than 3)

M/s. KCT Consultancy Services as per CPCB criteria carried out the stability analysis for Landfill Facility.

The capping activity is also carried out immediate once the waste filling is completed in particular cell.

After completion of capping of landfill site there should not be chances of increase moisture content of filled waste, so there should not be any chances of failure of top slop.

Phase I was competed in all respect with capping in Dec 2008 till date we have not observed any toe failure or slop failure in closed landfill site.

Phase II we have completed cell capping. Phase III has been started for landfilling.

Only present active cells are under operation so failure of slop is also minimized.

To prevent the failure of slop during the operation we are compacting it with dozer and roller. We are also making temporary bund wall to prevent any sliding of waste during operation.

Following steps to be carried out in case of slope failure:

- Implementation of onsite emergency plan
- Incoming waste to be stopped
- Slop failure may increase exposure risk to personnel and public so necessary PPEs to be provided. Relocation and covering of waste to be performed quickly and safely
- Perform mitigating activity to limit further contamination or damage
- Work to be done round the clock
- Primary report to be prepared and reviewed at regular intervals regarding the activities of waste shifting.

II. <u>Water accumulation in landfill due to heavy rain.</u>

We are keeping four nos of Diesel pump of 40 m^3/hr capacity and 5 Electric pump of 80 m^3/hr capacity to pump out the accumulated water due to heavy rain. In the event of a

landfill instability such as a slop failure the first concern is always safety, safety of site personnel, safety of site entrants, and safety of general public. The situation will need to be assessed concisely and necessary emergency procedures and precautions implemented as quickly as possible.

Following steps to be carried out in case of water accumulation in landfill due to heavy rain:

- Implementation of onsite emergency plan
- Start pumps to pump out the water accumulated.
- Check the water quality, if contaminated send for treatment.
- Necessary PPEs like helmet, gum boot, hand gloves, rain coat to be provided. If required, relocation and covering of waste to be performed quickly and safely
- Perform mitigating activity to limit further contamination or damage
- Work to be done round the clock
- Primary report to be prepared and reviewed at regular intervals regarding the activities of waste shifting.

2. <u>The following maximum credible accident scenarios may occur in a hazardous waste Incineration unit</u>

1. **MCA-1 Release of Acetone from Drum storage warehouse**
2. **MCA-2 Release of SO2 during fire in waste storage shed**
3. **MCA-3 Release of HCL vapour during Fire in waste storage shed**
4. **MCA-4 Release of NO2 during fire in waste storage shed**
5. **MCA-5 Jet fire from NG gas line leakage**

Dispersion Calculations

MCA-1- Release of Acetone from Drum storage warehouse

The properties of Hazardous waste are very difficult to determine the flammable characteristics, so the highly flammable solvents like Acetone is assumed for consequence modeling Storage stock arrangement of hazardous waste stored in HDPE or MS container arranged in three number of rows in each block with adequate separation distance between the blocks and each block contains 100 MT of hazardous

waste either solid or semi solid waste. Solvent vapours can get released due to radiation heat from nearby storage block. It can form flammable mixture cloud.

For consequence, modeling the inventory of 100 MT Acetone vapour is considered as most of the industries are using Acetone.

1. ACETONE, 2 m/s-wind velocity and F- Weather class

SITE DATA:

Location: ANKLESHWAR, INDIA

Building Air Exchanges Per Hour: 0.54 (unsheltered single storied)

Time: April 25, 2017 1051 hours ST (using computer's clock)

CHEMICAL DATA:

Chemical Name: ACETONECAS Number: 67-64-1

Molecular Weight: 58.08 g/mol

AEGL-1 (60 min): 200 ppm AEGL-2 (60 min): 3200 ppm AEGL-3 (60 min): 5700 ppm

LEL: 26000 ppm UEL: 130000 ppm

Ambient Boiling Point: 56.3° C

Vapor Pressure at Ambient Temperature: 0.41 atm

Ambient Saturation Concentration: 406,612 ppm or 40.7%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 2 meters/second from SW at 3 meters

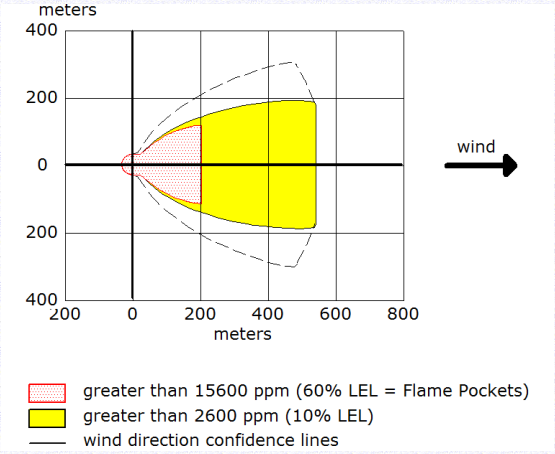
Ground Roughness: open country Cloud Cover: 5 tenths

Air Temperature: 32° C

Stability Class: F (user override)

No Inversion Height Relative Humidity: 50%

SCENARIO: Flammable cloud in organic waste drum storage shed.



THREAT ZONE:

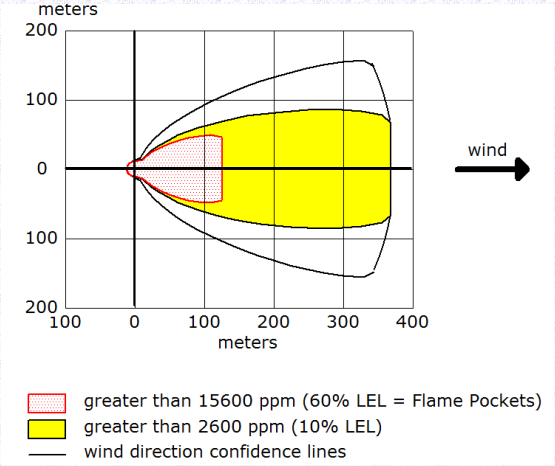
Threat Modeled: Flammable Area of Vapor Cloud

Model Run: Heavy Gas

Red : 203 meters --- (15600 ppm = 60% LEL = Flame Pockets)

Yellow: 540 meters --- (2600 ppm = 10% LEL)

SOURCE STRENGTH: Direct Source: 100000 kilograms/hr Source Height: 3 feet Release Duration: 30 minutes Release Rate: 1,670 kilograms/min Total Amount Released: 50,000 kilograms	

1. ACETONE, 3 m/s - wind velocity, D- Weather class	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.72 (unsheltered single storied) Time: April 25, 2017 1056 hours ST (using computer's clock) **CHEMICAL DATA:** Chemical Name: ACETONE CAS Number: 67-64-1 Molecular Weight: 58.08 g/mol AEGL-1 (60 min): 200 ppm AEGL-2 (60 min): 3200 ppm AEGL-3 (60 min): 5700 ppm LEL: 26000 ppm UEL: 130000 ppm Ambient Boiling Point: 56.3° C Vapor Pressure at Ambient Temperature: 0.41 atm Ambient Saturation Concentration: 406,612 ppm or 40.7% **ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)** Wind: 3 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C	**SCENARIO:** Flammable cloud in organic waste drum storage shed.  **THREAT ZONE:** Threat Modeled: Flammable Area of Vapor Cloud Model Run: Heavy Gas Red : 126 meters --- (15600 ppm = 60% LEL = Flame Pockets) Yellow: 369 meters --- (2600 ppm = 10% LEL)

Stability Class: D (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 100000 kilograms/hr Source Height: 3 feet Release Duration: 30 minutes Release Rate: 1,670 kilograms/min Total Amount Released: 50,000 kilograms	

MCA-2 - Release of SO2 during fire in waste storage shed

The properties of Hazardous waste are very difficult to determine the toxic characteristics so assuming the toxic vapors like SO2, HCL and NO2 are considered for consequence modeling

Storage stock arrangement of hazardous waste stored in HDPE or MS container arranged three number of stages in each block with adequate separation distance between the blocks and each block contains 300 MT of hazardous waste either solid or semi solid waste. For consequence modeling, the inventory of 1 MT SO2 toxic gas or vapor plume is considered.

2. Sulphur Dioxide, 2 m/s-wind velocity and F- Weather class - 1MT

SITE DATA:

Location: ANKLESHWAR, INDIA

Building Air Exchanges Per Hour: 0.54 (unsheltered single storied)

Time: April 25, 2017 1134 hours ST (using computer's clock)

CHEMICAL DATA:

Chemical Name: SULFUR DIOXIDE

CAS Number: 7446-9-5

Molecular Weight: 64.06 g/mol

AEGL-1 (60 min): 0.2 ppm AEGL-2 (60 min): 0.75 ppm AEGL-3 (60 min): 30 ppm

IDLH: 100 ppm

Ambient Boiling Point: -10.0° C

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

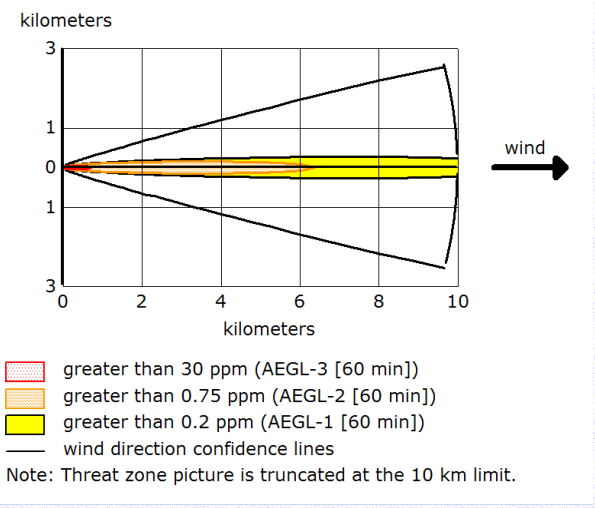
Wind: 2 meters/second from SW at 3 meters

Ground Roughness: open country Cloud Cover: 5 tenths

Air Temperature: 32° C

Scenario :

Toxic vapor release during the fire incident in300MT organic waste storage shed. Approximately 1 MT SO2 is considered.



THREAT ZONE:

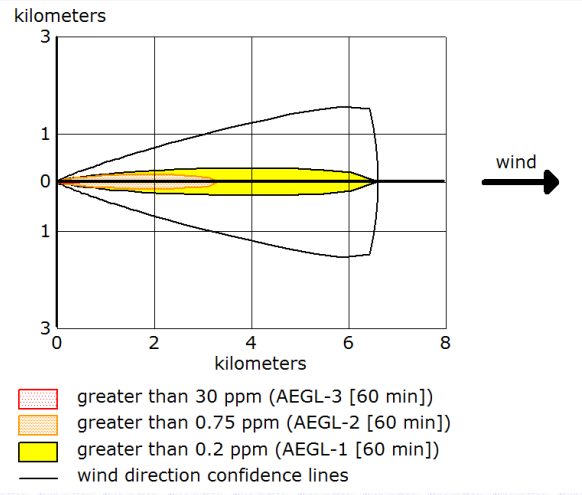
Model Run: Heavy Gas

Red : 729 meters --- (30 ppm = AEGL-3 [60 min])

Orange: 6.4 kilometers --- (0.75 ppm = AEGL-2 [60 min])

Yellow: greater than 10 kilometers --- (0.2 ppm = AEGL-1 [60 min])

Stability Class: F (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	

2.Sulphur Dioxide, 3 m/s - wind velocity, D- Weather class - 1MT	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.72 (unsheltered single storied) Time: April 25, 2017 1056 hours ST (using computer's clock) **CHEMICAL DATA**: Chemical Name: SULFUR DIOXIDE CAS Number: 7446-9-5 Molecular Weight: 64.06 g/mol AEGL-1 (60 min): 0.2 ppm AEGL-2 (60 min): 0.75 ppm AEGL-3 (60 min): 30 ppm IDLH: 100 ppm Ambient Boiling Point: -10.0° C Vapor Pressure at Ambient Temperature: greater than 1 atm Ambient Saturation Concentration: 1,000,000 ppm or 100.0% **ATMOSPHERIC DATA: (MANUAL INPUT OF**	**Scenario :** Toxic vapor release during the fire incident in300MT organic waste storage shed. Approximately 1 MT SO2 is considered.  **THREAT ZONE:** Model Run: Heavy Gas Red : 473 meters --- (30 ppm = AEGL-3 [60

DATA) Wind: 3 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C Stability Class: D (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	min]) Orange: 3.3 kilometers --- (0.75 ppm = AEGL-2 [60 min]) Yellow: 6.6 kilometers --- (0.2 ppm = AEGL-1 [60 min])

MCA-3 Release of HCL vapour during Fire in waste storage shed

3. HYDROGEN CHLORIDE, 2 m/s-wind velocity and F- Weather class - 1MT

SITE DATA:

Location: ANKLESHWAR, INDIA

Building Air Exchanges Per Hour: 0.54 (unsheltered single storied)

Time: April 25, 2017 1143 hours ST (using computer's clock)

CHEMICAL DATA:

Warning: HYDROGEN CHLORIDE can react with water and/or water vapor. This can affect the evaporation rate and downwind dispersion. ALOHA cannot accurately predict the air hazard if this substance comes in contact with water.

Chemical Name: HYDROGEN CHLORIDE

CAS Number: 7647-1-0 Molecular Weight: 36.46 g/mol

AEGL-1 (60 min): 1.8 ppm AEGL-2 (60 min): 22 ppm AEGL-3 (60 min): 100 ppm

IDLH: 50 ppm

Ambient Boiling Point: -85.0° C

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 2 meters/second from SW at 3 meters

Ground Roughness: open country Cloud Cover: 5 tenths

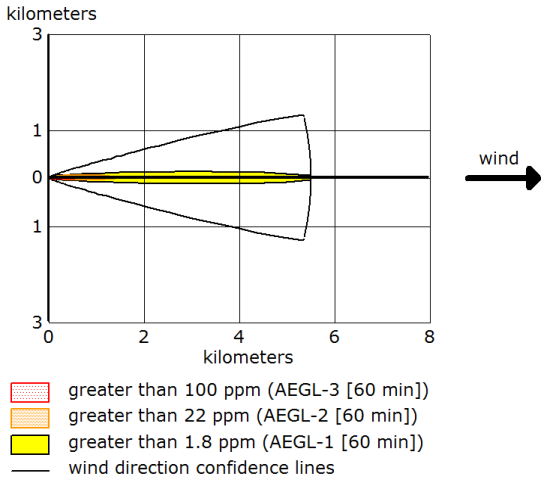
Air Temperature: 32° C

Stability Class: F (user override)

No Inversion Height

Scenario :

Toxic vapor release during the fire incident in300MT organic waste storage shed. Approximately 1 MT HCL is considered



THREAT ZONE:

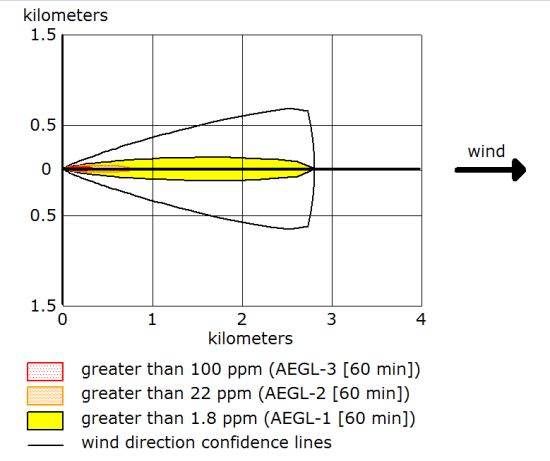
Model Run: Heavy Gas

Red : 577 meters --- (100 ppm = AEGL-3 [60 min])

Orange: 1.4 kilometers --- (22 ppm = AEGL-2 [60 min])

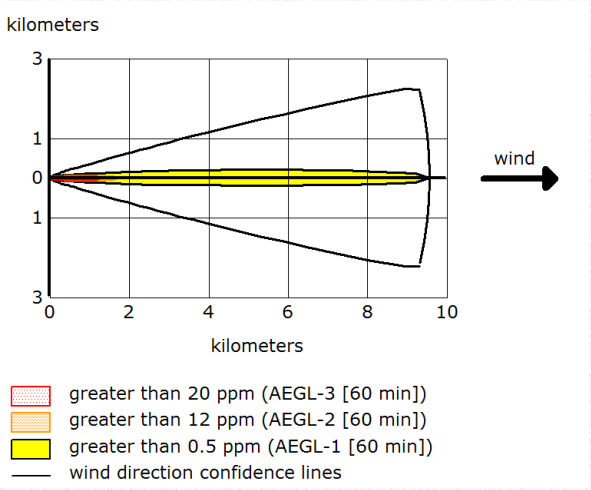
Yellow: 5.5 kilometers --- (1.8 ppm = AEGL-1 [60 min])

Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	

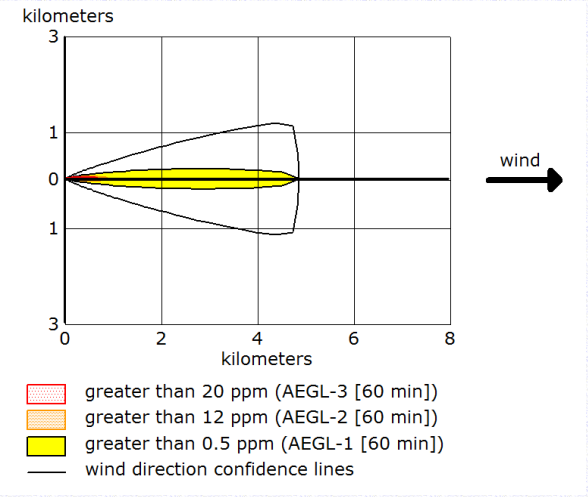
3. HYDROGEN CHLORIDE - 3 m/s - wind velocity, D- Weather class - 1MT	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.72 (unsheltered single storied) Time: April 25, 2017 1145 hours ST (using computer's clock) **CHEMICAL DATA:** Warning: HYDROGEN CHLORIDE can react with water and/or water vapor. This can affect the evaporation rate and downwind dispersion. ALOHA cannot accurately predict the air hazard if this substance comes in contact with water. Chemical Name: HYDROGEN CHLORIDE CAS Number: 7647-1-0 Molecular Weight: 36.46 g/mol AEGL-1 (60 min): 1.8 ppm AEGL-2 (60 min): 22 ppm AEGL-3 (60 min): 100 ppm IDLH: 50 ppm Ambient Boiling Point: -85.0° C Vapor Pressure at Ambient Temperature: greater than 1 atm Ambient Saturation Concentration: 1,000,000	**Scenario :** Toxic vapor release during the fire incident in300MT organic waste storage shed. Approximately 1 MT SO2 is considered.  **THREAT ZONE:** Model Run: Heavy Gas Red : 340 meters --- (100 ppm = AEGL-3 [60 min])

ppm or 100.0% **ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)** Wind: 3 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C Stability Class: D (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	Orange: 757 meters --- (22 ppm = AEGL-2 [60 min]) Yellow: 2.8 kilometers --- (1.8 ppm = AEGL-1 [60 min])

MCA-4 Release of NO2 during fire in waste storage shed

4. NITROGEN DIOXIDE, 2 m/s-wind velocity and F- Weather class - 1MT	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.54 (unsheltered single storied) Time: April 25, 2017 1134 hours ST (using computer's clock) **CHEMICAL DATA:** Chemical Name: NITROGEN DIOXIDE CAS Number: 10102-44-0 Molecular Weight: 46.01 g/mol AEGL-1 (60 min): 0.5 ppm AEGL-2 (60 min): 12 ppm AEGL-3 (60 min): 20 ppm IDLH: 20 ppm Ambient Boiling Point: 21.0° C Vapor Pressure at Ambient Temperature: greater than 1 atm Ambient Saturation Concentration: 1,000,000 ppm or 100.0% **ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)** Wind: 2 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C Stability Class: F (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source	**Scenario :** Toxic vapor release during the fire incident in300MT organic waste storage shed. Approximately 1 MT NO2 is considered.  **THREAT ZONE**: Model Run: Heavy Gas Red : 1.3 kilometers --- (20 ppm = AEGL-3 [60 min]) Orange: 1.7 kilometers --- (12 ppm = AEGL-2 [60 min]) Yellow: 9.6 kilometers --- (0.5 ppm = AEGL-1 [60 min])

Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	

4.NITROGEN DIOXIDE, 3 m/s - wind velocity, D- Weather class - 1MT	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.72 (unsheltered single storied) Time: April 25, 2017 1138 hours ST (using computer's clock) **CHEMICAL DATA:** Chemical Name: NITROGEN DIOXIDE CAS Number: 10102-44-0 Molecular Weight: 46.01 g/mol AEGL-1 (60 min): 0.5 ppm AEGL-2 (60 min): 12 ppm AEGL-3 (60 min): 20 ppm IDLH: 20 ppm Ambient Boiling Point: 21.0° C Vapor Pressure at Ambient Temperature: greater than 1 atm Ambient Saturation Concentration: 1,000,000 ppm or 100.0% **ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)** Wind: 3 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C Stability Class: D (user override) No Inversion Height Relative	**Scenario :** Toxic vapor release during the fire incident in1 MT organic waste drum storage shed.  **THREAT ZONE:** Model Run: Heavy Gas Red : 702 meters --- (20 ppm = AEGL-3 [60 min]) Orange: 920 meters --- (12 ppm = AEGL-2 [60 min]) Yellow: 4.9 kilometers --- (0.5 ppm = AEGL-1 [60 min])

Humidity: 50% **SOURCE STRENGTH:** Direct Source: 1000 kilograms/hr Source Height: 3 meters Release Duration: 30 minutes Release Rate: 16.7 kilograms/min Total Amount Released: 500 kilograms Note: This chemical may flash boil and/or result in two phase flow.	

MCA-5 Jet fire from NG gas line leakage

5. NG Gas, 2 m/s-wind velocity and F- Weather class

SITE DATA:

Location: ANKLESHWAR, INDIA

Building Air Exchanges Per Hour: 0.54 (unsheltered single storied)

Time: May 8, 2017 1205 hours ST (using computer's clock)

CHEMICAL DATA:

Chemical Name: METHANE

CAS Number: 74-82-8 Molecular Weight: 16.04 g/mol

PAC-1: 65000 ppm PAC-2: 230000 ppm PAC-3: 400000 ppm

LEL: 50000 ppm UEL: 150000 ppm

Ambient Boiling Point: -161.5° C

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)

Wind: 2 meters/second from SW at 3 meters

Ground Roughness: open country Cloud Cover: 5 tenths

Air Temperature: 32° C

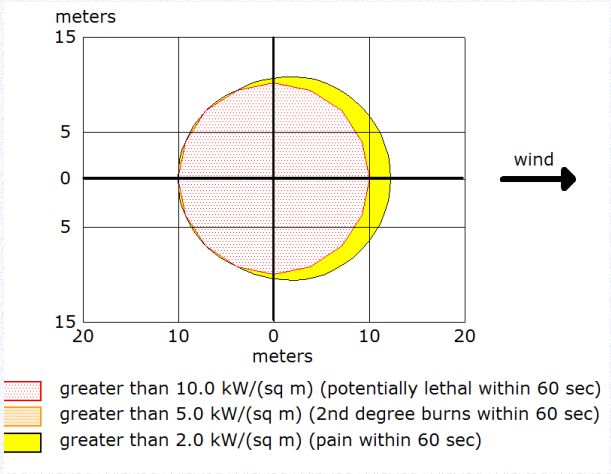
Stability Class: F (user override)

No Inversion Height

Relative Humidity: 50%

SOURCE STRENGTH:

Scenario: Jet fire from NG gas line leakage, 3 inch pipe size



THREAT ZONE:

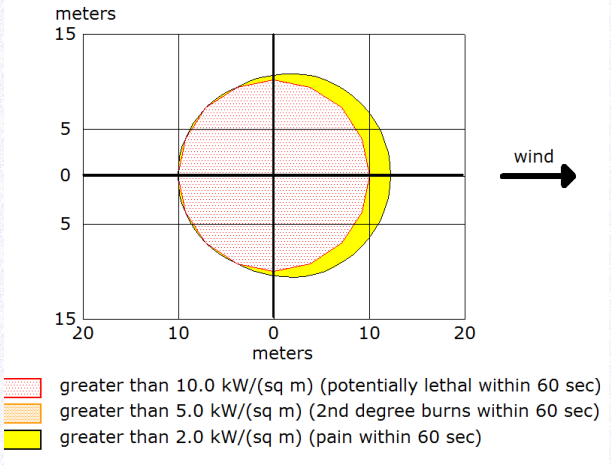
Threat Modeled: Thermal radiation from jet fire

Red : 10 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

Orange: 10 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Yellow: 12 meters --- (2.0 kW/(sq m) = pain within 60 sec)

Flammable gas is burning as it escapes from pipe Pipe Diameter: 3 inches Pipe Length: 200 meters Unbroken end of the pipe is connected to an infinite source Pipe Roughness: smooth Hole Area: 7.07 sq in Pipe Press: 2 atmospheres Pipe Temperature: 32° C Max Flame Length: 6 meters Burn Duration: ALOHA limited the duration to 1 hour Max Burn Rate: 46.5 kilograms/min Total Amount Burned: 964 kilograms	

5.NG Gas, 3 m/s - wind velocity, D- Weather class	
SITE DATA: Location: ANKLESHWAR, INDIA Building Air Exchanges Per Hour: 0.72 (unsheltered single storied) Time: May 8, 2017 1206 hours ST (using computer's clock) **CHEMICAL DATA:** Chemical Name: METHANE CAS Number: 74-82-8 Molecular Weight: 16.04 g/mol PAC-1: 65000 ppm PAC-2: 230000 ppm PAC-3: 400000 ppm LEL: 50000 ppm UEL: 150000 ppm Ambient Boiling Point: -161.5° C Vapor Pressure at Ambient Temperature: greater than 1 atm. Ambient Saturation Concentration: 1,000,000	**Scenario:** Jet fire from NG gas line leakage, 3 inch pipe size  **THREAT ZONE:** Threat Modeled: Thermal radiation from jet fire Red : 10 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec) Orange: 10 meters --- (5.0 kW/(sq m) = 2nd

ppm or 100.0% **ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)** Wind: 3 meters/second from SW at 3 meters Ground Roughness: open country Cloud Cover: 5 tenths Air Temperature: 32° C Stability Class: D (user override) No Inversion Height Relative Humidity: 50% **SOURCE STRENGTH:** Flammable gas is burning as it escapes from pipe Pipe Diameter: 3 inches Pipe Length: 200 meters Unbroken end of the pipe is connected to an infinite source Pipe Roughness: smooth Hole Area: 7.07 sq in Pipe Press: 2 atmospheres Pipe Temperature: 32° C Max Flame Length: 6 meters Burn Duration: ALOHA limited the duration to 1 hour Max Burn Rate: 46.5 kilograms/min Total Amount Burned: 964 kilograms	degree burns within 60 sec) Yellow: 12 meters --- (2.0 kW/(sq m) = pain within 60 sec)

Pls. refer Annexure – 10 & 11 on page no. 110 & 111 respectively.

8. ENVIRONMENTAL IMPACT ASSESSMENT

The project data/activities has been analyzed & linked with the existing baseline environmental conditions in order to list out the affected environmental parameters and assess the likely impacts on such parameters. Pls. refer Annexure – 12 & 13 on page no. & 112 & 113 respectively.

CHAPTER-III

EMERGENCY ORGANISATION

This chapter is device to suggest the organization for emergency preparedness. No plan will succeed without emergency organization. Key personnel to combat emergency are nominated with specific responsibilities according to the set procedures (rehearsed) and making the best use of resources available and to avoid confusion). Such key personnel include incident controller, Site main controller, other key personnel and essential workers. Assembly points for non-essential workers, emergency control centre, ambulance van, fire and toxicity control arrangements, medical arrangements, transport and evacuation arrangements, pollution control arrangements, other arrangements and persons to manage them are also an important part of the emergency organization.

1. INCIDENT CONTROLLER:

His primary duty is to take charge at the scene of the incident. In the initial stages he may be require to take decisions involving the operation of the other plants or to stop or to continue any process and to take technical decision to control the incident. Therefore, he should be fully knowledgeable for these purposes. He might be the shift or plant manager. Appoint such person for each shift including holidays. Any one incident controller must be available at any time. Their duties are fixed that way. The deputy is appointed to take charge of Incident Controller, if he is not available due to some any reason. He is also equally competent.

Responsibilities / Duties of Incident Controller

1. Assess the scale of the emergency and decide if a major emergency (for identification see page-6) exists or is likely. On his decision, he will activate the on-site emergency plan and if necessary the off-site emergency plan (see page-6).
2. Assume the duties of the Site Main Controller pending the latter's arrival (for SMC's duties see page-43). For this purpose, he will depute his deputy on the scene and he will go to the control center. Particularly he will-
    a. Direct the shutting down and evacuation of the plant and areas likely to be affected by the emergency.
    b. Ensure that the outside emergency services, including mutual aid, have been called in.

c. Ensure that key personnel have been called in.

3. Direct all operations within the affected area with the following priorities:

   a. Secure the safety of the personnel.

   b. Minimize damage to plant, property and the environment.

   c. Minimize loss of material.

4. Direct rescue and fire-fighting operations until the arrival of the outside Fire Brigade, when he will relinquish control to the Fire Brigade.

5. Search for casualties.

6. Evacuate non-essential workers to the assembly points.

7. Set up a communications point and establish radio/telephone/messenger contact as appropriate with the Emergency Control Centre.

8. Give advice and information as requested to the Head of the Fire Brigade and other Emergency Services.

9. Brief the site main controller and keep informed of developments.

10. Preserve evidences that will be necessary for subsequent inquiry in to the cause of the emergency and concluding preventive measures.

Pls. refer Annexure – 14 on page no. 114

Deputy Incident controller is appointed to deal with the emergency in absence of Incident Controller.

Pls. refer Annexure – 15 on page no. 114

2. SITE MAIN CONTROLLER:

He has overall responsibility for directing operations and calling outside help from emergency control center. He is required to take decisions by collaboration between the senior managers at the site (works) and the senior officers of the outside services.

Responsibilities / Duties of Incident Controller

Immediately being aware of the emergency, he will go to the emergency control center. On arrival, he will –

1. Relieve the incident controller of responsibility for overall main control.

2. On consultation with the incident controller decide whether major emergency exist and on declaration of a major emergency, ensure that the outside emergency services and mutual help are called, the off-site plan (page-3) activated and if necessary, nearby factories and population are informed.

3. Ensure that the key personnel are called in.
4. Exercise direct operational control of those parts of the works outside the affected area.
5. Continually review and assess possible developments to determine the most probable course of events.
6. Direct the safe close down and evacuation of plants in consultation with the incident controller and key personnel. If necessary, arrange for evacuation of neighboring population.
7. Ensure that casualties are receiving adequate attention. Arrange for hospitalization of victims and additional help, if required. Ensure that the relatives are advised.
8. Inform and communicate with the chief officers of the fire and police service. District emergency authority and with the factory inspectorate and experts on health and safety. Provide advice on possible effects on areas outside the factory.
9. In case of prolonged emergencies involving risk to outside areas by wind-blown materials. Contact the local meteorological office to receive early notification of impending changes in weather conditions.
10. Ensure the accounting for personnel and rescue of missing persons.
11. Control traffic movement within the factory.
12. Arrange for a chronological record of the emergency to be maintained.
13. Where the emergency is prolonged, arrange for the relief of personnel and the provision of catering facilities.
14. Issue authorized statements to the news media. Where necessary, inform head office.
15. Ensure that proper consideration is given to the preservation of evidence. Arrange for photographs/videos.
16. Control rehabilitation of affected areas and victims on cessation of the emergency. Do not restart the plant unless it is ensured safe to start and cleared by authorities.

Pls. refer Annexure – 16 on page no. 115

3. OTHER KEY PERSONNEL:

Other key personnel are required to provide advice to and implement the decisions made by the site main controller in the light of information received on the developing situation at the emergency.

Such key personnel include the senior managers responsible for safety, security, fire, gas, and spill control, pollution control, communication system including telephone, wireless, messenger etc. medical services, transport, engineering, production, technical

services (including utilities, laboratories), stores and personnel (including welfare, canteen, etc.).

As necessary, they will decide the actions needed to shut down plants, evacuate personnel, carry out emergency engineering work, arrange for supplies of equipment, utilities (fuel, water, power, etc.) carry out atmospheric tests, provide catering facilities, liaise with police, fire brigade, emergency planning authority, factory inspectorate, hospitals, neighboring industries find population, assembly points, outside shelters, mutual aid centers, relatives of casualties, press and so on, under the direction of the site main controller.

At the declaration of a major emergency, all key personnel and others called in to assist shall report to the emergency control center. They shall be available at any time on duty or on call on off-duty or holiday.

Pls. refer Annexure – 17 on page no. 115

4. ESSENTIAL WORKERS:

A taskforce of essential trained workers (expert's teams) must be available to get the work done by the incident controller and the site main controller, such work will include:

1. Firefighting, gas leak and spill control till a fire brigade takes the charge.
2. To help to the fire brigade and mutual aid teams, if it is so required.
3. Shutting down plant and making it safe.
4. Emergency engineering work e.g. isolating equipment, materials, process, providing temporary by-pass lines, safe transfer of material, urgent repairing or replacement, electrical work etc.
5. Provision of emergency power, water, lighting, instruments, equipments, material etc.
6. Movement of equipment, special vehicle and transport to or from the site of the incident.
7. Search evacuation, rescue, and welfare.
8. First-aid and medical help.
9. Moving tankers or other vehicles from areas of risk.
10. Carrying out atmospheric test and pollution control.
11. Managing of assembly points to record the arrival of evacuated personnel. Managing for outside shelters and welfare of evacuated persons there.
12. Assistance at casualties' reception areas to record details of casualties.

13. Assistance at communication centers to handle outgoing and incoming calls and to act as messengers if necessary.
14. Manning of works entrances in liaison with the police to direct emergency vehicles entering the work, to control traffic leaving the works and to turn away or make alternative safe arrangements for visitors, contractors and other traffic arriving at the works.
15. Informing surrounding factories and the public as directed by the site main controller.
16. Any special help required.

Pls. refer Annexure – 18 on page no. 116

5. ASSEMBLY POINTS:

In affected and vulnerable plants, all non-essential workers (who are not assigned any emergency duty) shall evacuate the area and report to a specified assembly point. The need to evacuate non-essential workers from non-affected area will be determined by the size of works and the foreseeable rate at which the incident may escalate.

Each assembly point is clearly marked by a conspicuous notice and provided with an identification number e.g. ASSEMBLY POINT NO.1 mark such points permanently for the notice of people.

Total three assembly points are provided:

(1) To ensure that employees do not have to approach the affected area to reach the point

(2) In case any assembly point lies in the path of windblown harmful materials e.g. toxic gas, burning brands, thrown (exploded) materials, etc. in case the factory is big having more plants and wide area.

Each assembly point is managed by a nominated person(s) to record the names and departments of those reporting there. He has a means of communication with the site main controller in case it is necessary to establish the whereabouts of people and to receive further instructions concerning the deployment of the evacuated personnel.

Before reaching an assembly point or subsequently, if it is required to pass through an affected area or the release of toxic substance, suitable personal protective equipments (PPE) including respirator, helmets, etc. should be available to the people.

Pls. refer Annexure – 19 on page no. 117

6. EMERGENCY CONTROL CENTRE:

The emergency control center (or room) is the place from which the operations to handle the emergency are directed and coordinated. It will be attended by the site main controller, key personnel and senior officers of the fire, police, factory inspectorate, district authorities and emergency services. The center is equipped to receive and transmit information and directions from and to the incident controller and areas of the works as well as outside. It also has equipment for logging the development of the incident to assist the controllers to determine any necessary action.

In addition to the means of communication, the center is equipped with relevant data and equipment which will assist those manning the center to be conversant with the developing situation and enable them to plan accordingly.

It is sited in an area of minimum risk and close to a road to allow for ready access by a radio-equipped vehicle for use if other systems fail or extra communication facilities are needed.

The center therefore contains:

1. An adequate number of external telephones.
2. An adequate number of internal telephones.
3. Mobile phones and walkie-talkie.
4. Plans of the factory.
5. Additional plans which may be marked up during the emergency to show:

    a) Areas affected or endangered within the factory.

    b) Surrounding areas, population and other environment likely to be affected due to toxic release, wind speed recorders and ready computer models (risk counters) based on prevailing wind direction, velocity, weather conditions and other parameters, will be much useful for quick judgment and evacuation of those areas.

    c) Areas where particular problems arise.

    d) Area evacuated and safe routes for escape.

    e) Deployment of emergency vehicles and personnel.

    f) Other relevant information.

6. Nominal roll of employees, work permits, gate entries and documents for head count or access to this information. Employee’s blood group information and addresses will also be useful.

7. Note pads, pens, pencils, rubber and stationery to record all messages received and sent by whatsoever means.

8. Note copies of this on-site emergency plan i.e. updated full text including all annexure. From this, some vehicles and messengers (runners) should be kept ready at the center.

9. A tape-recorder and video to record the incident and evidences of the cause and effect and actions to control the emergency.

10. Torches, umbrella, rain coats and some extra sets of gas detectors, explosive meters and personal protective equipments.

Pls. refer Annexure – 20 on page no. 117

7. FIRE AND TOXIC CONTROL ARRANGEMENTS:

BEIL has its own TAC approved wet fire hydrant system:

1. Total 120 numbers of Fire Extinguishers are available in plant, utility, QC, tank farm and storage area to handle any class of Fire. The portable fire extinguishers provided in the all area are mainly of ABC/ Dry Chemical, Carbon Dioxide & M. Foam type. The Electrical installations are provided with Carbon dioxide type of fire extinguishers. Apart from above, trolley mounted Carbon Dioxide & M. Foam type fire extinguisher is located near Electrical Control Panel & storage area.

2. Wet fire hydrant system has been provided in the factory area with jockey pump and main fire pumps, which come on line automatically when there is a pressure drop in the fire hydrant system. The main Hydrant Pump connected to the Fire Hydrant System is electrical driven. The standby can be Diesel Engine Driven Pump or Electrical Motor driven connecting to alternate source of energy from DG in case of failure of main electrical supply.

a) Fire Fighting Water Storage Details

Sr. No.	Description	Capacity
1	Raw water storage	200 KL
2	Fire water storage	1000 KL
	Total Water Storage	1200 KL

b) Jockey Pump

Capacity : 03 M3/Hr. at 70-M head

RPM : 2900

Motor HP : 10

c) Diesel Driven Pump

Capacity : 273 M3/hr. at 70-M head

RPM : 1880

Motor HP : 133

d) Electrical Power-Driven Pump

Capacity : 273 M3/Hr. at 70-M head

RPM : 2970

Motor HP : 120

e) Electrical Power-Driven Pump

Capacity : 173 M3/Hr. at 70-M head

RPM : 2935

Motor HP : 60

f) Fire Hydrant Point Details

Sr. No.	Description	Quantity
1	Single hydrant	57 Nos.
2	Water monitor	26 Nos.
3	Hose pipe	28 Nos.
4	Hose box	23 Nos.

g) Sand Buckets

Sr. No.	Description	Quantity
1	DG room	03 Nos.
2	HT yard	03 Nos.
3	Shed No. 1	05 Nos.
4	Shed No. 2	05 Nos.
5	Shed No. 3	05 Nos.
6	Shed No. 4	05 Nos.
7	Shed No. 5	05 Nos.
8	Shed No. 6	04 Nos.
9	Shed No. 7	05 Nos.
10	Shed No. 8	05 Nos.
11	Shed No. 9	05 Nos.
12	Shed No. 10	05 Nos.
13	Helipad	07 Nos.
	Total	62 Nos.

h) External Fire Fighting Service

For additional help in firefighting, the fire brigade can be called from DPMC Ankleshwar, Panoli, ONGC & Bharuch Nagarpalika. The response time to get external help from above fire station and the distances are as below:

Sr. No.	Fire Brigade Station	Distance	Response Time
1	DPMC Ankleshwar	3 KM	5 Min.
2	ONGC, Ankleshwar	6 KM	8 Min.
3	Nagarpalika,Ankleshwar	7 KM	10 Min.
4	Fire Station, Panoli	10 KM	15 Min.
5	Nagarpalika,Bharuch	12 KM	30 Min.
6	GNFC Bharuch	15 KM	35 Min.

2. Emergency Handling Arrangement

1. Emergency Control Center : 01 Nos. (Main Gate)

It is sited in Office Building, which is readily accessible & with minimum risks equipped with telephone facilities and announcements if extra communications facility needed. It has enough means to receive and transmit information and directions from Emergency Controller to incident controller and other areas.

In emergency control center due to its safer location and advantage of easier accessibility, all necessary personnel protective equipment, and fire fighting extinguishers are stocked in sufficient quantity.

2. SCBA : 06 Nos.
   - Near Old control room : 01 Nos.
   - Safety Office : 01 Nos
   - Charging Area : 01 Nos
   - Incinerator Plant Building : 01 Nos
   - MEE Plant : 01 Nos
   - Plastic Processing Plant : 01 Nos
3. Assembly Points : 03 Nos.
4. Siren : 02 Nos. (Plant-1 + Adm. Building)
5. Wind Indicator : 07 Nos. (Plant-1 + Adm. Bldg. + Phase-1 +Lab building+ plant-2+ inci control room)

3. Other PPE's available at ECC.

Sr. No.	Name of PPE	Qty.	Sr. No.	Name of PPE	Qty.
1	Safety Helmet	06 Nos.	5	Face Shield	03 Nos.
2	Disposable Hand Gloves	02 Pkts.	6	PVC Apron	02 Nos.
3	PVC Hand Gloves	06 Pkts.	7	Safety Belt	02 Nos.
4	Safety Goggles	06 Nos.	8	Air Bubble Hood	02 Nos.

Pls. refer Annexure – 21 on page no 118

8. MEDICAL ARRANGEMENTS:

Occupational health centre is available for medical treatment of the workers in normal working and also at the time of emergency. It is fully equipped with necessary instruments, arrangements, medicines including antidotes, and staff. It has sufficient space, capacity and sited in a safe place (avoiding normal downwind direction). There are sufficient first aid boxes and first aiders properly trained. The staff is available round the clock.

An emergency vehicle is available for the purpose of transportation of serious cases of accidents or sickness.

First Aiders

1. First Aid trained staff available round the clock in each plant. The First Aiders are arranged/selected such that in each shift, minimum one first aider is available in all plant.
2. External Faculty gives First Aid Training to all First Aiders.

First Aid Box

First-aid boxes with emergency medicines are available at following locations:

- ✓ Electrical panel room
- ✓ Safety office
- ✓ Safety office (mobile)
- ✓ Instrument office
- ✓ Plant-1 control room
- ✓ Laboratory
- ✓ Security office
- ✓ MEE plant
- ✓ Plastic Processing Plant
- ✓ Stabilisation Plant
- ✓ Manitenance room
- ✓ Ambulance Van
- ✓ OHC (Mobile first aid box)

Routine checking of First Aid Box by HSE department.

Emergency Vehicle

Ambulance is available round the clock in factory premises to carry injured person into nearby hospital.

Hospital

Jayaben Modi hospital, GIDC Ankleshwar & Municipal Hospital, Bharuch Hospital has all the facilities for treatment of serious cases and is well equipped with following. The hospitals are 5 km and 15 km away respectively Bharuch Enviro Infrastructure Ltd, Ankleshwar.

- X-Ray facilities, Pathological Laboratory.
- Well-equipped operation theatre and facilities to carry emergency surgery.
- Blood grouping facilities and Blood Bank.

The hospital has all the necessary specialists and medical staff with different wards and hospitalization.

Pls. refer Annexure – 22 on page no. 122

9. TRANSPORT AND EVACUATION ARRANGEMENTS:

Transport & Evacuation Arrangements are available in the factory round the clock.

Pls. refer Annexure – 23 on page no. 123

10. POLLUTION CONTROL ARRANGEMENTS:

Adequate pollution control arrangements for water, air & soil are provided.

Pls. refer Annexure – 24 on page no. 124

11. OTHER ARRANGEMENTS:

Heavy vehicles like JCB, forklifts are available round the clock. Transporters for material are also available round the clock. Two DG sets having 600 KV capacity are provided for alternate power supply in case of electricity failure.

Special equipments like oxygen meter, LEL meter, VOC meter are easily available.

Weather monitoring system is installed to monitor following parameters:

- Ambient temperature
- Wind direction
- Wind speed
- Humidity
- Rain flow
- UV radiation
- Barometric pressure

Apart from these, BEIL has formed an Emergency Response Team to deal with any kind of emergency.

Pls. refer Annexure – 25 on page no. 125

CHAPTER-IV

COMMUNICATION SYSTEM

The communication system beginning with raising the alarm, declaring the major emergency and procedure to make it known to others is explained below in brief.

1. RAISING THE ALARM:

In BEIL plant there are 02 Nos. of alarm/sirens. In case of an emergency, any person can press the button so that alarm/alarm can be heard. Alarm is audible all over the factory.

Siren Code

Sr. No.	Siren Type	Description
1	Fire or Other emergency	10 sec. ON & 5 sec. OFF three times
2	Gas leak	15 Sec. ON & 15 Sec. OFF four times
3	All clear	1 min. continue
4	Testing	1 Min. Continuous on every Wednesday

Pl. refer Annexure-26 on page No. 125

Security personnel who will initiate appropriate action to call on/pass on information to all required persons. Complete list of internal phone nos. & external phone nos. is available with security personnel. Availability of emergency vehicle is always ensured.

Pl. refer Annexure-27 & 28 on page No. 126 & 127 respectively for the list of internal phone nos. & external phone nos.

As standard procedure any person can raise the alarm to control the situation at earliest possible and avoid the development of major emergency, where appropriate early notification to outside agency is also needed.

2. DECLARING THE MAJOR EMERGENCY:

The declaration of major emergency puts many agencies on action and the running system may be disturbed which may be very costly at times or the consequences may be serious, therefore such declaration should not be decided on whims or immature judgment or without proper thought.

In BEIL plant only Site Main Controller (SMC) does declaration of major emergency. In absence of SMC, persons are nominated for declaration of emergency.

Pl. refer Annexure-29 on page No. 128

3. TELEPHONE MESSAGES:

After hearing the emergency alarm and emergency declaration or even while just receiving the emergency message on phone, a telephone operator will immediately contact SMC and on his advice call the local fire brigade. In case internal/external telephone system becomes inoperative, he shall inform the Officer-HRD through a messenger/runner. In case fire is discovered but no alarm is sounding, he shall receive information about location from the person discovering the fire and thereafter immediately consult the Emergency Controller and inform on telephone to the staff, location of the Incident and to evacuate to their assembly points. His such duties are described in the emergency instruction booklet given as the last annexure.

Pl. refer Annexure-30 on page No. 129

4. COMMUNICATION OF EMERGENCY:

The telephone operator or ECC receives message regarding emergency and informs relevant authorities.

1. Inside the Factory to the Employees

Through the internal plant Announcement System.

2. To Key Personnel Outside Normal Working Hours

The detail of key personnel availability after working hours is made available at security gate as well as plants. Availability of emergency vehicle is ensured to fetch the key personnel residing outside.

3. To The Outside Emergency Services & The Authorities

Facilities such as phones, emergency vehicle, and security personnel are available to help in calling outside emergency services and authorities.

The emergency will be immediately communicated to the government officers and other authorities such as fire brigade, police, district emergency authority, factory inspectorate, hospital etc.

4. To Neighboring Firms & The General Public

In case of emergency public will be cautioned regarding the same. Co-ordination of police will be sought for speedy action.

Pl. refer Annexure-31 on page No. 130

CHAPTER-V

ACTION ON SITE

1. CO-RELATED ACTIVITIES:

Following three stage co-related activities provide better points for emergency preparedness, emergency actions and subsequent follow up.

(a) Pre-emergency activities

- Internal safety survey with regard to identification of hazards, availability of protective equipment, checking for proper installation of safety devices is carried out periodically.
- Periodic pressure testing of equipment.
- Periodic non-destructive testing of lines.
- Periodic safety/relief valves testing.
- Periodic fire hydrant system testing.
- Mutual aid scheme with the neighboring organizations for getting / extending help to each other in emergency.
- Mock drill to check up level of confidence, extent of preparedness of personnel to face emergency is being contemplated.
- Regular training to all personnel to create awareness.
- Adequate safety equipments are made available.
- Internal/ external communication system is maintained in good working order.
- 5 kms. Range siren system is installed which can be operated in case of emergency.
- Wind-cocks/wind recorders are installed inside the plan areas as prominent locations to indicate wind direction and velocity.

- Periodic checkup of emergency lights.
- Emergency Control Center is identified
- Safe assembly points are identified.
- Storage of adequate first aids treatment facilities.
- Statutory information is imparted to workers

(b) Emergency Time activities

During emergency, all personnel will work with specific objective in consultation with Incident Controller to tackle the situation.

(c) Post Emergency Time activities

Post emergency activities comprise of steps taken after the emergency is over so as to establish the reasons of the emergency and preventive measures.

The steps involved are-

- ✓ Collection of records
- ✓ Conducting enquiries and concluding preventive measures
- ✓ Making insurance claims
- ✓ Preparation of inquiry reports and suggestion scheme.
- ✓ Implementation of inquiry report's recommendations.
- ✓ Rehabilitate the affected persons within the plant and outside the plant.
- ✓ To restart the plant.

2. CONTROLLING EMERGENCY:

MODE OF EMERGENCY

Man made	Natural Calamities	Extraneous
Fire	Flood	Riots/Civil Disorder /Mob attack
Toxic Release	Earthquake	Terrorism
Spillage / Leakage of solid / liquid material during transportation	Cyclone	Bomb Threat
Unsafe act / condition		War

In-adequate maintenance		Food / water poisoning

Some hazardous events and their control procedures are explained below in brief:

(A) Fire

- ✓ Inform Incident Controller at once when the fire is noticed.
- ✓ Put off electrical mains for the plant where in fire is observed, connected MCC's for the plant should be put off.
- ✓ Fire lighting crew to be directed for immediate actions in the area for extinguishing the fire by use of fire extinguishers and water from fire hydrant posts.
- ✓ Simultaneously put off the source of gas emission.
- ✓ Steps to be taken to evacuate non-essential persons.
- ✓ Use of portable fire extinguishers like foam type, ABC type to be made to contain the solvent fire.
- ✓ Use of water to be made to extinguish the fire and cooling off the equipment and storage surface till the fire extinguished and equipment are cooled.
- ✓ In case of Carbon dioxide do not allow the persons to enter into the area till the time, the carbon dioxide is dispersed and diluted to avoid any suffocation.
- ✓ To put off the fire due to solvents make use of excessive foam/DCP/ABC type fire extinguishers & water fog. Make use of excessive water to cool the surface area of equipment.
- ✓ Provide gas masks, Goggles, Aprons, Helmets and safety wears to the firefighting team.
- ✓ Keep people away from the danger area.
- ✓ Do not permit any naked flame and smoking in the area.
- ✓ Stop leakages and flush the leaky liquid, do not allow flow the leaky liquid in the drain.
- ✓ Give the first aid to the injured persons.
- ✓ If necessary induce vomiting, give artificial respiration and the effected person should be sent to the nearest doctor/clinic.
- ✓ Inform neighboring industries and population.
- ✓ Contact fire brigade, Police, Doctor/Hospital and other authorities.
- ✓ Contact statutory authorities and give information.
- ✓ Cordoned off whole area to restrict the entry by posting security personnel.

Action after Fire is Extinguished

The Incident Controller shall…

a. Prepare immediate abnormal occurrence report as soon as possible and submit it to safety department/administration department.

b. The affected department head shall carry out an investigation and prepare a detailed report mentioning any further requirement of facilities for tackling such type of emergencies.

c. Before the plant is re-commissioned the mechanical/ electrical / instrumentation shall assess the danger to ensure equipment is safe for continued services.

d. Make a note of the fire extinguisher used and need replacement

(B) Toxic Release

- Inform Incident Controller when vapors/gas leakage is noticed.
- Try to close the necessary valves to stop the gas leakage.
- Call the firefighting crew to take the immediate action to curtail the gas emission and spread up by use of water or appropriate medium (water in the form of fog will reduce the concentration of acidic vapors in the surrounding).
- Start putting water on the source of leakage to minimize gas emission.
- During above operation use longer duration sets of breathing apparatus and full body protective suits apart from plastic or rubber gloves, boots and goggles.
- Keep people away from the danger area.
- Do not permit naked flame or smoking in the area.
- After stopping the leakages flush the area with ample water if the leaked material does not react with water. For the material, which reacts with water, absorb in sawdust & incinerate.
- Give the first aid to the injured persons.
- Bring the patient to the fresh air, give the victim sufficient water and milk and transport to health care facility.
- In the event of a fire, the emergency plan must be executed on a timely basis.

In case of release of liquid/vapors in high concentration the Site Main Controller will co-ordinate the activities with incident controller. Under his direction, plant will be shut down. Non-essential workers will be sent to assembly points.

(C) Spillage of solid waste during transportation:

- On Noticing spillage, intimate safety officer and Plant Manager through Intercom/telephone system and clearly inform about
    1) The Location
    2) Manifest No.
    3) Characteristics of material
- Evacuate & barricade the Area
- Use following PPEs
    - Boiler suit
    - Hand Gloves
    - Apron
    - Face Mask or Safety goggles
    - Helmet
    - Multi gas cartridge mask
    - Gum Boot
- Check Wind Direction & monitor the surrounding environment.
- Reach to the place through the opposite way to wind direction
- Cover the spilled are by using dry soil or fly ash as absorbing inert media.
- Collect the material in plastic bags / drums and clean the floor.
- Send the material for proper disposal.

(D) Leakage of liquid material during transportation:

- On Noticing leakage, intimate safety officer and Plant Manager through Intercom/telephone system and clearly inform about
    4) The Location
    5) Manifest No.
    6) Characteristics of material
- Evacuate & barricade the Area
- Use following PPEs
    - Boiler suit
    - Hand Gloves

- Apron
- Face Mask or Safety goggles
- Helmet
- Multi gas cartridge mask
- Gum Boot

- Check Wind Direction & monitor the surrounding environment.
- Reach to the place through the opposite way to wind direction
- Roll the drum and take down from the palate
- Put on other palates as such the leaky position of drum or container comes on upside, so the leakage of liquid can be stopped immediately.
- Cover the leaky part by applying liner or plastic bag and tight by using plastic string
- Use dry soil or fly ash as absorbing inert media and spray over the spilled liquid.
- After solidification collect the material in a plastic bag and clean the floor
- Send the material for proper disposal
- Send the leaky container or drum to Incinerable waste treatment area

(E) Landfill slope failure:

- Inform Incident Controller when slope failure is noticed
- Implementation of onsite emergency plan
- Incoming waste to be stopped
- Slop failure may increase exposure risk to personnel and public so necessary PPEs to be provided. Relocation and covering of waste to be performed quickly and safely
- Perform mitigating activity to limit further contamination or damage
- Work to be done round the clock
- Primary report to be prepared and reviewed at regular intervals regarding the activities of waste shifting.

(F) Water accumulation in landfill due to heavy rain:

We are keeping four nos of Diesel pump of 40 m^3/hr capacity and 5 Electric pump of 80 m^3/hr capacity to pump out the accumulated water due to heavy rain. In the event of a landfill instability such as a slop failure the first concern is always safety, safety of site personnel, safety of site entrants, and safety of general public. The situation will need to be assessed concisely and necessary emergency procedures and precautions implemented as quickly as possible.

- Inform Incident Controller when water accumulation is noticed
- Implementation of onsite emergency plan
- Start pumps to pump out the water accumulated.
- Check the water quality, if contaminated send for treatment.
- Necessary PPEs like helmet, gum boot, hand gloves, rain coat to be provided. If required, relocation and covering of waste to be performed quickly and safely
- Perform mitigating activity to limit further contamination or damage
- Work to be done round the clock
- Primary report to be prepared and reviewed at regular intervals regarding the activities of waste shifting.

(G) Electric Shock:

- Electric shock results in irreversible damage to brain cells followed by deterioration of other organs.
- Rescue and first aid –
- Do first thing first, quickly and without fuss or panic.
- Switch off the supply if this can be done at once. If not possible, use a dry stick, dry cloth or other nonconductor to separate the victim of electrical contact. The rescuer must avoid receiving shock himself by wearing gloves or using a jacket to pull the victim. Always keep in mind that delay in rescue and resuscitation may be fatal. Every second counts.
- Artificial respiration
  - Give artificial respiration, if breathing has stopped. There are several methods of artificial respiration. If the victim is not injured over the face, try mouth to mouth. If the victim is injured over the face, use Silverster Brosch method.

(H) Snake Bite:

- Reassure the patient
- Do not allow the person to run or walk
- Apply a ligature above the wound (in between the heart and the wound) if the bite is in the leg or hand.
- Wash the wound with potassium permanganate solution or with soap and water.
- Allow free bleeding.
- Never suck the blood from the wound.
- Treat for shock.
- Arrange immediate hospitalization, by transporting the patient in a lying down position.

3. EVACUATION & TRANSPORT:

In case of emergency, evacuation and transportation of non-essential workers is carried out immediately after hearing Siren. The effected personnel will be transported for medical aid. Availability of transportation is always essential.

4. SAFE CLOSE DOWN:

During emergency, plant shut down will be carried out if you hear siren or instruction from SMC or Incident Controller.

5. USE OF MEDICAL AID:

The help from outside i.e. mutual aid will be taken if required by Site Main Controller.

6. USE OF EXTERNAL AUTHORITIES:

As and when necessary, statutory authorities, police, pollution control personnel, medical aid/center, ambulance etc. will be contacted.

7. MEDICAL TREATMENT:

The effected personnel will be brought to safer place immediately to give them first aid. Immediate medical attention will be sought.

8. ACCOUNTING FOR PERSONNEL:

Proper accounting for personnel as laid down in all the shifts. The number of persons present inside the plant premises, their duty etc. will be available with the security staff. This record will be regularly updated and will be made available.

9. ACCESS TO RECORD:

The relatives of affected personnel will be informed. The details regarding all employees are made available at Administration building.

10. PUBLIC RELATIONS:

A senior manager is appointed as the sole authoritative source of information to the news media. All other employees are instructed not to divulge information themselves which may, in the event, be misleading or inaccurate.

11. REHABILITATION:

The affected area will be cleared from emergency activities only after positive ascertaining of the system in all respects. The entry to affected area will have to be restricted until statutory authorities visit and inspect the spot of incident. Nothing should be disturbed from the area till their clearance. The Site Main Controller will be incharge of the activities to be undertaken.

The plan will cover emergencies, which can be brought under control by the works with the help of emergency team/fire services. Emergency Control Plan for gas leak & fire has been prepared for entire factory.

LEVEL OF EMERGACY

Level of emergency can be classified in three categories:

Level 1

The emergency, which is containable within the plant premises. Emergency may be due to

A. Small spot fire in the Incinerator plant or Landfill

B. Low quantity toxic gas leakage for short duration / small organic liquid leakage

C. Collapsing of small equipment's / line failure.

D. Electrical Shock

E. Snake bite

Level 2

The emergency, which is containable within the factory premises. Emergency may due to

A. Big fire in factory premises/Fall of structure/failure of line, vessel etc...

B. Medium scale explosion.

C. Heave leakage of toxic / flammable gas for short duration

D. Leakage from drum containing toxic hazardous liquid waste

E. Collapsing of heap of soil during construction of landfill

Level 3

1. Incinerator

Likelihood of cloud formation of toxic and / or flammable gases & drifting of such cloud affecting the general public and/or surrounding industries. The emergency may be due to

A. Explosion in high-pressure vessel containing toxic / flammable material.

B. Heavy leakage of toxic material or corrosive fumes for a long duration, from pipeline or storage tanks.

C. Fire/Explosion in storage areas causing heave radiation/fire balls etc.

2. Landfill

A. Slop failure of landfill

B. Flood hazards

- Water accumulation due to heavy rain
- Resulting from Dam and / or reservoir failure*
- Resulting from seismic sea waves*

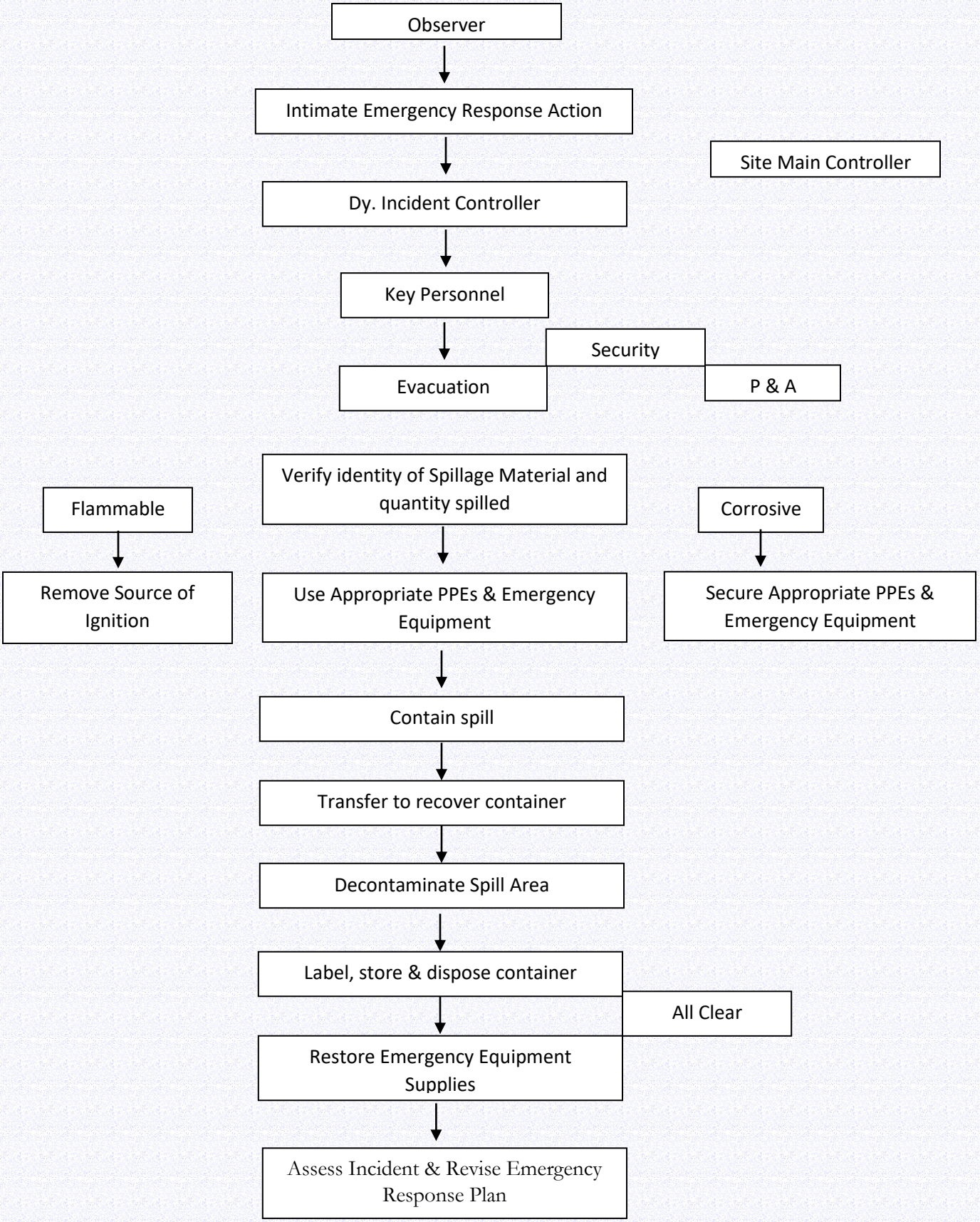
*BEIL is facility at Ankleshwar GIDC, Dist. Bharuch. Neither a dam nor reservoir near to the Facility, which failure can affect the TSDF. The Sea Mean level is below 32.78 Meter and highest flood level height is below 12.77 Meter from BEIL

ON HEARING EMERGANCY SIREN

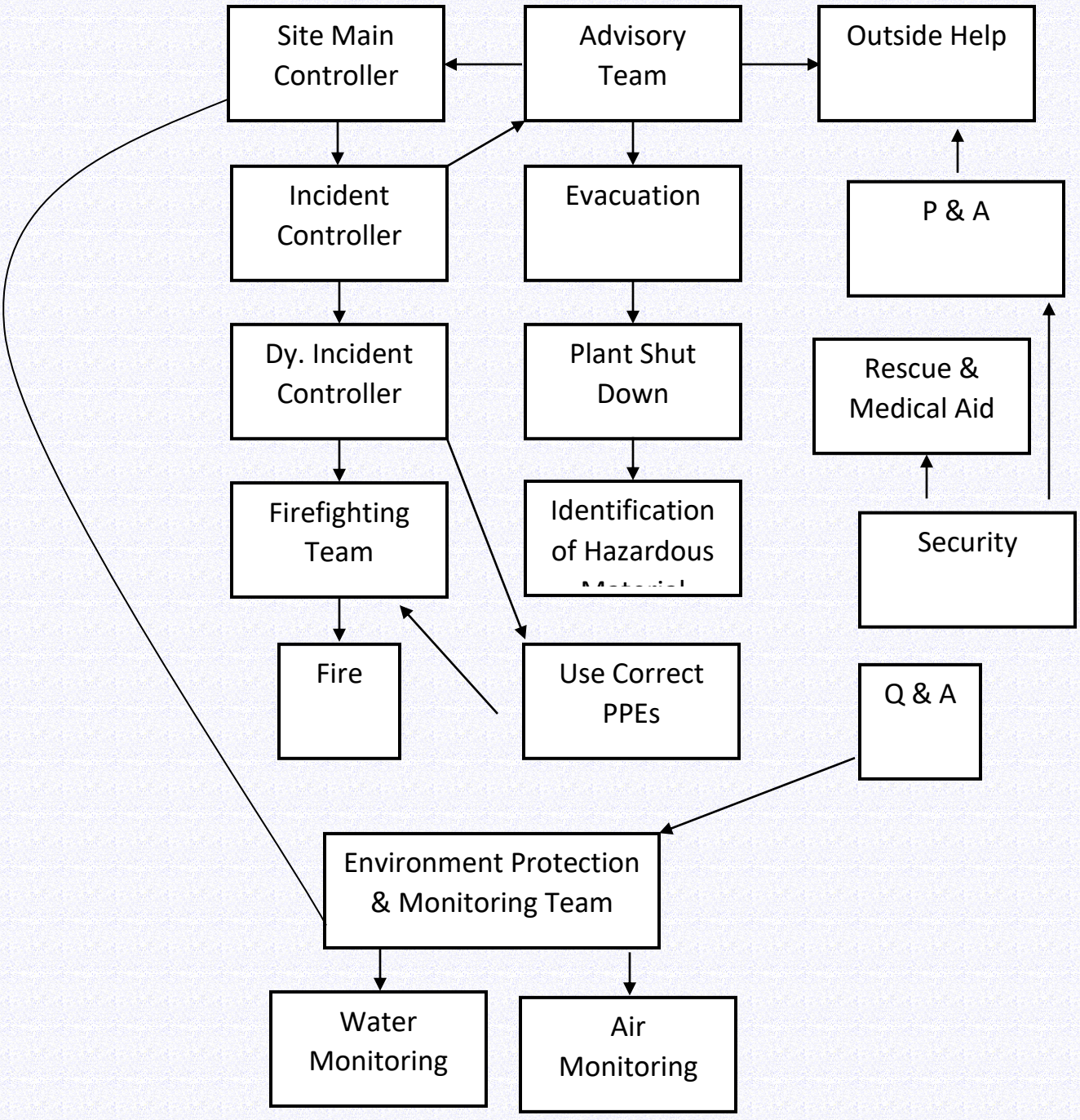
*Non-essential personnel shall follow safe route for evacuation.

Non-essential personnel will not rush towards incident site.

Emergency Response Flow Chart for Major Spills



Emergency Response Flow Chart for Major Fire


Site Main Controller
Advisory Team
Outside Help
Incident Controller
Evacuation
P & A
Dy. Incident Controller
Plant Shut Down
Rescue & Medical Aid
Firefighting Team
Identification of Hazardous
Security
Fire
Use Correct PPEs
Q & A
Environment Protection & Monitoring Team
Water Monitoring
Air Monitoring

CHAPTER-VI

OFF-SITE EMERGENCY PLAN

1. NEED OF THE EMERGENCY PLAN:

Depending on the wind direction and velocity the effects of accident in factory may spread to outside its premises. To avoid major disaster, it is essential to seek guidance/assistance of statutory authorities, police, and health department. The movement of traffic may have to be restricted.
Required information will be given to the authority and consultation will be sought for remedial measures.

Purposes of the off-site emergency plan are:

a) To provide the local/district authorities, police, fire brigade, doctors, surrounding industries and public the basic information of risk and environmental impact assessment and appraise them of the consequences and the protection/ prevention measures and to seek their help to communicate with public in case of major emergency.

b) To assist district authorities for preparing the off-site emergency plan for district or particular area and to organize rehearsals from time to time and initiate corrective actions on experience.

2. STRUCTURE OF THE OFF-SITE EMERGENCY PLAN:

3. ROLE OF THE FACTORY MANAGEMENT:

The Emergency Controller will provide a copy of action plan to the statutory authorities in order to facilitate preparedness of district/area off-site emergency plan.

4. ROLE OF THE EMERGENCY CO-ORDINATION OFFICE (ECO):

He will be a senior police or fire officer co-ordinating with Emergency Controller. He will utilize emergency control center.

5. ROLE OF THE LOCAL AUTHORITY:

Preparation of off-site plan lies with local authorities. An emergency planning officer (EPO) works to obtain relevant information for preparing basis for the plan & ensures that all that organization involved in offsite emergency and to know their role and responsibilities.

Separation distances in respect of chemicals in BEIL is given in Annexure 32.

Pls. refer Annexure 32 on page no. 130

6. ROLE OF THE FIRE AUTHORITY:

The fire authorities will take over the site responsibility from incident controller after arrival. They will be familiarized with site of flammable materials water and foam applies points, firefighting equipment.

7. ROLE OF THE POLICE AND EVACUATION AUTHORITY:

Senior Police Officer designed as emergency coordinating officer shall take overall control of an emergency. The duties include protection of life, property and control of traffic movement.

Their functions include controlling standards, evacuating public, and identifying dead and dealing with casualties and informing relatives of dead or injured.

There may be separate authorities / agencies to carry out evaluation and transportation work.

Evacuation depends upon the nature of accident, in case of fire only neighboring localities shall be alerted. Whole areas have to be evacuated in case of toxic release.

8. ROLE OF THE HEALTH AUTHORITY:

After assessing the extent of effect caused to a person the health authorities will treat them

9. ROLE OF THE MUTUAL AID AGENCIES:

Various types of mutual aid available from the surrounding factories and other agencies will be utilized.

10. ROLE OF THE FACTORY INSPECTORATE:

In the event of an accident, the Factory Inspector will assist the District Emergency Authority for information and helping in getting Neighboring Industries / mutual aid from surrounding factories.

In the aftermath, Factory Inspector may wish to ensure that the affected areas are rehabilitated safely.

CHAPTER-VII

TRAINING, REHEARSHAL AND RECORDS

1. NEED OF REHEARSAL & TRAINING:

Regular training and rehearsal program of emergency procedures shall be conducted with elaborate discussions and testing of action plan with mock drill. If necessary, the co-operation / guidance of outside agencies will be sought.

2. SOME CHECK POINTS:

Following check points are help-full in assessing the adequacy of the emergency plan, At the time of training these can be checked:

- The extent of realistic nature of incidents.
- Adequate assessment of consequences of various incidents.
- Availability of sufficient resources such as water, firefighting aids, personnel.
- The assessment of time scales.
- Logical sequences of actions.
- The involvement of key personnel in the preparation of plan.
- At least 24 hours cover to take account of absences due to sickness and holiday, minimum shift manning.
- Satisfactory co-operation with local emergency services and district or regional emergency planning offices.
- Adequacy of site.

3. RECORDS AND UPDATING THE PLAN:

All records of various on-site and off-site emergency plans of factory will be useful alone with those of the factors by which statutory authorities draw a detailed plan for the whole area/district. The records of the activity is being updated regularly.

4. EMERGENCY BOOKLET:

The duties/functions of particular role are mentioned in the last annexure given as Emergency Instruction Booklet.

Pls. refer Annexure 33 on page no. 131

ANNEXURE-1

IDENTIFICATION OF FACTORY

1.	Name of the Factory	:	**BEIL Infrastructure Ltd.**
2.	Address	:	Plot # 9701 – 9716, GIDC Estate, Ankleshwar – 393 002 Dist – Bharuch, Gujarat
3.	Telephone No.	:	02646-253135/226591/225228
4.	Fax No.	:	02646-222849/250707
5.	E-mail I.D.	:	panjawania@uniphos.com
6.	Full Name & Address of the Factory Occupier	:	Mr. Ashok Panjwani Near navsarjan bank, GIDC – Ankleshwar
	Telephone No.	:	9909994902
7.	Full Name & Address of the Factory Manager	:	Mr. B D Dalwadi 408/9, Sardar Patel Society, GIDC – Ankleshwar
8.	Manufacturing process	:	TSDF of Hazardous waste
9.	Shift details:	:	

Name of the Shift	Staff	Contract	Total
General(G)	50	148	198
First (A)	15	110	125
Second (B)	15	60	75
Third I	15	50	65
TOTAL	95	368	463

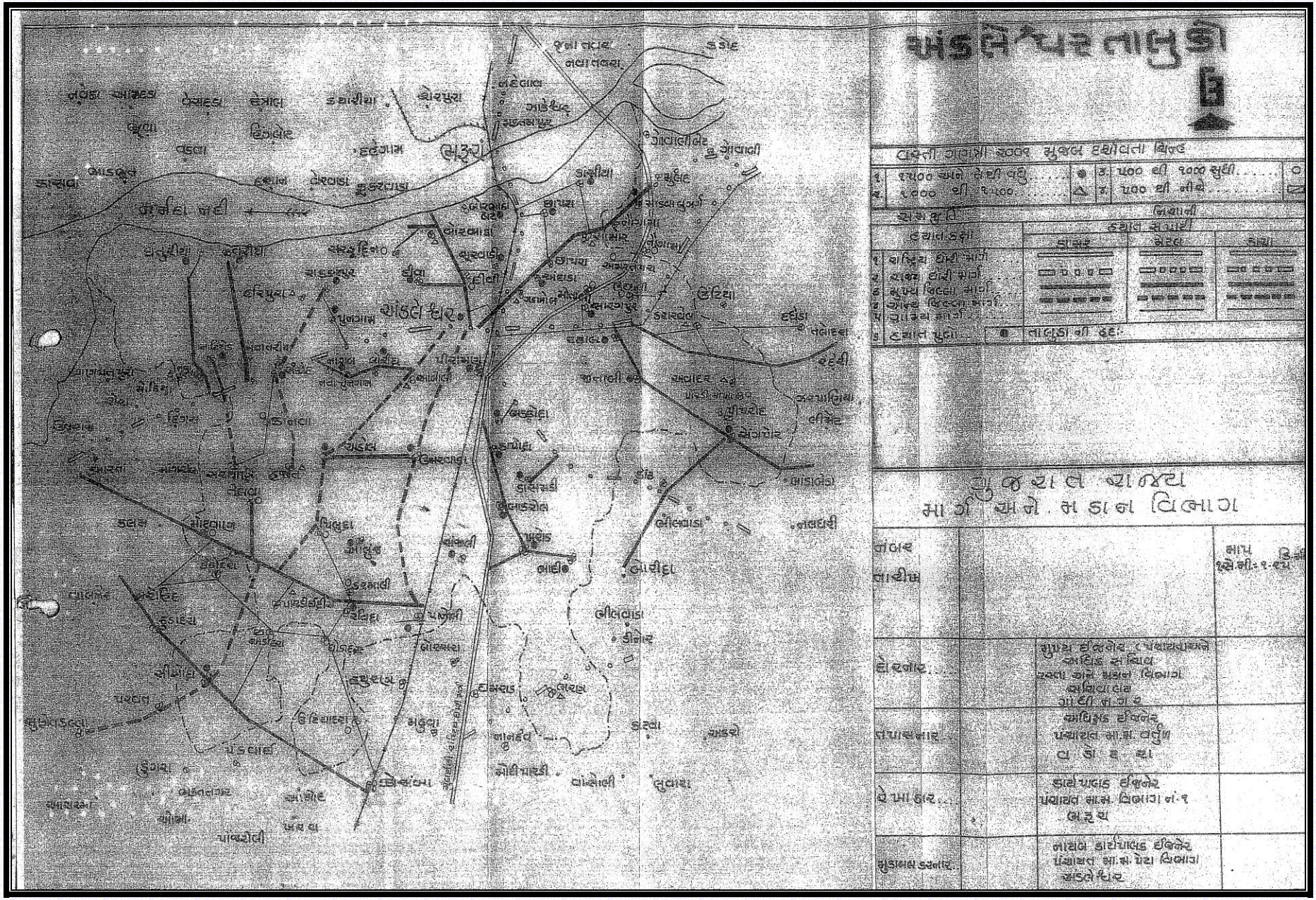
First person to be contacted in case of emergency:

Name of the shift	First person to be contacted in case of emergency			
	Name & Designation	Place of Availability	Phone No.	
			Office	Res.
General(G)	Mr. Atul Agarwal (GM – works)	Plant Office	02646-226591	9909994904

First	(A)	Mr. Dinkar trivedi (Sr. Manager)	Plant Office	02646-226591	9978996347
Second	(B)	Mr. Denish Patel (Executive)	Control Room	02646-226591	
Third	I	Mr. Shailesh Patel (Officer)	Control Room	02646-226591	9727990047
On Holiday		Mr. Kevin (officer)	Control Room	02646-226591	8511043083
Any other information, if any:					

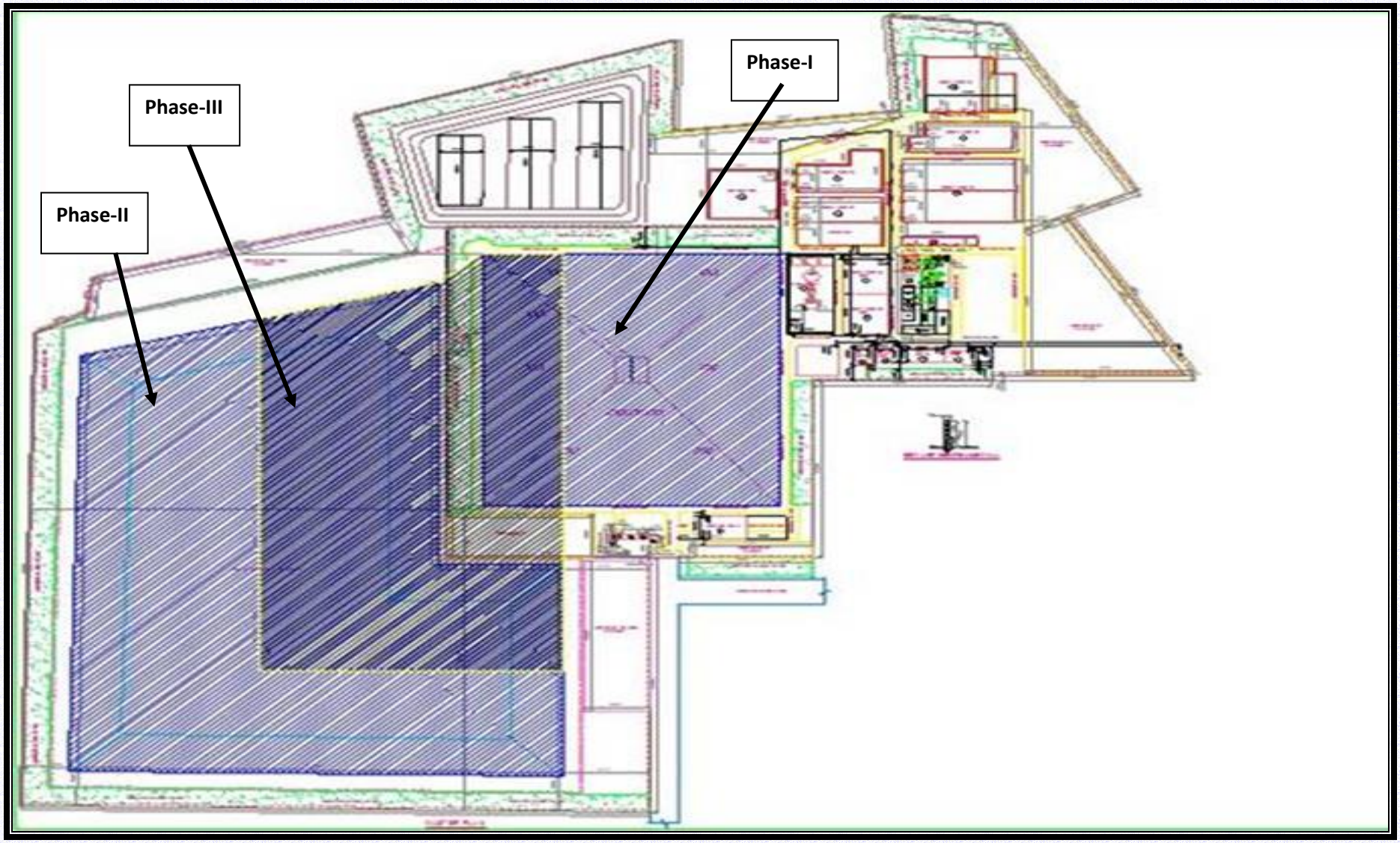
ANNEXURE-2

MAP OF THE AREA



ANNEXURE-3

FACTORY LAY OUT



ANNEXURE-4

STORAGE HAZARDS AND CONTROLS

Name of the hazardous substance	**Max. Storage Capacity**	**Place of its storage**	**State & operating pressure & Temperature**	**Type of Hazards possible (fire, explosion toxic release, spill, etc.)**	**Control Measures provided**
1	2	3	4	5	6
High CV liquid waste	25 KL	ST-3010	Liquid State, stored under N2 blanket with 150 mm WC pressure & ambient temp.	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion of liquid may become fatal to human life. ➢ Highly flammable fire & explosion hazard	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower ➢ Breather Valve and venting line provided and line is connected with scrubbing system. ➢ Inter locking system provided. ➢ Provision of Fire Hydrant System & Extinguishers. ➢ Grounding of storage vessel to earth pit. ➢ Declared as No Hot Work Zone. ➢ Tanks are provided with dip pipe. ➢ Proper Earthing & bonding before Loading/Unloading operations. ➢ N2 blanketing system. ➢ Automatic sprinkler system provided.
High CV liquid waste	35 KL	ST-3020			
Aqueous waste	35 KL	ST-3030	Liquid State, stored under ambient pressure & temp.	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion of liquid may become fatal to human life.	
Aqueous waste	35 KL	ST-3040			
High CV liquid waste	35 KL	ST-3050	Liquid State, stored under N2 blanket with 150 mm WC	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness,	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments

			pressure & ambient temp.	eye irritation & headache. ➢ Ingestion of liquid may become fatal to human life. ➢ Highly flammable fire & explosion hazard	are being used ➢ Provision of Safety shower ➢ Breather Valve and venting line provided and line is connected with scrubbing system. ➢ Inter locking system provided. ➢ Provision of Fire Hydrant System & Extinguishers. ➢ Grounding of storage vessel to earth pit. ➢ Declared as No Hot Work Zone. ➢ Tanks are provided with dip pipe. ➢ Proper Earthing & bonding before Loading/Unloading operations. ➢ N2 blanketing system. ➢ Automatic sprinkler system provided.
Aqueous waste	35 KL	ST-3060	Liquid State, stored under ambient pressure & temp.	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion of liquid may become fatal to human life.	
Aqueous waste	25 KL	ST-4010			
Aqueous waste	25 KL	ST-4020			
Aqueous waste	25 KL	ST-4030			
Aqueous waste	25 KL	ST-4040			
Aqueous waste	25 KL	ST-4050			
Aqueous waste	25 KL	ST-4060			
Caustic Lye	30 MT	T-3030A	Liquid State, stored under ambient pressure & temp.	➢ Skin irritation due to material contact. ➢ Damage to eye due to direct contact. ➢ Ingestion may become fatal to human life.	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower
Caustic Lye	30 MT	T-3030B			
Caustic Lye	40 MT	T-3030C			
Bleed Water	60 KL	T-3040	Liquid State, stored under ambient pressure & temp.	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion of liquid may	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower

				become fatal to human life.	
Aqueous Liquid waste	8 KL	T-2010	Liquid State, stored under N2 blanket with 150 mm WC pressure & ambient temp.	➢ May Cause irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion may become fatal to human life.	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower ➢ Breather Valve and venting line provided and line is connected with RK Blower system. ➢ Grounding of storage vessel to earth pit. ➢ Declared as No Hot Work Zone. ➢ Tanks are provided with dip pipe. Proper Earthing & bonding before Loading/Unloading operations
Aqueous Liquid waste	8 KL	T-2010A			
Aqueous liquid waste	6.8 KL	T-2030			
Aqueous liquid waste	8 KL	T-2030A			
High CV liquid waste	8 KL	T-2020A	Liquid State, stored under N2 blanket with 150 mm WC pressure & ambient temp.	➢ Causes irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion of liquid may become fatal to human life. ➢ Highly flammable fire & explosion hazard	
High CV liquid waste	8 KL	T-2040			
High CV liquid waste	8 KL	T-2040A			
High CV liquid waste	8 KL	T-2050			
High CV liquid waste	8 KL	T-2050A			
High CV liquid waste	8 KL	T-2020			
Hydrated Lime	50 TON	Old Storage yard	Solid Powder State, stored under ambient pressure & temp.	➢ Dust May Cause irritation to skin & eyes.	➢ Stored in a segregated & approved area. ➢ Personal protective equipments are being used
Hydrated Lime	70 TON	New Storage yard	Solid Powder State, stored under ambient pressure & temp.	➢ Dust May Cause irritation to skin & eyes.	➢ Stored in a segregated & approved area. ➢ Personal protective equipments are being used

Activated carbon	02 TON	Storage yard	Solid Powder State, stored under ambient pressure & temp.	➢ In case of contact, may Cause irritation to skin & eyes. ➢ Flammable.	➢ Store in a segregated, approved & ventilated area. ➢ Personal protective equipments are being used ➢ Fire extinguishers & Fire hydrant system provided
Incinerable hazardous waste	10529 MT	Storage sheds no. 1 to 10	Aqueous, Organic Liquid, Solid, Semi Solid & Tarry Waste stored under ambient pressure & temp	➢ May Cause irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion may become fatal to human life. ➢ Fire hazard	➢ Provision of Fire Hydrant System & Extinguishers. ➢ Provision of Water sprinkler system ➢ Provision of heat & smoke detectors. ➢ Provision of Safety Shower.
High TDS Effluent	150 KL 150 KL 150 KL	ST-01 ST-02 ST-03	Liquid State, stored under ambient pressure & temp.	➢ May Cause irritation to skin & eyes. ➢ Inhalation causes dizziness, eye irritation & headache. ➢ Ingestion may become fatal to human life.	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower
Condensate water	450 KL	CS Tank	Liquid State, stored under ambient pressure & temp.	➢ May Cause slight irritation to skin & eyes. ➢ Ingestion may become fatal to human life.	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used

ANNEXURE-5

MATERIAL SAFETY DATA SHEET

INDEX

MSDS of commonly used Volatile Organic Compounds (Solvents)

MSDS of Combustion product of Incinerable Hazardous Waste (Gases)

Nitrogen Dioxide

Phosgene

Sulphur dioxide

MSDS of Hazardous waste received from member industries

RPG life science limited (Petroleum Ether)

K. Patel chemopharma limited (Methyl violet, Chrysidine y, Victoria blue, Solvent black, and Ethyl Amine)

Trans Metal (Distillation residue of TCAC)

Panorama Aromatic Limited (Benzaldihyde)

Tatva chintan Pharma Limited (Distillation Residue(Mix solvents , EA, Toluene))

RPG life science limited (Methyl Chloride, Acetone)

UPL -2 (Low boiler MCP & DDVP)

Dishman Pharma (IPA & Toluene , Bromo , PCA)

Sanofi Aventis

PI industries

GACL (high Boiling Material)

UPL-2 (1- Nephthol, Methyl dichloride , Chloro propyonil chloride , EA)

Safety Data Sheet

According to EC Directive 91/155/EEC

Date of issue: 09.03.2006

Supersedes edition of 10.12.2004

1. Identification of the substance/preparation and of the company/undertaking *Identification of the product*

Catalogue No.: 100013

Product name: Acetone extra pure Ph Eur,BP,NF

Use of the substance/preparation

Pharmaceutical production and analysis

Solvent

Company/undertaking identification

Company: Merck KGaA * 64271 Darmstadt * Germany * Phone: +49 6151 72-0

Emergency telephone No.: Please contact the regional Merck representation in your country.

2. Composition/information on ingredients

Synonyms

Dimethyl ketone, Propanone

CAS-No.:	67-64-1	EC-Index-No.:	606-001-00-8
M:	58.08 g/mol	EC-No.:	200-662-2
Formula Hill:	C_3H_6O		
Chemical formula:	CH_3COCH_3		

3. Hazards identification

Highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking. Vapours may cause drowsiness and dizziness.

4. First aid measures

After inhalation: fresh air. Consult doctor if feeling unwell.

After skin contact: wash off with plenty of water. Remove contaminated clothing.

After eye contact: rinse out with plenty of water with the eyelid held wide open. Call in ophthalmologist.

After swallowing: caution if victim vomits. Risk of aspiration! Keep airways free. Immediately call in physicia

5. Fire-fighting measures

Suitable extinguishing media: CO_2, foam, powder.

Special risks:

Combustible. Vapours heavier than air.

Forms explosive mixtures with air at ambient temperatures. Beware of backfiring. Development of hazardous combustion gases or vapours possible in the event of fire.

Special protective equipment for firefighting:

Do not stay in dangerous zone without self-contained breathing apparatus. In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

Other information:

Prevent fire-fighting water from entering surface water or groundwater. Cool container with spray water from a save distance.

6. Accidental release measures

Person-related precautionary measures:

Avoid substance contact. Do not inhale vapours/aerosols. Ensure supply of fresh air in enclosed rooms.

Environmental-protection measures:

Do not allow to enter sewerage system; risk of explosion!

Procedures for cleaning / absorption:

Take up with liquid-absorbent material (e.g. Chemizorb®). Forward for disposal. Clean up affected area.

7. Handling and Storage

Handling:

Notes for prevention of fire and explosion:

Keep away from sources of ignition. Take measures to prevent electrostatic charging.

Notes for safe handling:

Work under hood. Do not inhale substance. Avoid generation of vapours/aerosols.

Storage:

Tightly closed in a well-ventilated place, away from sources of ignition and heat.
At +15˚C to +25˚C.

8. Exposure control/personal protection

Specific control parameter

EC

Name	Acetone
Value	500 ml/m^3
	1210 mg/m^3

Personal protective equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier

Respiratory protection: required when vapours/aerosols are generated. Filter AX (EN 371).

Eye protection: required

Hand protection: In full contact:

Glove material: butyl rubber

Layer thickness: 0.7mm

Breakthrough time: >480 min

In splash contact:

Glove material: natural latex

Layer thickness: 0.6mm

Breakthrough time: >10 min

The protective gloves to be used must comply with the specifications of EC directive 89/686/EEC and the resultant standard EN374, for example KCL 898 Butoject® (full contact), 706 Lapren® (splash contact). The breakthrough times stated above were determined by KCL in laboratory tests acc. to EN374 with samples of the recommended glove types.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Other protective equipment: Flame-proof protective clothing.

Antistatic protective clothing.

Industrial hygiene:

Immediately change contaminated clothing. Apply skin- protective barrier cream. Wash hands and face after working with substance. Work under hood. Do not inhale substance.

9. Physical and chemical properties

Form:		liquid			
Colour:		colourless			
Odour:		fruity			
pH value					
at 395 g/l H_2O		(20 ˚C)	5-6		
Viscosity dynamic		(20 ˚C)	0.32	mPa*s	
Melting point			-95.4	˚C	
Boiling point		(1013 hPa)	56.2	˚C	
Ignition temperature			465	˚C	(DIN 51794)
Flash point			< -20	˚C	c.c.
Explosion limits	lower		2.6	Vol%	
	upper		12.8	Vol%	
Vapour pressure		(20 ˚C)	233	hPa	
Relative vapour density			2.01		
Density		(20 ˚C)	0.79	g/cm^3	

Solubility in water	(20 ˚C)	soluble
log Pow	-0.24	(experimental) (Lit.)

10. Stability and reactivity

Conditions to be avoided

Warming.

Substances to be avoided

Risk of ignition or formation of inflammable gases or vapors with: Activated charcoal. chromosulfuric acid, chromyl chloride, CrO_3, ethanolamine, fluorine, strong oxidizing agents, strong reducing agents, nitric acid.

Risk of explosion with: nonmetallic oxyhalides, halogen-halogen compounds, chloroform, nitrating acid, nitrosyl compounds, hydrogen peroxide (Formation of peroxides possible.).

Exothermic reaction with: bromine, alkali metals, alkali hydroxides, halogenated hydrocarbons.

Hazardous decomposition products

no information available

Further information

light-sensitive; sensitive to air.

unsuitable working materials: various plastics, rubber.

Explosible with air in a vaporous/gaseous state.

11. Toxicological information

Acute toxicity

LC_{50} (inhalation, rat): 76 mg/l /4 h (Lit.).

LD_{50} (dermal, rabbit): 20000 mg/kg (IUCLID).

LD_{50} (oral, rat): 5800 mg/kg (RTECS).

Specific symptoms in animal studies:

Eye irritation test (rabbit): Irritations (External MSDS).

Skin irritation test (rabbit): No irritation (External MSDS).

Subacute to chronic toxicity

Sensitization:

Sensitization test (guinea pig): negative. (Lit.)

Noncarcinogenic in animal experiments. (IUCLID)

Bacterial mutagenicity: Ames test: negative. (in vitro) (National Toxicology Program)

Mutagenicity (mammal cell test): chromosome aberration negative. (in vitro) (National Toxicology Program)

Mutagenicity (mammal cell test): micronucleus nagative. (in vivo) (National Toxicology Program)

Further toxicological information

After inhalation of vapours: mucosal irritations, drowziness, dizziness, absorption.

After skin contact: Drying-out effect resulting in rough and chapped skin.

After eye contact: Irritations. Risk of corneal clouding.

After swallowing: gastrointestinal complaints, absorption.

After absorption: headache, salivation, nausea, vomiting, dizziness, narcosis, coma.

Further data

The product should be handled with the care usual when dealing with chemicals.

12. Ecological information

Biologic degradation:
Biodegradation: 91 % /28 d (IUCLID);
Readily biodegradable.

Behavior in environmental compartments:
Distribution: log Pow: -0.24 (experimental) (Lit.).
No bioaccumulation is to be expected (log Pow <1).

Ecotoxic effects:
Biological effects:
Fish toxicity: Onchorhynchus mykiss LC_{50}: 5540 mg/l /96 h (Lit.).

Daphnia toxicity: Daphnia magna EC_{50}: 6100 mg/l /48 h (Lit.).
Maximum permissible toxic concentration:
Algeal toxicity: Sc.quadricauda IC_5: 7500 mg/l /8 d (IUCLID);

Bacterial toxicity: M.aeruginosa EC_5: 530 mg/l /8 d (IUCLID); Ps.putida EC_5: 1700 mg/l /16 h (IUCLID);

Protozoa: E.sulcatum EC_5: 28 mg/l /72 h (Lit.).

Further ecologic data:
Degradability:

BOD_5: 1.85 g/g (IUCLID);

COD: 2.07 g/g (IUCLID);

TOD: 2.20 g/g (Lit.).

Do not allow to enter waters, waste water, or soil!

13.Disposal considerations

Product:

Chemicals must be disposed of in compliance with the respective national regulations. Under www.retrologistik.de you will find country- and substance-specific information as well as contact partners.

Packaging:

Merck product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system. Under www.retrologistik.de you will find special information on the respective national conditions as well as contact partners.

14. Transport information

Road & Rail ADR, RID
UN 1090 ACETON, 3, II

Inland waterway ADN, ADNR not tested

Sea IMDG-Code

UN 1090 ACETONE, 3, II
Ems F-E S-D

Air CAO, PAX

UN 1090 ACETONE, 3, II

The transport regulations are cited according to international regulations and in the form applicable in Germany. Possible national deviations in other countries are not considered.

15. Regulatory information

Labelling according to EC Directives

Symbol:	F	Highly flammable
	Xi	Irritant
R-phrases:	11-36-66-67	Highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking. Vapours may cause drowsiness and dizziness.
S-phrases:	9-16-26	Keep container in a well-ventilated place. Keep away from sources of ignition - No smoking. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
EC-No.:	200-662-2	EC label

16. Other Information

Reason for alteration

Chapter 11: toxicological information.
Chapter 12: ecological information.

General update.

Regional representation:

This information is given on the authorised Safety Data Sheet for your country.

The information contained herein is based on the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Safety Data Sheet

According to EC Directive 91/155/EEC

Date of issue: 13.12.2004

Supersedes edition of 30.01.2004

1. Identification of the substance/preparation and of the company/undertaking

Identification of the product

Catalogue No.: 101782

Product name: Benzene extra pure

Use of the substance/preparation

Chemical production

Company/undertaking identification

Company: Merck KGaA * 64271 Darmstadt * Germany * Phone: +49 6151 72-0

Emergency telephone No.: Please contact the regional Merck representation in your country.

2. Composition/information on ingredients

Synonyms

Cyclohexatriene

CAS-No.:	71-43-2	EC-Index-No.:	601-020-00-8
M:	78.11g/mol	EC-No.:	200-753-7
Formula Hill:	C_6H_6		

3. Hazards identification

May cause cancer. May cause heritable genetic damage. Highly flammable. Irritating to eyes and skin. Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed.

Restricted to professional users. Attention -

Avoid exposure - obtain special instructions before use.

4. First aid measures

First-aid personnel: ensure self-protection!

After inhalation: fresh air.

If breathing stops: immediately apply mechanical ventilation, if necessary oxygen mask. Immediately call in physician

After skin contact: wash off with plenty of water. Dab with polyethylene glycol 400. Immediately remove contaminated clothing. Immediately call in physician.

After eye contact: rinse out with plenty of water with the eyelid held wide open. Call in ophthalmologist.

After swallowing: immediately make victim drink plenty of water. Immediately call in physician.

In case of spontaneous vomiting: Risk of aspiration. Pulmonary failure possible. Call in physician.

1. Fire-fighting measures

Suitable extinguishing media:
CO_2, foam, powder.

Special risks:

Combustible. Vapours heavier than air. Forms explosive mixtures with air at ambient temperatures. Beware of backfiring. Development of hazardous combustion gases or vapours possible in the event of fire.

Special protective equipment for fire fighting:

Do not stay in dangerous zone without self-contained breathing apparatus. In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

Other information:

Prevent fire-fighting water from entering surface water or groundwater. Cool container with spray water from a save distance. Contain escaping vapours with water.

2. Accidental release measures

Person-related precautionary measures:

Do not inhale vapours/aerosols. Avoid substance contact. Ensure supply of fresh air in enclosed rooms.

Environmental-protection measures:

Do not allow to enter sewerage system; risk of explosion!

Procedures for cleaning / absorption:

Take up with liquid-absorbent material (e.g. Chemizorb). Forward for disposal. Clean up affected area.

7. Handling and storage *Handling:*

Notes for prevention of fire and explosion:

Keep away from sources of ignition. Take measures to prevent electrostatic charging.

Notes for safe handling:

Work under hood. Do not inhale substance. Avoid generation of vapours/aerosols.

Storage:

Tightly closed in a well-ventilated place, away from sources of ignition and heat. At +15˚C to +25˚C.

Accessible only for authorized persons.

8. Exposure controls/personal protection

Specific control parameter
EC

Name	Benzene
Value	1 ml/m^3
	3.25 mg/m^3
Carcinogenic	C 1: known to be carcinogenic to man
mutagenic	M 2: substance which should be regarded as if mutagenic to man
Skin resorption	Risk of skin absorption

Personal protective equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

Respiratory protection: required when vapours/aerosols are generated. Filter A (acc. to DIN 3181) for vapours of organic compounds, Respirator.

Eye protection: required

Hand protection: In full contact:

Glove material: viton

Layer thickness: 0.70mm

Breakthrough time: > 480min

In splash contact:

Glove material: nitrile rubber

Layer thickness: 0.40mm

Breakthrough time: > 10min

The protective gloves to be used must comply with the specifications of EC directive 89/686/EEC and the resultant standard EN374, for example KCL 890 Vitoject (full contact), 730 Camatril -Velours (splash contact). The breakthrough times stated above were determined by KCL

in laboratory tests acc. to EN374 with samples of the recommended glove types.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Industrial hygiene:

Immediately change contaminated clothing. Apply skin- protective barrier cream. Wash hands and face after working with substance. Under no circumstances eat or drink at workplace. Work under hood . Do not inhale substance.

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9. Physical and chemical properties

Form:	liquid
Colour:	colourless
Odour:	characteristic
pH value	not available

Viscosity dynamic	(20 ˚C)	0.66	mPa*s	
Viscosity kinematic		0.75	mm^2/s	
Melting point		5.5	˚C	
Boiling point		80.1	˚C	
Ignition temperature		555	˚C	(DIN 51794)
Flash point		-11	˚C	(DIN 51755)
Explosion limits	lower	1.4	Vol%	
	upper	8.0	Vol%	
Vapour pressure	(20 ˚C)	101	hPa	
Density	(20 ˚C)	0.88	g/cm^3	
Solubility in water				
	(20 ˚C)	1.770	g/l	
log Pow:		2.13		
Bioconcentration factor		1-10		

10. Stability and reactivity

Conditions to be avoided

Warming.

Substances to be avoided

Exothermic reaction with: halogens, halogenated hydrocarbons (in the presence of: light metals), uranium hexafluoride.

Risk of explosion with: perchlorates, nitric acid, ozone, peroxi compounds.

Risk of ignition or formation of inflammable gases or vapors with: oxygen, halogen-halogen compounds, oxyhalogenic compounds, CrO_3.

Violent reactions possible with: mineral acids, sulfur, oxidizing agent.

Hazardous decomposition products

not known to date

Further information

steam-volatile;

incompatible with rubber, various plastics.

explosible with air in a vaporous/gaseous state

11. Toxicological information

Acute toxicity

LC_{50} (inhalation, rat): 44 mg/l /4 h.

LD_{50} (dermal, rabbit): >8260 mg/kg.

LD_{50} (oral, rat): 930 mg/kg.

LDLo (oral, human): 50 mg/kg.

Specific symptoms in animal studies:

Eye irritation test (rabbit): Severe irritations.

Skin irritation test (rabbit): Irritations.

The literature data available to us do not conform with the labelling prescribed by the EC. The EC has dossiers which have not been published.

Subacute to chronic toxicity

Experience has shown this substance to be carcinogenic in man.

A mutagenic effect has been demonstrated in animal studies on mammals, justifying the assumption that exposure of humans to the substance produces hereditary damage.

Mutagenic effect in animal experiments.

Bacterial mutagenicity: Salmonella typhimurium: negative.
No teratogenic effect in animal experiments.

Further toxicological information

After inhalation: absorption, Irritation symptoms in the respiratory tract.

After skin contact: Irritations. Degreasing effect on the skin, possibly followed by secondary inflammation. Danger of skin absorption.

After eye contact: Severe irritations.

After swallowing: nausea. After accidental swallowing the substance may pose a risk of aspiration. Passage into the lung (vomiting)! can result in a condition resembling pneumonia (chemical pneumonitis).
After absorption: agitation, euphoria, headache, dizziness, inebriation, tiredness, CNS disorders, narcosis, respiratory arrest.

Subacute and chronic toxicity: After a latency period: changes in the blood picture, haemolysis.

Further data

This substance should be handled with particular care.

12. Ecological information

Biologic degradation:

Readily biodegradable (reduction: DOC >70 %; BOD >60 %; BOD_5 to COD >50 %).

Behavior in environmental compartments:
Distribution preferentially in air.
Distribution: log p(o/w): 2.13;

No appreciable bioaccumulation potential is to be expected (log P(o/w) 1-3).
Henry constant: 450 Pa*m^3/mol.

Ecotoxic effects:
Biological effects:
Toxic for aquatic organisms. Endangers drinking-water supplies if allowed to enter soil or water.

Fish toxicity: Onchorhynchus mykiss LC_{50}: 5.3 mg/l /96 h;

C.auratus LC_{50}: 34 mg/l /96 h.

Daphnia toxicity: Daphnia magna EC_{50}: 200 mg/l /48 h.

Algeal toxicity: Chlorella vulgaris IC_{50}: 530 mg/l /24 h.

Bacterial toxicity: Ps.putida EC_{10}: 168 mg/l.

The literature data available to us do not conform with the labelling prescribed by the EC. The EC has dossiers which have not been published.

Further ecologic data:
Degradability:
BOD 71 % from TOD /5 d; COD 19 % from TOD; TOD: 3.10 g/g.
Do not allow to enter waters, waste water, or soil!

13. Disposal considerations

Product:

Chemicals must be disposed of in compliance with the respective national regulations. Under www.retrologistik.de you will find country- and substance-specific information as well as contact partners.

Packaging:

Merck product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system. Under www.retrologistik.de you will find special information on the respective national conditions as well as contact partners.

14. Transport information

Road & Rail ADR, RID
UN 1114 BENZEN, 3, II

Inland waterway ADN, ADNR not tested

Sea IMDG-Code

UN 1114 BENZENE, 3, II

Ems F-E S-D

Air CAO, PAX
BENZENE, 3, UN 1114, II

The transport regulations are cited according to international regulations and in the form applicable in Germany. Possible national deviations in other countries are not considered.

15. Regulatory information

Labelling according to EC Directives

Symbol:	T	Toxic
	F	Highly flammable
R-phrases:	45-46-11-36/38-48/23/24/25-65	
		May cause cancer. May cause heritable genetic damage. Highly flammable. Irritating to eyes and skin. Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed.
S-phrases:	53-45	Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
EC-No.:	200-753-7	EC label

Reduced labelling (1999/45/EC,Art.10,4)

Symbol:	T	Toxic
	F	Highly flammable
R-phrases:	45-46-48/23/24/25-65	May cause cancer. May cause heritable genetic damage. Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed.
S-phrases:	53-45	Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

16. Other information

Reason for alteration
Chapter 8: specific control parameter.
Chapter 15: labelling.

General update.

Regional representation:

This information is given on the authorised Safety Data Sheet for your country.

Safety Data Sheet

According to EC Directive 91/155/EEC

Date of issue: 28.02.2006

Supersedes edition of 20.08.2004

1. Identification of the substance/preparation and of the company/undertaking

Identification of the product

Catalogue No.: 100955

Product name: 1,2-Dichloroethane extra pure

Use of the substance/preparation

Chemical production

Company/undertaking identification

Company: Merck KGaA * 64271 Darmstadt * Germany * Phone: +49 6151 72-0

Emergency telephone No.: Please contact the regional Merck representation in your country.

2. Composition/information on ingredients

Synonyms

Ethylene chloride, Ethylene dichloride

CAS-No.:	107-06-2	EC-Index-No.:	602-012-00-7
M:	98.97 g/mol	EC-No.:	203-458-1
Formula Hill:	$C_2H_4Cl_2$		
Chemical formula:	$ClCH_2CH_2Cl$		

3. Hazards identification

May cause cancer. Highly flammable. Also harmful if swallowed. Irritating to eyes, respiratory system and skin.

Restricted to professional users. Attention -

Avoid exposure - obtain special instructions before use.

4. First aid measures

First-aid personnel: ensure self-protection!

After inhalation: fresh air.
If breathing stops: immediately apply mechanical ventilation, if necessary oxygen mask. Immediately call in physician.

After skin contact: wash off with plenty of water. Dab with polyethylene glycol 400. Immediately remove contaminated clothing.

After eye contact: rinse out with plenty of water with the eyelid held wide open. Call in ophtalmologist.

After swallowing: immediately make victim drink plenty of water. Subsequently administer: activated charcoal (20 - 40 g in 10% slurry). Laxative: Sodium sulfate (1 tablespoon/1/4 l water). Immediately call in physician.

Indications for the doctor: Gastric lavage. No milk. No castor oil. No alcohol.

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5. Fire-fighting measures

Suitable extinguishing media:
powder, foam, water.

Special risks:
Combustible. Vapours heavier than air.
Forms explosive mixtures with air at ambient temperatures. Beware of backfiring.

Development of hazardous combustion gases or vapours possible in the event of fire. The following may develop in event of fire: hydrochloric acid.

Special protective equipment for fire fighting:

Do not stay in dangerous zone without self-contained breathing apparatus. In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

Other information:

Contain escaping vapours with water. Prevent fire-fighting water from entering surface water or groundwater. Cool container with spray water from a save distance.

6. Accidental release measures

Person-related precautionary measures:
Do not inhale vapours/aerosols. Avoid substance contact. Ensure supply of fresh air in enclosed rooms.

Environmental-protection measures:
Do not allow to enter sewerage system; risk of explosion!

Procedures for cleaning / absorption:
Take up with liquid-absorbent material (e.g. Chemizorb®). Forward for disposal. Clean up affected area.

7. Handling and storage

Handling:

Notes for prevention of fire and explosion:
Keep away from sources of ignition. Take measures to prevent electrostatic charging.

Notes for safe handling:
Work under hood . Do not inhale substance. Avoid generation of vapours/aerosols.

Storage:

Tightly closed in a well-ventilated place, away from sources of ignition and heat. Storage temperature: no restrictions.

Accessible only for authorized persons.

8. Exposure controls/personal protection

Specific control parameter

EC

Name	1,2-Dichloroethane
Carcinogenic	C 2:should be regarded as if it is carcinogenic to man

Personal protective equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

Respiratory protection:	required when vapours/aerosols are generated. Filter A (acc. to DIN 3181) for vapours of organic compounds		
Eye protection:	required		
Hand protection:	In full contact:		
	Glove material:	viton	
	Layer thickness:	0.70	mm
	Breakthrough time:	>480	Min.
	In splash contact:		
	Glove material:	polychloroprene	
	Layer thickness:	0.65	mm
	Breakthrough time:	> 10	Min.

The protective gloves to be used must comply with the specifications of EC directive 89/686/EEC and the resultant standard EN374, for example KCL 890 Vitoject® (full contact), 720 Camapren® (splash contact). The breakthrough times stated above were determined by KCL in laboratory tests acc. to EN374 with samples of the recommended glove types.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell,)

Other protective equipment: Flame-proof protective clothing.

Antistatic protective clothing

Industrial hygiene:

Immediately change contaminated clothing. Apply skin- protective barrier cream. Wash hands and face after working with substance. Under no circumstances eat or drink at workplace. Work under hood . Do not inhale substance.

9. Physical and chemical properties

Form:	liquid				
Colour:	colourless				
Odour:	of solvents				
pH value	not available				
Viscosity dynamic		(20 ˚C)	0.82-0.84	mPa*s	
Melting point			-35.5	˚C	
Boiling point		(1013 hPa)	83.5-84.1	˚C	
Ignition temperature			412.6-440	˚C	
Flash point			13	˚C	c.c.
Explosion limits	lower		6	Vol%	
	upper		11.4	Vol%	
Vapour pressure		(20 ˚C)	87	hPa	
Relative vapour density	3.4				

Density	(20 ˚C)	1.25	g/cm^3
Solubility in water	(20 ˚C)	8.7	g/l
log Pow		1.45	(OECD 107)
Evaporation rate		4.1	

10. Stability and reactivity

Conditions to be avoided

Warming.

Substances to be avoided

Risk of explosion with: / Exothermic reaction with: alkali metals, alkaline earth metals, aluminium in powder form, alkali amides, nitric acid, nitrogen oxides, oxidizing agent, chlorine, metals in powder form.

Hazardous decomposition products
in the event of fire: See chapter 5.

Further information

light-sensitive;
Solvent for: fats, resines.
unsuitable working materials: various plastics, light metals.
Explosible with air in a vaporous/gaseous state.

11. Toxicological information

Acute toxicity

LC_{50} (inhalation, rat): 7.2 mg/l /4 h (RTECS).
LD_{50} (dermal, rabbit): 2800 mg/kg (RTECS).
LD_{50} (oral, rat): 670 mg/kg (RTECS).

Specific symptoms in animal studies:

Eye irritation test (rabbit): Severe irritations (RTECS).
Skin irritation test (rabbit): Slight irritations (RTECS).

Subacute to chronic toxicity

Animal experiments performed under conditions comparable with the workplace situation have shown the substance to be carcinogenic.

Bacterial mutagenicity: Salmonella typhimurium: positive. (National Toxicology Program)

Further toxicological information

After inhalation: Irritations of the mucous membranes, coughing, and dyspnoea.
After skin contact: Irritations. Danger of skin absorption.
After eye contact: Severe irritations.
After swallowing: irritations of mucous membranes in the mouth, pharynx, oesophagus and gastrointestinal tract.

Systemic effects: CNS disorders, dizziness, headache, tiredness, coma, respiratory paralysis, death.
Absorption may result in damage of the following: liver, kidneys.

Further data

This substance should be handled with particular care.

12. Ecological information

Behavior in environmental compartments: Distribution: log Pow: 1.45 (OECD 107).

No appreciable bioaccumulation potential is to be expected (log Pow 1-3).
Henry constant: 149 Pa*m^3/mol (experimental) (IUCLID) (volatile).
Concentration in organisms is not to be expected.

Ecotoxic effects:
Biological effects:
Fish toxicity: P.promelas LC_{50}: 116 mg/l /96 h (in soft water) (IUCLID).
Daphnia toxicity: Daphnia magna EC_{50}: 155 mg/l /48 h (in soft water) (IUCLID).
Algeal toxicity:
Maximum permissible toxic concentration: Desmodesmus subspicatus IC_5: 412 mg/l /7 d (IUCLID).
Bacterial toxicity:
Maximum permissible toxic concentration: Ps.putida EC_5: 135 mg/l /16 h (IUCLID).

Further ecologic data:

Do not allow to enter waters, waste water, or soil!

13. Disposal considerations

Product:

Chemicals must be disposed of in compliance with the respective national regulations. Under www.retrologistik.de you will find country- and substance-specific information as well as contact partners.

Packaging:

Merck product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system. Under www.retrologistik.de you will find special information on the respective national conditions as well as contact partners.

14. Transport information

Road & Rail ADR, RID

UN 1184 ETHYLENDICHLORID, 3 (6.1), II

Inland waterway ADN, ADNR not tested

Sea IMDG-Code

UN 1184 ETHYLENE DICHLORIDE, 3 (6.1), II
Ems F-E S-D

Air CAO, PAX

UN 1184 ETHYLENE DICHLORIDE, 3 (6.1), II

The transport regulations are cited according to international regulations and in the form applicable in Germany . Possible national deviations in other countries are not considered.

15. Regulatory information

Labelling according to EC Directives

Symbol:	T	Toxic
	F	Highly flammable
R-phrases:	45-11-22-36/37/38	May cause cancer. Highly flammable. Also harmful if swallowed. Irritating to eyes, respiratory system and skin.
S-phrases:	53-45	Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
EC-No.:	203-458-1	EC label

Reduced labelling (1999/45/EC,Art.10,4)

Symbol:	T	Toxic
	F	Highly flammable
R-phrases:	45-22	May cause cancer. Also harmful if swallowed.
S-phrases:	53-45	Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell,seek medical advice immediately (show the label where possible).

16. Other information

Reason for alteration
Chapter 8: personal protective equipment.
Chapter 10: stability and reactivity.
Chapter 11: toxicological information.
Chapter 12: ecological information.

General update.

Regional representation:

This information is given on the authorised Safety Data Sheet for your country.

Safety Data Sheet

According to EC Directive 91/155/EEC

Date of issue: 13.02.2006

Supersedes edition of 05.10.2004

1. Identification of the substance/preparation and of the company/undertaking

Identification of the product

Catalogue No.: 102222

Product name: Carbon tetrachloride GR for analysis

Use of the substance/preparation

Reagent for analysis

Company/undertaking identification

Company: Merck KGaA * 64271 Darmstadt * Germany * Phone: +49 6151 72-0

Emergency telephone No.: Please contact the regional Merck representation in your country.

2. Composition/information on ingredients

Synonyms

Tetrachloromethane

CAS-No.:	56-23-5	EC-Index-No.:	602-008-00-5
M:	153.82 g/mol	EC-No.:	200-262-8
Formula Hill:	CCl_4		

3. Hazards identification

Toxic by inhalation, in contact with skin and if swallowed. Limited evidence of a carcinogenic effect. Toxic: danger of serious damage to health by prolonged exposure through inhalation. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Dangerous for the ozone layer.

4. First aid measures

First-aid personnel: ensure self-protection!

After inhalation: fresh air.
If breathing stops: immediately apply mechanical ventilation, if necessary oxygen mask. Immediately call in physician.
After skin contact: wash off with plenty of water. Remove contaminated clothing. Immediately call in physician.
After eye contact: rinse out with plenty of water with the eyelid held wide open. Call in ophtalmologist.
After swallowing: caution if victim vomits. Risk of aspiration! Keep airways free. Immediately call in physician.

5. Fire-fighting measures

Suitable extinguishing media:

In adaption to materials stored in the immediate neighbourhood.

Special risks:

Non-combustible. Vapours heavier than air. Ambient fire may liberate hazardous vapours. The following may develop in event of fire: hydrochloric acid, phosgene.
Special protective equipment for fire fighting:

Do not stay in dangerous zone without self-contained breathing apparatus. In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

Other information:

Cool container with spray water from a save distance. Contain escaping vapours with water. Prevent fire-fighting water from entering surface water or groundwater.

6. Accidental release measures

Person-related precautionary measures:

Do not inhale vapours/aerosols. Avoid substance contact. Ensure supply of fresh air in enclosed rooms.

Environmental-protection measures:
Do not allow to enter sewerage system.

Procedures for cleaning / absorption:

Take up with liquid-absorbent material (e.g. Chemizorb®). Forward for disposal. Clean up affected area. Do not inhale vapours.

7. Handling and storage

Handling:

Notes for safe handling:

Work under hood . Do not inhale substance. Avoid generation of vapours/aerosols.

Storage:

Tightly closed in a well-ventilated place. Accesible only for authorised persons. Storage temperature: no restrictions.

8. Exposure controls/personal protection

Specific control parameter

EC

Name	Carbon tetrachloride
Carcinogenic	C 3:owing possible carcinogenic effects for man

Personal protective equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

Respiratory protection:	required when vapours/aerosols are generated. Filter A (acc. to DIN 3181) for vapours of organic compounds.	
Eye protection:	required	
Hand protection:	In full contact:	
	Glove material:	viton
	Layer thickness:	0.70mm
	Breakthrough time:	>480Min.
	In splash contact:	
	Glove material:	nitrile rubber
	Layer thickness:	0.40mm
	Breakthrough time:	> 240Min.

The protective gloves to be used must comply with the specifications of EC directive 89/686/EEC and the resultant standard EN374, for example KCL 890 Vitoject® (full contact), 730 Camatril® -Velours (splash contact). The breakthrough times stated above were determined by KCL in laboratory tests acc. to EN374 with samples of the recommended glove types.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Industrial hygiene:

Immediately change contaminated clothing. Apply skin- protective barrier cream. Wash hands and face after working with substance. Under no circumstances eat or drink at workplace. Work under hood. Do not inhale substance.

9. Physical and chemical properties

Form:		liquid		
Colour:		colourless		
Odour:		characteristic		
pH value		not available		
Viscosity dynamic		(20 ˚C)	0.96	mPa*s
Viscosity kinematic		(20 ˚C)	0.00061	mm^2/s
Melting point			-23	˚C
Boiling point			76.7	˚C
Ignition temperature			> 982	˚C
Flash point		not applicable		
Explosion limits	lower		not available	
	upper		not available	
Vapour pressure		(20 ˚C)	120	hPa
Relative vapour density			5.3	
Density		(20 ˚C)	1.59	g/cm^3
Solubility in				
water		(20 ˚C)	0.8	g/l
Thermal decomposition			> 100	˚C
log Pow		(23 ˚C)	2.75	(OECD 107)

10. Stability and reactivity

Conditions to be avoided
Strong heating (decomposition).

Substances to be avoided
Risk of explosion with: alkali metals, alkaline earth metals, aluminium in powder form, zinc in powder form, metals in powder form, calcium silicide, fluorine, silanes, silver- perchlorates / chlorates.

Violent reactions possible with: aluminium halides / triethylaluminium, alkali amides, boron triiodide, halogen-halogen compounds, sodium amide, nitrogen dioxide, air / oxygen / heat.

Hazardous decomposition products in the event of fire: See chapter 5.
Further information

unsuitable working materials: various plastics, light metals, metal alloys (iron, copper).

11. Toxicological information

Acute toxicity

LC_{50} (inhalation, rat): 51.1 mg/l /4 h (RTECS).
LCLo (inhalation, human): 1000 ppm(V) (RTECS).
LD_{50} (dermal, rat): 5070 mg/kg (RTECS).
LD_{50} (oral, rat): 1770 mg/kg (Lit.).

Specific symptoms in animal studies:
Eye irritation test (rabbit): Slight irritations (IUCLID).
Skin irritation test (rabbit): Slight irritations (IUCLID).

The literature data available to us do not conform with the labelling prescribed by the EC. The EC has dossiers which have not been published.

Subacute to chronic toxicity
The carcinogenic potential requires further clarification.

Bacterial mutagenicity: Salmonella typhimurium: positive. (IUCLID)

Further toxicological information
After inhalation: mucosal irritations, headache, nausea, vomiting, dizziness, unconsciousness.
In high concentrations: narcosis, respiratory arrest.
After skin contact: Slight irritations. Danger of skin absorption.
After eye contact: Slight irritations.
After swallowing: gastric pain (bloody diarrhoea), nausea, vomiting, dizziness. After accidental swallowing the substance may pose a risk of aspiration. Passage into the lung (vomiting!) can result in a condition resembling pneumonia (chemical pneumonitis).

After a latency period: Damage of: liver, kidneys.

Further data
This substance should be handled with particular care.

12. Ecological information

Abiotic degradation:
Slow degradation. (air and water).

Biologic degradation:
Slightly biodegradable (DOC or COD reduction <20 %).

Behavior in environmental compartments:
Distribution: log Pow: 2.75 (23 ˚C) (OECD 107).
No appreciable bioaccumulation potential is to be expected (log Pow 1-3).
Ecotoxic effects:
Biological effects: Harmfull effect on aquatic organisms. Hazard for drinking water supplies. Concentration in organisms is not to be expected. May cause long-term adverse effects in the aquatic environment.
Fish toxicity: L.macrochirus LC_{50}: 27 mg/l /96 h (IUCLID).
Daphnia toxicity: Daphnia magna EC_{50}: 29 mg/l /48 h (IUCLID).
Bacterial toxicity: Photobacterium phosphoreum EC_{50}: 5.6 mg/l /5 min (Lit.).
Maximum permissible toxic concentration:
Algeal toxicity: M.aeruginosa IC_5: 105 mg/l /8 d (IUCLID).

Further ecologic data:
Substance which may present a danger to the structure and/or the functioning of the stratospheric ozone layer according to EC Regulation No 2037/2000 (listed in Annex I, Group IV).

Do not allow to enter waters, waste water, or soil!

13. Disposal considerations

Product:

Chemicals must be disposed of in compliance with the respective national regulations. Under www.retrologistik.de you will find country- and substance-specific information as well as contact partners.

Packaging:
Merck product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system. Under www.retrologistik.de you will find special information on the respective national conditions as well as contact partners.

14. Transport information

Road & Rail ADR, RID
UN 1846 TETRACHLORKOHLENSTOFF, 6.1, II
Inland waterway ADN, ADNR not tested

Sea IMDG-Code
UN 1846 CARBON TETRACHLORIDE, 6.1, II , Marine Pollutant: P
Ems F-A S-A

Air CAO, PAX
UN 1846 CARBON TETRACHLORIDE, 6.1, II
The transport regulations are cited according to international regulations and in the form applicable in Germany. Possible national deviations in other countries are not considered.

15. Regulatory information

Labelling according to EC Directives

Symbol:	T	Toxic
	N	Dangerous for the environment
R-phrases:	23/24/25-40-48/23-52/53-59	
	Toxic by inhalation, in contact with skin and if swallowed. Limited evidence of a carcinogenic effect. Toxic: danger of serious damage to health by prolonged exposure through inhalation. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Dangerous for the ozone layer.	
S-phrases:	23-36/37-45-59-61	
	Do not breathe vapour. Wear suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Refer to manufacturer/supplier for information on recovery/recycling. Avoid release to the environment. Refer to special instructions/Safety data sheets.	
EC-No.:	200-262-8	EC label
Additional labelling	Only to be used in industrial processes. For use in research and analysis.	

Reduced labelling (1999/45/EC,Art.10,4)

Symbol:	T	Toxic
	N	Dangerous for the environment
R-phrases:	23/24/25-40-48/23-52/53	
	Toxic by inhalation, in contact with skin and if swallowed. Limited evidence of a carcinogenic effect. Toxic: danger of serious damage to health by prolonged exposure through inhalation. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.	
S-phrases:	36/37-45-59	
	Wear suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Refer to manufacturer/supplier for information on recovery/recycling.	

16. Other information

Reason for alteration

Chapter 9: change/addition in physical/chemical proprties.
Chapter 10: stability and reactivity.
Chapter 15: labelling.

General update.

Regional representation:

This information is given on the authorised Safety Data Sheet for your country.

Safety Data Sheet

According to EC Directive 91/155/EEC

Date of issue: 16.09.2005

Supersedes edition of 05.10.2004

1. Identification of the substance/preparation and of the company/undertaking

Identification of the product

Catalogue No.: 822265
Product name: Chloroform (stabilized) for synthesis

Use of the substance/preparation
Chemical for synthesis

Company/undertaking identification
Company: Merck Schuchardt OHG * 85662 Hohenbrunn * Germany *
Tel: +49 8102/802-0

Emergency telephone No.:Please contact the regional Merck representation in your country.

2. Composition/information on ingredients

Synonyms
Trichloromethane

CAS-No.:	67-66-3	EC-Index-No.:	602-006-00-4
M:	119.38 g/mol	EC-No.:	200-663-8
Formula Hill:	$CHCl_3$		

3. Hazards identification

Harmful if swallowed. Irritating to skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

4. First aid measures

After inhalation: fresh air.
If breathing stops: mouth-to-mouth respiration or mechanical ventilation. Oxygen mask if necessary! Immediately call in physician.
After skin contact: wash off with plenty of water. Remove contaminated clothing.
After eye contact: rinse out with plenty of water with the eyelid held wide open. Call in ophtalmologist if necessary.
After swallowing: caution if victim vomits. Risk of aspiration! Keep airways free.
Immediately call in physician.

Laxative: Sodium sulfate (1 tablespoon/1/4 l water). Subsequently administer: activated charcoal (20 - 40 g in 10% slurry).

In case of spontaneous vomiting: Risk of aspiration. Pulmonary failure possible. Call in physician.

5. Fire-fighting measures

Suitable extinguishing media:

In adaption to materials stored in the immediate neighbourhood.

Special risks:

Non-combustible. Ambient fire may liberate hazardous vapours. The following may develop in event of fire: hydrochloric acid.

Special protective equipment for fire fighting:

Do not stay in dangerous zone without self-contained breathing apparatus.
In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

Other information:

Contain escaping vapours with water. Prevent fire-fighting water from entering surface water or groundwater.

6. Accidental release measures

Person-related precautionary measures:
Do not inhale vapours/aerosols. Avoid substance contact. Ensure supply of fresh air in enclosed rooms.
Environmental-protection measures:
Do not allow to enter sewerage system.

Procedures for cleaning / absorption:
Take up with liquid-absorbent material (e.g. Chemizorb®). Forward for disposal. Clean up affected area. Do not inhale vapours.

7. Handling and storage *Handling:*

Notes for safe handling:
Work under hood . Do not inhale substance. Avoid generation of vapours/aerosols.

Improper storage for a longer period may lead to the formation of phosphen due to the escape of stabilizer.

Storage:

Tightly closed. At +15˚C to +25˚C.

8. Exposure controls/personal protection *Specific control parameter*

EC

Name	Chloroform
Value	2 ml/m^3
	10 mg/m^3
Carcinogenic	C 3:owing possible carcinogenic effects for man
Skin resorption	Risk of skin absorption

Personal protective equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

Respiratory protection: required when vapours/aerosols are generated. Filter AX (EN 371).

Eye protection: required

Hand protection: In full contact:

Glove material:	viton
Layer thickness	0.70 mm
Breakthrough time	>480min

In splash contact:

Glove material:	butyl rubber
Layer thickness	0.7 mm
Breakthrough time	>10 min

The protective gloves to be used must comply with the specifications of EC directive 89/686/EEC and the resultant standard EN374, for example KCL 890 Vitoject® (full contact), 898 Butoject® (splash contact). The breakthrough times stated above were determined by KCL in laboratory tests acc. to EN374 with samples of the recommended glove types.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Industrial hygiene:

Immediately change contaminated clothing. Apply skin- protective barrier cream. Wash hands and face after working with substance. Work under hood. Do not inhale substance.

9. Physical and chemical properties

Form:	liquid			
Colour:	colourless			
Odour:	characteristic			
pH value	not available			
Viscosity dynamic		(20 ˚C)	0.56	mPa*s
Melting point			-63	˚C
Boiling point		(1013 hPa)	61	˚C
Ignition temperature	not combustible			
Flash point	not flammable			
Explosion limits	lower		not applicable	
	upper		not applicable	
Vapour pressure		(20 ˚C)	213	hPa
Relative vapour density			4.25	
Density		(20 ˚C)	1.47	g/cm^3
Solubility in water		(20 ˚C)	8	g/l
log Pow		(25 ˚C)	2	(experimental) (IUCLID)

10. Stability and reactivity

Conditions to be avoided
Strong heating.

Substances to be avoided

alkali metals, alkaline earth metals, metals (in powder form), peroxi compounds, fluorine, alcoholates, strong alkalis, ketones / alkalis, alkali hydroxides / alcohols, organic nitro compounds, alkali amides, oxygen, oxygen / alkalis, nitrogen oxides, nonmetallic hydrogen compounds, bis(dimethylamino)dimethyl tin, amines, ammonia, alcohols / strong alkalis, phosphines.

Hazardous decomposition products in the event of fire: See chapter 5.

Stabilizer
2-methyl-2-butene (amylene).

Further information
heat-sensitive, light-sensitive.

11.Toxicological information

Acute toxicity

LC_{50} (inhalation, rat): 47.7 mg/l /4 h (IUCLID).
LCLo (inhalation, human): 25000 ppm(V) /5 min (RTECS).
LD_{50} (oral, rat): 908 mg/kg (HSDB).

Specific symptoms in animal studies:
Eye irritation test (rabbit): Slight irritations (IUCLID).
Skin irritation test (rabbit): Slight irritations (IUCLID).

The literature data available to us do not conform with the labelling prescribed by the EC. The EC has dossiers which have not been published.

Subacute to chronic toxicity

The carcinogenic potential requires further clarification.

Bacterial mutagenicity: Ames test: negative. (IUCLID)

Further toxicological information
After inhalation of vapours: coughing, dyspnoea, absorption.
After skin contact: Irritations. Drying-out effect resulting in rough and chapped skin. Danger of skin absorption.
After eye contact: Slight irritations.
After swallowing: nausea, vomiting, absorption. After accidental swallowing the substance may pose a risk of aspiration. Passage into the lung (vomiting!) can result in a condition resembling pneumonia (chemical pneumonitis).
Systemic effects:
After absorption: agitation, spasms, narcosis.

After long-term exposure to the chemical: drop in blood pressure, headache, ataxia (impaired locomotor coordination), gastrointestinal complaints, cardiovascular disorders. Damage of: liver, kidneys, heart.
Effect potentiated by: ethanol

Further data

The product should be handled with the care usual when dealing with chemicals.

12. Ecological information

Biologic degradation: Not degradable in water.

Behavior in environmental compartments:
Distribution: log Pow: 2 (25 ˚C) (experimental) (IUCLID);
No appreciable bioaccumulation potential is to be expected (log Pow 1-3).
Distribution preferentially in air. Henry constant: 14084 Pa*m^3/mol (experimental) (IUCLID).

Ecotoxic effects:
Biological effects: Harmfull effect on aquatic organisms. Endangers drinking-water supplies if allowed to enter soil and/or waters in large quantities.

Fish toxicity: L.macrochirus LC_{50}: 18 mg/l /96 h (IUCLID).
Daphnia toxicity: Daphnia magna EC_{50}: 79 mg/l /48 h (IUCLID).
Bacterial toxicity: activated sludge EC_{50}: 1010 mg/l /3 h (OECD 209); Maximum permissible toxic concentration: Ps.putida EC_5: 125 mg/l /16 h (IUCLID).
Algeal toxicity: Maximum permissible toxic concentration: Sc.quadricauda IC_5: 1100 mg/l /8 d (IUCLID).

Protozoa: Maximum permissible toxic concentration: E.sulcatum EC_5: >6560 mg/l /72 h (IUCLID).

Further ecologic data:
Do not allow to enter waters, waste water, or soil!

13. Disposal considerations

Product:

Chemicals must be disposed of in compliance with the respective national regulations. Under www.retrologistik.de you will find country- and substance-specific information as well as contact partners.

Packaging:

Merck product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system. Under www.retrologistik.de you will find special information on the respective national conditions as well as contact partners.

14. Transport information

Road & Rail ADR, RID

UN 1888 CHLOROFORM, 6.1, III
Inland waterway ADN, ADNR not tested

Sea IMDG-Code

UN 1888 CHLOROFORM, 6.1, III
Ems F-A S-A

Air CAO, PAX
UN 1888 CHLOROFORM, 6.1, III

The transport regulations are cited according to international regulations and in the form applicable in Germany. Possible national deviations in other countries are not considered.

15. Regulatory information

Labelling according to EC Directives

Symbol:	Xn	Harmful
R-phrases:	22-38-40-48/20/22	Harmful if swallowed. Irritating to skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
S-phrases:	36/37	Wear suitable protective clothing and gloves.
EC-No.:	200-663-8	EC label

Reduced labelling (1999/45/EC,Art.10,4)

Symbol:	Xn	Harmful
R-phrases:	22-40-48/20/22	Harmful if swallowed. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
S-phrases:	36/37	Wear suitable protective clothing and gloves.

16. Other information

Reason for alteration

Chapter 7: handling. General update.

Regional representation:

This information is given on the authorised Safety Data Sheet for your country.

Material Safety Data Sheet

Chlorine

Section 1. Chemical product and company identification

Product name	: Chlorine
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Cl2; Bertholite; Chloor; Chlor; Chlore; Chlorine mol.; Cloro; Molecular chlorine; UN 1017
MSDS #	: 001015
Date of	: **4/26/2010.**
Preparation/Revision	: 1-866-734-3438
In case of emergency	

Section 2. Hazards identification

Physical state	: Gas. [GREENISH-YELLOW GAS WITH SUFFOCATING ODOR]
Emergency overview	: DANGER! OXIDIZER. CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF INHALED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE. CONTENTS UNDER PRESSURE. Do not puncture or incinerate container. Do not breathe gas. Do not get on skin or clothing. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed. Do not get in eyes, on skin or on clothing. Avoid breathing gas. Wash thoroughly after handling. Store in tightly-closed container. Avoid contact with combustible materials. Contact with rapidly expanding gases can cause frostbite.

Target organs	**:** May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.
Routes of entry	**:** Inhalation Dermal Eyes
Potential acute health effects	
Eyes	**:** Severely corrosive to the eyes. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.
Skin	**:** Severely corrosive to the skin. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation	**:** Toxic by inhalation. Severely corrosive to the respiratory system.
Ingestion	**:** Ingestion is not a normal route of exposure for gases
Potential chronic health effects	**:** **CARCINOGENIC EFFECTS**: A4 (Not classifiable for humans or animals.) by ACGIH. **MUTAGENIC EFFECTS**: Not available. **TERATOGENIC EFFECTS**: Not available.
Medical conditions aggravated by over-exposure	**:** Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Chlorine

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Chlorine	7782-50-5	100	**ACGIH TLV (United States, 1/2009).** STEL: 2.9 mg/m³ 15 minute(s). STEL: 1 ppm 15 minute(s). TWA: 1.5 mg/m³ 8 hour(s). TWA: 0.5 ppm 8 hour(s). **NIOSH REL (United States, 6/2009).** CEIL: 1.45 mg/m³ 15 minute(s). CEIL: 0.5 ppm 15 minute(s). **OSHA PEL (United States, 11/2006).** CEIL: 3 mg/m³ CEIL: 1 ppm **OSHA PEL 1989 (United States, 3/1989).** STEL: 3 mg/m³ 15 minute(s). STEL: 1 ppm 15 minute(s). TWA: 1.5 mg/m³ 8 hour(s). TWA: 0.5 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbit: Try to warm up the frozen tissues and seek medical attention.

Inhalation: Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion: As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product: Non-flammable.

Products of combustion : Decomposition products may include the following materials:
halogenated compounds

Fire hazards in the presence of various substances :Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials, organic materials and alkalis.

Fire-fighting media and Instructions : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk. Contains gas under pressure. Contact with combustible material may cause fire. This material increases the risk of fire and may aid combustion. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions	**:** Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Eliminate all ignition sources if safe to do so. Do not touch or walk through spilled material. Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
Environmental precautions	**:** Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Methods for cleaning up	**:** Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling	**:** Use only with adequate ventilation. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not get in eyes, on skin or on clothing. Keep container closed. Do not get on skin or clothing. Store in tightly-closed container. Avoid contact with combustible materials. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Storage	**:** Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls	**:** Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
Personal protection	
Eyes	**:** Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
Skin	**:** Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory	**:** Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands	**:** Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Personal protection in case of a large spill	**:** Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

Chlorine

ACGIH TLV (United States, 1/2009).
STEL: 2.9 mg/m³ 15 minute(s).
STEL: 1 ppm 15 minute(s).
TWA: 1.5 mg/m³ 8 hour(s).
TWA: 0.5 ppm 8 hour(s).
NIOSH REL (United States, 6/2009).
CEIL: 1.45 mg/m³ 15 minute(s).
CEIL: 0.5 ppm 15 minute(s).
OSHA PEL (United States, 11/2006).
CEIL: 3 mg/m³
CEIL: 1 ppm
OSHA PEL 1989 (United States, 3/1989).
STEL: 3 mg/m³ 15 minute(s).
STEL: 1 ppm 15 minute(s).
TWA: 1.5 mg/m³ 8 hour(s).
TWA: 0.5 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	70.9 g/mole
Molecular formula	Cl2
Boiling/condensation point	-33.9°C (-29°F)
Melting/freezing point	-101.1°C (-150°F)
Critical temperature	143.9°C (291°F)
Vapor pressure	85.3 (psig)
Vapor density	2.4 (Air = 1)
Specific Volume (ft^3/lb)	5.4054
Gas Density (lb/ft^3)	0.185

Section 10. Stability and reactivity

Stability and reactivity	The product is stable.
Incompatibility with various substances	Extremely reactive or incompatible with the following materials: reducing materials, combustible materials, organic materials and alkalis.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
chlorine	LC50 Inhalation Gas.	Rat	293 ppm	1 hours
	LC50 Inhalation Gas.	Rat	293 ppm	1 hours
	LC50 Inhalation Gas.	Mouse	137 ppm	1 hours

IDLH	10 ppm
Chronic effects on humans	**CARCINOGENIC EFFECTS**: A4 (Not classifiable for humans or animals.) by ACGIH. May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.
Other toxic effects on humans	Hazardous by the following route of exposure: of skin contact (irritant), of eye contact (irritant), of inhalation (lung irritant).
Specific effects	
Carcinogenic effects	No known significant effects or critical hazards.
Mutagenic effects	No known significant effects or critical hazards.
Reproduction toxicity	No known significant effects or critical hazards.

Section 12. Ecological information

Ecotoxicity data

Aquatic ecotoxicity

Product/ingredient name	Test	Result	Species	Exposure
chlorine	-	Acute LC50 0.75 mg/L Marine water	Crustaceans - Blue crab – Callinectes sapidus - Adult	48 hours
	-	Acute LC50 838 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 752 to 33400 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 380 to 3390 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 354 to 488 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 150 ug/L Fresh water	Daphnia – Water flea – Daphnia magna	48 hours
	-	Acute LC50 136 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 130 ug/L Fresh water	Daphnia – Water flea – Daphnia magna	48 hours
	-	Acute LC50 120 ug/L Fresh water	Daphnia – Water flea – Daphnia magna	48 hours
	-	Acute LC50 116 ug/L Fresh water	Daphnia – Water flea – Daphnia magna	48 hours
	-	Acute LC50 110 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 107 to ug/L Fresh water 110110	Fish - Brook trout – Salvelinus fontinalis - Juvenile (Fledgling, Hatchling, Weanling) - 7.5 to 10 cm	96 hours
	-	Acute LC50 102 to 124 ug/L Fresh water	Fish - Brook trout – Salvelinus fontinalis - Juvenile (Fledgling,	96 hours

			Hatchling, Weanling) - 10 to 15 cm	
	-	Acute LC50 91 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 90 ug/L Marine water	Fish - Spot - Leiostomus xanthurus	96 hours
	-	Acute LC50 85 to 5670 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 85 ug/L Fresh water	Daphnia – Water Fresh water magna	48 hours
	-	Acute LC50 75 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 40 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 37 ug/L Marine water	Fish – Atlantic silverside - Menidia menidia	96 hours
	-	Acute LC50 37 to 220 ug/L Marine water	Fish – Northern pipefish – Syngnathus fuscus	96 hours
	-	Acute LC50 30 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 29 ug/L Fresh water	Fish – Rainbow trout,Donaldso trout – Oncorhynchus mykiss	96 hours
	-	Acute LC50 13.6 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 40 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 37 ug/L Marine water	Fish – Atlantic silverside - Menidia menidia	96 hours
	-	Acute LC50 37 to 220 ug/L Marine water	Fish – Northern pipefish – Syngnathus fuscus	96 hours
	-	Acute LC50 30 ug/L Fresh water	Daphnia – Water flea – Daphnia pulex	48 hours
	-	Acute LC50 29 ug/L Fresh water	Fish – Rainbow trout,Donaldson Oncorhynchus mykiss	96 hours

	-	Acute LC50 14 ug/L Fresh water	Fish – Rainbow trout,Donaldson trout Oncorhynchus mykiss	96 hours
	-	Acute LC50 13.6 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 2.03 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
	-	Acute LC50 4720 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days

Environmental fate **:** Not available

Environmental hazards **:** Water polluting material. May be harmful to the environment if released in large

Toxicity to the environment: Not available

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group		Additional information
DOT Classification	UN1017	CHLORINE	2.3	Not applicable (gas).		Marine Pollutant

					  	**Reportable quantity** 10lbs(4.45kg) **Limited quantity** Yes **Packaging** Instruction **Passenger aircraft** Quantity Limitation: Forbidden: **Cargo aircraft** Quantity Limitation : Forbidden: **Special provision** 2,B9,B14,T50,TP19
TDG Classification	UN1017	CHLORINE	2.3	Not applicable	  	Marine Pollutant **Explosive limit and limited quantity index** 0 **ERP index** 500 **Passenger Carrying ship Index** Forbidden **Passenger carrying Road or Rail Index** Forbidden

Mexico Classification	UN 1017	Chlorine	2.3	Not applicable(gas)	  	-

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.

Section 15. Regulatory information

United States

U.S. regulations **Federal**	TSCA 8(a) CAIR: chlorine **United States inventory (TSCA 8b):** This material is listed or exempted. **SARA 302/304/311/312 extremely hazardous substances**: chlorine **SARA 302/304 emergency planning and notification**: chlorine **SARA 302/304/311/312 hazardous chemicals**: chlorine **SARA 311/312 MSDS distribution - chemical inventory - hazard identification**: chlorine: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard **Clean Water Act (CWA) 307**: No products were found. **Clean Water Act (CWA) 311**: chlorine **Clean Air Act (CAA) 112 accidental release prevention**: chlorine **Clean Air Act (CAA) 112 regulated flammable substances**: No products were found. **Clean Air Act (CAA) 112 regulated toxic substances**: chlorine

SARA 313

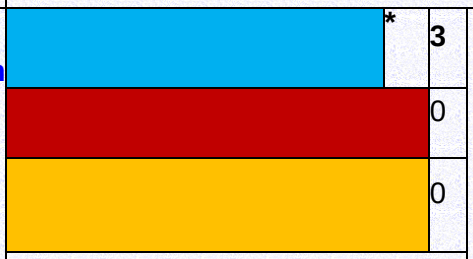
	Product name	CAS number	Concentration
Form R - Reporting requirements	Chlorine	7782-50-5	100
Supplier notification	Chlorine	7782-50-5	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations	**Connecticut Carcinogen Reporting:** This material is not listed. **Connecticut Hazardous Material Survey:** This material is not listed. **Florida substances:** This material is not listed. **Illinois Chemical Safety Act:** This material is not listed. **Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed. **Louisiana Reporting:** This material is not listed. **Louisiana Spill:** This material is not listed. **Massachusetts Spill:** This material is not listed. **Massachusetts Substances:** This material is listed. **Michigan Critical Material:** This material is not listed. **Minnesota Hazardous Substances:** This material is not listed. **New Jersey Hazardous Substances:** This material is listed. **New Jersey Spill:** This material is not listed. **New Jersey Toxic Catastrophe Prevention Act:** This material is listed. **New York Acutely Hazardous Substances:** This material is listed. **New York Toxic Chemical Release Reporting:** This material is not listed. **Pennsylvania RTK Hazardous Substances:** This material is listed. **Rhode Island Hazardous Substances:** This material is not listed.
Canada	
WHMIS (Canada)	Class A: Compressed gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class E: Corrosive material **CEPA Toxic substances:** This material is not listed. **Canadian ARET:** This material is not listed. **Canadian NPRI:** This material is listed. **Alberta Designated Substances:** This material is not listed. **Ontario Designated Substances:** This material is not listed. **Quebec Designated Substances:** This material is not listed.

Section 16. Other information

United States

Label requirements	OXIDIZER. CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF INHALED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE. CONTENTS UNDER PRESSURE.
Canada	
Label requirements	Class A: Compressed gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class E: Corrosive material
Hazardous Material Information System (U.S.A.)	
National Fire Protection Association (U.S.A.)	

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

Carbon Monoxide

Section 1. Chemical product and company identification

Product name	Carbon Monoxide
Supplier	AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	Synthetic/Analytical chemistry.
Synonym	Carbon oxide (CO); CO; Exhaust Gas; Flue gas; Carbonic oxide; Carbon oxide; Carbone; Carbonio; Kohlenmonoxid; Kohlenoxyd; Koolmonoxyde; NA 9202; Oxyde de carbone; UN 1016; Wegla tlenek; Flue gasnide; Carbon monooxide
MSDS #	001014
Date of Preparation/Revision	**12/3/2012.**
In case of emergency	**:** 1-866-734-3438

Section 2. Hazards identification

Physical state	Gas. [[COLORLESS GAS, MAY BE A LIQUID AT LOW TEMPERATURE OR HIGH PRESSURE.]]
Emergency overview	**:** WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. MAY BE FATAL IF INHALED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Avoid breathing gas. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed. Contact with rapidly expanding gases can cause frostbite.
Target organs	May cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, central nervous system (CNS).

Routes of entry	**:** Inhalation
Potential acute health effects	
Eyes	Contact with rapidly expanding gas may cause burns or frostbite.
Skin	Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation	Toxic by inhalation.
Ingestion	Ingestion is not a normal route of exposure for gases
Potential chronic health effects	
Chronic effects	May cause target organ damage, based on animal data.
Target organs	May cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, central nervous system (CNS).
Medical conditions aggravated by over-exposure	Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Carbon Monoxide	630-08-0	100	**ACGIH TLV (United States, 2/2010).** TWA: 29 mg/m³ 8 hour(s). TWA: 25 ppm 8 hour(s). **NIOSH REL (United States, 6/2009).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 10 hour(s). TWA: 35 ppm 10 hour(s). **OSHA PEL (United States, 6/2010).** TWA: 55 mg/m³ 8 hour(s). TWA: 50 ppm 8 hour(s). **OSHA PEL 1989 (United States, 3/1989).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 8 hour(s). TWA: 35 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product: Flammable.

Auto-ignition temperature : 605°C (1121°F)

Flammable limits : Lower: 12.5% Upper: 74.2%

Products of combustion : Decomposition products may include the following materials carbon dioxide carbon monoxide

Fire hazards in the presence of various substances Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Fire-fighting media and instructions : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions	Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Methods for cleaning up	Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling	Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Storage	Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperature should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls	Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Personal protection **Eyes**	Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
Skin	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Personal protection in case of a large spill	Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

carbon monoxide

ACGIH TLV (United States, 2/2010).

TWA: 29 mg/m³ 8 hour(s).

TWA: 25 ppm 8 hour(s).

NIOSH REL (United States, 6/2009).

CEIL: 229 mg/m³

CEIL: 200 ppm

TWA: 40 mg/m³ 10 hour(s).

TWA: 35 ppm 10 hour(s).

OSHA PEL (United States, 6/2010).

TWA: 55 mg/m³ 8 hour(s).

TWA: 50 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

CEIL: 229 mg/m³

CEIL: 200 ppm

TWA: 40 mg/m³ 8 hour(s).

TWA: 35 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	28.01 g/mole
Molecular formula	C-O
Boiling/condensation point	-191°C (-311.8°F)
Melting/freezing point	-205°C (-337°F)
Critical temperature	-140.1°C (-220.2°F)
Vapor density	0.97 (Air = 1)
Specific Volume (ft^3/lb)	13.8889
Gas Density (lb/ft^3)	0.072

Section 10. Stability and reactivity

Stability and reactivity	The product is stable.
Incompatibility with various substances	Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
carbon monoxide	TDLo Intraperitoneal	Rat	35 mL/kg	-
	LC50 Inhalation Vapor	Rat	13500 mg/m3	15 minutes
	LC50 Inhalation Vapor	Rat	1900 mg/m3	4 hours
	LC50 Inhalation Gas.	Rat	6600 ppm	30 minutes
	LC50 Inhalation Gas.	Rat	3760 ppm	1 hours

	LC50 Inhalation Gas.	Mouse	2444 ppm	4 hours
	LC50 Inhalation Gas.	Rat	1807 ppm	4 hours
IDLH	1200 ppm			
Chronic effects on humans	**TERATOGENIC EFFECTS**: Classified 1 by European Union. May cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, central nervous system (CNS).			
Other toxic effects on humans	No specific information is available in our database regarding the other toxic effects of this material to humans.			
Specific effects				
Carcinogenic effects	No known significant effects or critical hazards.			
Mutagenic effects	No known significant effects or critical hazards.			
Reproduction toxicity	No known significant effects or critical hazards.			

Section 12. Ecological information

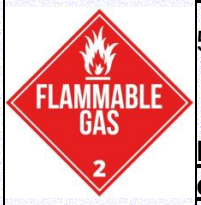
Aquatic ecotoxicity	
Not available.	
Products of degradation	**:** Products of degradation: carbon oxides (CO, CO_2).
Environmental fate	**:** Not available.
Environmental hazards	**:** No known significant effects or critical hazards.
Toxicity to the environment	**:** Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	**UN number**	**Proper shipping name**	**Class**	**Packing group**	**Label**	**Additional information**
DOT Classification	UN1016	CARBON MONOXIDE, COMPRESSED	2.3	Not applicable (gas).	 	Inhalation hazard zone D **Limited quantity** Yes. **Packaging Instruction** **Passenger aircraft** Quantity limitation: Forbidden

						Cargo aircraft Quantity limitation: Forbidden **Special provision** **4**
TDG Classification	UN1016	CARBON MONOXIDE, COMPRESSED	2.3	Not applicable (gas).	 	**Explosive limit and Limited quantity Index** 0 **ERAP Index** 500 **Passenger carrying ship Index** Forbidden **Passenger carrying Road or Rail Index** Forbidden
Mexico Classification	UN1016	CARBON MONOXIDE, COMPRESSED	2.3	Not applicable (gas).	 	-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States	
U.S. Federal regulations	**TSCA 8(a) IUR**: Not determined **United States inventory (TSCA 8b)**: This material is listed or exempted. **SARA 302/304/311/312 extremely hazardous substances**: No products were found. **SARA 302/304 emergency planning and notification**: No products were found. **SARA 302/304/311/312 hazardous chemicals**: carbon monoxide **SARA 311/312 MSDS distribution - chemical inventory - hazard identification**: carbon monoxide: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard
State regulations	**: Connecticut Carcinogen Reporting**: This material is not listed. **Connecticut Hazardous Material Survey**: This material is not listed. **Florida substances**: This material is not listed. **Illinois Chemical Safety Act**: This material is not listed. **Illinois Toxic Substances Disclosure to Employee Act**: This material is not listed. **Louisiana Reporting**: This material is not listed. **Louisiana Spill**: This material is not listed. **Massachusetts Spill**: This material is not listed. **Massachusetts Substances**: This material is listed. **Michigan Critical Material**: This material is not listed. **Minnesota Hazardous Substances**: This material is not listed. **New Jersey Hazardous Substances**: This material is listed. **New Jersey Spill**: This material is not listed. **New Jersey Toxic Catastrophe Prevention Act**: This material is listed. **New York Acutely Hazardous Substances**: This material is not listed. **New York Toxic Chemical Release Reporting**: This material is not listed. **Pennsylvania RTK Hazardous Substances**: This material is listed. **Rhode Island Hazardous Substances**: This material is not listed.

California Prop. 65	**WARNING:** This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.			
Ingredient name	**Cancer**	**Reproductive**	**No significant risk level**	**Maximum acceptable dosage level**
Carbon Monoxide	No.	Yes.	No.	No.

Canada

WHMIS (Canada) **:** Class A: Compressed gas.

Class B-1: Flammable gas.

Class D-1A: Material causing immediate and serious toxic effects (Very toxic).

Class D-2A: Material causing other toxic effects (Very toxic).

CEPA Toxic substances: This material is not listed.

Canadian ARET: This material is not listed.

Canadian NPRI: This material is listed.

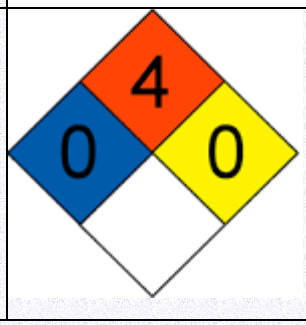
Alberta Designated Substances: This material is not listed.

Ontario Designated Substances: This material is not listed.

Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements	**:** FLAMMABLE GAS. MAY CAUSE FLASH FIRE. MAY BE FATAL IF INHALED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTENTS UNDER PRESSURE.
Canada	
Label requirements	Class A: Compressed gas. Class B-1: Flammable gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class D-2A: Material causing other toxic effects (Very toxic).
Hazardous Material Information System (U.S.A.)	**Health** * 2 **Flammability** 4 **Physical hazards** 0
National Fire Protection Association (U.S.A.)	

Notice to reader

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Material Safety Data Sheet

Hydrogen Sulfide

Section 1. Chemical product and company identification

Product name	Hydrogen Sulfide
Supplier	AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	Synthetic/Analytical chemistry.
Synonym	Dihydrogen monosulfide; Dihydrogen sulfide; Hydrosulfuric acid; Stink damp; Sulfur hydride; Sulfureted hydrogen; H2S; Sulfuretted hydrogen; Hydrogen-sulphide-; Hydrogen sulfide (H2S); Acide sulfhydrique; Hydrogene sulfure; Idrogeno solforato; Rcra waste number U135; Schwefelwasserstoff; Siarkowodor; UN 1053; Zwavelwaterstof; Hepatic gas; Hepatic acid; Hydrogen monosulfide; Sewer gas; Sour gas; Sulfur hydroxide
MSDS #	001029
Date of	**5/7/2013.**
Preparation/Revision In case of emergency	1-866-734-3438

Section 2. Hazards identification

Physical state : Gas. [COLORLESS LIQUEFIED COMPRESSED GAS WITH A ROTTEN EGG ODOR, BUT ODORLESS AT POISONOUS CONCENTRATIONS. [NOTE: SENSE OF SMELL BECOMES RAPIDLY FATIGUED AND CAN NOT BE RELIED UPON TO WARN OF THE CONTINUOUS PRESENCE OF H2S.]]

Emergency overview: DANGER!

FLAMMABLE GAS. MAY CAUSE FLASH FIRE. MAY BE FATAL IF INHALED. MAY CAUSE EYE AND SKIN IRRITATION. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTENTS UNDER PRESSURE.

Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not breathe gas. Avoid contact with eyes, skin and clothing. May cause target organ damage, based on animal data. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed.

Contact with rapidly expanding gases can cause frostbite.

Target organs : May cause damage to the following organs: lungs, upper respiratory tract, eyes, central nervous system (CNS).

Routes of entry : Inhalation Dermal Eyes

Potential acute health effects

Eyes : Moderately irritating to eyes. Contact with rapidly expanding gas may cause burns or frostbite.

Skin : Moderately irritating to the skin. Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : Very toxic by inhalation.

Ingestion : Ingestion is not a normal route of exposure for gases

Potential chronic health effects

Chronic effects : Can cause target organ damage.

Target organs : May cause damage to the following organs: lungs, upper respiratory tract, eyes, central nervous system (CNS).

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Hydrogen Sulfide	7783-06-4	100	**ACGIH TLV (United States, 3/2012)** STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). **NIOSH REL (United States, 1/2013).** CEIL: 15 mg/m³ 10 minute(s). CEIL: 10 ppm 10 minute(s). **OSHA PEL 1989 (United States, 3/1989).** STEL: 21 mg/m³ 15 minute(s). STEL: 15 ppm 15 minute(s). TWA: 14 mg/m³ 8 hour(s). TWA: 10 ppm 8 hour(s). **OSHA PEL Z2 (United States, 11/2006).** AMP: 50 ppm 10 minute(s). CEIL: 20 ppm

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Call medical doctor or poison control center immediately. Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Flammable.

Auto-ignition temperature : 259.85°C (499.7°F)

Flammable limits : Lower: 4% Upper: 44%

Products of combustion : Decomposition products may include the following materials:

sulfur oxides

Fire-fighting media and Instructions : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur, and the container may burst, with the risk of a subsequent explosion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drain tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling	Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Avoid contact with skin and clothing. Avoid contact with eyes. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Storage	Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls	Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Personal protection **Eyes**	Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
Skin	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
Hands	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Personal protection in case **of a large spill**	Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name	
hydrogen sulphide	**ACGIH TLV (United States, 3/2012).** STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). **NIOSH REL (United States, 1/2013).** CEIL: 15 mg/m³ 10 minute(s). CEIL: 10 ppm 10 minute(s). **OSHA PEL 1989 (United States, 3/1989).** STEL: 21 mg/m³ 15 minute(s). STEL: 15 ppm 15 minute(s). TWA: 14 mg/m³ 8 hour(s). TWA: 10 ppm 8 hour(s). **OSHA PEL Z2 (United States, 11/2006).** AMP: 50 ppm 10 minute(s). CEIL: 20 ppm

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	34.08 g/mole
Molecular formula	H2-S
Boiling/condensation point	-60°C (-76°F)
Melting/freezing point	-82.8°C (-117°F)
Critical temperature	100.5°C (212.9°F)
Vapor pressure	252 (psig)
Vapor density	1.19 (Air = 1)
Specific Volume (ft^3/lb)	11.236
Gas Density (lb/ft^3)	0.089

Section 10. Stability and reactivity

Stability and reactivity	The product is stable.
Incompatibility with various substances	Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
hydrogen sulphide	LD50 Intraperitoneal	Rat	2300 ug/kg	-
	LD50 Intravenous	Rat	270 ug/kg	-
	LC50 Inhalation Vapor	Rat	820 mg/m3	3 hours
	LC50 Inhalation Vapor	Rat	700 mg/m3	4 hours
	LC50 Inhalation Vapor	Rat	470 mg/m3	6 hours
	LC50 Inhalation Gas.	Rat	712 ppm	1 hours
	LC50 Inhalation Gas.	Mouse	634 ppm	1 hours
	LC50 Inhalation Gas.	Rat	444 ppm	4 hours

IDLH	100 ppm
Chronic effects on humans	May cause damage to the following organs: lungs, upper respiratory tract, eyes, central nervous system (CNS).
Other toxic effects on humans	No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects	No known significant effects or critical hazards.
Mutagenic effects	No known significant effects or critical hazards.

Reproduction toxicity	No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Product/ingredient name	Test	Result	Species	Exposure
hydrogen sulphide	-	Acute EC50 770 ug/L Fresh water	Crustaceans - Amphipod - Crangonyx richmondensis ssp. lauren - 10 mm	48 hours
	-	Acute EC50 540 ug/L Fresh water	Crustaceans - Amphipod - Crangonyx richmondensis ssp. lauren - 10 mm	48 hours
	-	Acute EC50 95 ug/L Fresh water	Crustaceans - Scud - Gammarus pseudolimnaeus -11 mm	2 days
	-	Acute EC50 71 ug/L Fresh water	Crustaceans - Scud - Gammarus pseudolimnaeus -11 mm	2 days
	-	Acute EC50 62 ug/L Fresh water	Crustaceans - Scud - Gammarus pseudolimnaeus -11 mm	2 days

	-	Acute LC50 4 ug/L Fresh water	Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry	96 hours
	-	Acute LC50 3.2 ug/L Fresh water	Fish - Asian redtail catfish - Hemibagrus nemurus	96 hours
	-	Acute LC50 3 ug/L Fresh water	Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry	96 hours
	-	Acute LC50 2 ug/L Fresh water	Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry	96 hours
	-	Acute LC50 <2 ug/L Fresh water	Fish - Yellow perch - Perca flavescens - Yolk-sac fry	96 hours
Products of degradation				
Environmental fate	Not available.			
Environmental hazards	No known significant effects or critical hazards.			
Toxicity to the environment	Not available.			

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1053	HYDROGEN SULFIDE	2.3	Not applicable (gas).	 	**Reportable quantity** 100 lbs. (45.4 kg) **Limited quantity** Yes. **Packaging instruction** Passenger aircraft Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: Forbidden: **Special provision** 2,B9,B14

TDG Classification	UN1053	HYDROGEN SULFIDE	2.3	Not applicable (gas).	 	**Explosive Limit and Limited Quantity Index** 0 **ERAP Index** 0 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** Forbidden
Mexico Classification	UN1053	HYDROGEN SULFIDE	2.3	Not applicable (gas).	 	-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations : United States inventory (TSCA 8b): This material is listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: hydrogen sulphide

SARA 302/304 emergency planning and notification: hydrogen sulphide

SARA 302/304/311/312 hazardous chemicals: hydrogen sulphide

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: hydrogen sulphide: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: hydrogen sulphide

SARA 313			
	Product name	**CAS number**	**Concentration**
Form R - Reporting requirements	Hydrogen Sulfide	7783-06-4	100
Supplier notification	Hydrogen Sulfide	7783-06-4	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations	**Connecticut Carcinogen Reporting:** This material is not listed. **Connecticut Hazardous Material Survey:** This material is not listed. **Florida substances:** This material is not listed. **Illinois Chemical Safety Act:** This material is not listed. **Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed. **Louisiana Reporting:** This material is not listed. **Louisiana Spill:** This material is not listed. **Massachusetts Spill:** This material is not listed. **Massachusetts Substances:** This material is listed. **Michigan Critical Material:** This material is not listed. **Minnesota Hazardous Substances:** This material is not listed. **New Jersey Hazardous Substances:** This material is listed. **New Jersey Spill:** This material is not listed. **New Jersey Toxic Catastrophe Prevention Act:** This material is listed. **New York Acutely Hazardous Substances:** This material is listed. **New York Toxic Chemical Release Reporting:** This material is not listed. **Pennsylvania RTK Hazardous Substances:** This material is listed. **Rhode Island Hazardous Substances:** This material is not listed.
Canada	
WHMIS (Canada)	Class A: Compressed gas. Class B-1: Flammable gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.

Canadian ARET: This material is not listed.

Canadian NPRI: This material is listed.

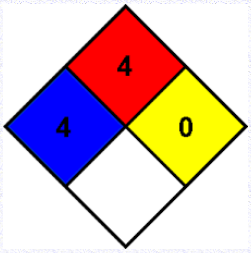
Alberta Designated Substances: This material is not listed.

Ontario Designated Substances: This material is not listed.

Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements	FLAMMABLE GAS. MAY CAUSE FLASH FIRE. MAY BE FATAL IF INHALED. MAY CAUSE EYE AND SKIN IRRITATION. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTENTS UNDER PRESSURE.
Canada	
Label requirements	Class A: Compressed gas. Class B-1: Flammable gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class D-2B: Material causing other toxic effects (Toxic).
Hazardous Material Information System (U.S.A.)	**Health** * 4 **Flammability** 4 **Physical hazards** 0
National Fire Protection Association (U.S.A.)	

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: PHOSGENE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700

24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802

EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: PHOSGENE

CHEMICAL NAME: Phosgene

COMMON NAMES/SYNONYMS: Carbon Oxychloride; Carbonyl Chloride; Carbonyl Dichloride; Diphosgene

TDG (Canada) CLASSIFICATION: 2.3 (8)

WHMIS CLASSIFICATION: A, E, F, D1A

PREPARED BY: Loss Control (908)464-8100/(905)501-1700

PREPARATION DATE: 6/1/95

REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Phosgene FORMULA: CCl_20 CAS: 75-44-5 RTECS #: SY5600000	100.0	0.1 ppm TWA	0.1 ppm TWA	LC_{50} 800 ppm (human)

As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agent

3. Hazards Identification+

EMERGENCY OVERVIEW

Corrosive to exposed tissues. Inhalation of vapors may result in pulmonary edema and chemical pneumonitis. Nonflammable. Reacts violently and decomposes to toxic compounds, including chlorine, on contact with moisture.

ROUTE OF ENTRY:				
Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

HEALTH EFFECTS:		
Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects None Reported		
Carcinogenicity: -- NTP: No ARC: No OSHA: No		
EYE EFFECTS:		
None known.		
SKIN EFFECTS:		
None known.		
INGESTION EFFECTS:		
None known.		

INHALATION EFFECTS:

Immediate symptoms from inhalation are choking, coughing, tightness of the chest, catching of the breath, lacrimation, difficulty in and painful breathing and eventual cyanosis. Serious symptoms are pulmonary edema and asphyxiation which may not be manifested for several hours after overexposure. Long lasting (several months) symptoms may be coughing, bloody sputum and general malaise.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health:4	Health:4	0 = No Hazard
Flammability: 0	Flammability: 0	1 = Slight Hazard
Reactivity:1	Reactivity:1	2 = Moderate Hazard
		3= Serious Hazard
		4= Severe Hazard

4. First Aid Measures

EYES:

None required.

SKIN:

None required.

INGESTION:

None required.

INHALATION:

Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Unconscious persons should be moved to an uncontaminated area, and given artificial resuscitation and supplemental oxygen. Keep the victim warm and quiet. Assure that mucous does not obstruct the airway by positional drainage. Delayed pulmonary edema may occur. Keep patient under medical observation for at least 48 hours. Treatment should be symptomatic and supportive.

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PHOSGENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

5. Fire Fighting Measures

Conditions of Flammability: Nonflammable			
Flash point:	Method:		Autoignition
None	Not Applicable		Temperature: None
LEL(%): None		UEL(%): None	
Hazardous combustion products: None			
Sensitivity to mechanical shock: None			
Sensitivity to static discharge: None			

FIRE AND EXPLOSION HAZARDS:

Nonflammable.

FIRE FIGHTING INSTRUCTIONS:

NONE. Material is not flammable. See spill and leaks information for protective equipment when fighting a spill.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Moist phosgene is corrosive to most metals. Hastelloy A or B as well as tantalum, platinum and gold show good corrosive resistance to moist phosgene.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130^{o}F (54^{o}C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

Use only in well-ventilated areas. Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (less than 75 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional storage and handling recommendations, consult Compressed Gas Association's Pamphlet P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	%VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Phosgene FORMULA: CCl_20 CAS: 75-44-5 RTECS #: SY5600000	100.0	0.1 ppm TWA	0.1 ppm TWA	LC_{50} 800 ppm (human)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.

[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

IDLH: 2 ppm

ENGINEERING CONTROLS:

Use a laboratory hood with forced ventilation for handling small quantities. Use local exhaust to prevent accumulation above the exposure limits.

EYE/FACE PROTECTION:

Gas tight chemical goggles or full-face piece respirator.

SKIN PROTECTION:

Rubber or Teflon ®protective gloves.

RESPIRATORY PROTECTION:

Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use and routine use when exposures are above set limits.

OTHER/GENERAL PROTECTION:

Safety shoes, safety shower, eyewash "fountain".

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	Gas	
Vapor pressure	22.6	psia
Vapor density (Air = 1)	3.41	
Evaporation point	Not Available	
Boiling point	45.6	F
	7.55	C
Freezing point	-198	F
	-127	C
Ph	Not Available	
Specific gravity	Not Available	
Oil/water partition coefficient	Not Available	
Solubility (H20)	Decomposes	
Odor threshold	Not Available	
Odor and appearance	Colorless gas with sweet odor in low concentrations, becoming suffocating in high concentrations	

10. Stability and Reactivity

STABILITY:

Stable at temperatures below 572^{o}F (300^{o}C).

INCOMPATIBLE MATERIALS:

May react violently with water, ammonia, primary amines.

HAZARDOUS DECOMPOSITION PRODUCTS:

Hydrochloric acid and carbon dioxide. Carbon monoxide, chlorine.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. Toxicological Information

No chronic effects data unrelated to phosgene's corrosivity given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Phosgene	Phosgene
HAZARD CLASS:	2.3	2.3 (8)
IDENTIFICATION NUMBER:	UN 1076	UN 1076
SHIPPING LABEL:	POISON GAS, CORROSIVE	POISON GAS, CORROSIVE

Additional Marking Requirement: "Inhalation Hazard"

If net weight of product ≥ 10 pounds, the container must be also marked with the letters "RQ".

Additional Shipping Paper Description Requirement: "Poison Inhalation Hazard, Zone A"

If net weight of product ≥ 10 pounds, the shipping papers must be also marked with the letters "RQ".

15. Regulatory Information

Phosgene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity Q) of 500 pounds

SARA TITLE III NOTIFICATIONS AND INFORMATION

Phosgene is listed as an extremely hazardous substance (EHS) subject to state and local reporting under Section 304 of SARA Title III (EPCRA).

The presence of phosgene in quantities in excess of the threshold planning quantity (TPQ) of 10 pounds requires certain emergency planning activities to be conducted.

Releases of phosgene in quantities equal to or greater than the reportable quantity (RQ) of 10 pounds are subject to reporting to the National Response Center under CERCLA, Section 304 SARA Title III.

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard

Chronic Health Hazard

Sudden Release of Pressure Hazard

Reactivity Hazard

Fire Hazard

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

CAS NUMBER	INGREDIENT NAME	PERCENT BY VOLUME
75-44-5	PHOSGENE	~ 100.0

This information must be included on all MSDSs that are copied and distributed for this material.

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

ANNEXURE-6

PROCESS & VESSEL HAZARDS & CONTROLS

Hazardous process & operation	**Materials in the process / operation**	**Name of the vessel & its location**	**Operating parameters**	**Type of hazards possible**	**Control measures**	**Incharge Person with designation**
1	2	3	4	5	6	7
Charging Area						
Charging & Mixing of Hazardous Liquid waste	Hazardous Liquid waste	T-1010 at charging area T-1020 at charging area T-1030 at charging area T-1040 at charging	Atmospheric temp. & pressure	➢ Pressure develop in case of material incompatibility	➢ Mechanical seal for transferring pump. ➢ Personal protective equipments are being used ➢ Provision of Safety shower ➢ Breather Valve and venting line provided. Vent line is connected with scrubbing system. ➢ Inter locking system provided. ➢ Provision of Fire Hydrant System & Extinguishers. ➢ Grounding of storage vessel to earth pit. ➢ Declared as No Hot Work Zone. ➢ Tanks are provided with dip pipe. ➢ N2 blanketing system.	Mr. Dinkar Trivedi Manager

Incinerator Plants						
Incineration of hazardous waste	-Natural Gas -Hazardous solid waste -Hazardous Liq. Waste	Rotary Kiln incinerator plant 1 & 2	Pressure☹ -ve) 2 mm wc Temp.: 850 ± 50ºC	➢ Fire & explosion in case of positive pressure ➢ Toxic gas release	➢ Interlocking system is provided ➢ Auto control DCS system is provided ➢ Regular preventive maintenance	Mr. M G Gami Sr. Manager
Incineration of hazardous waste	-Natural Gas -Hazardous Lig. Waste	SCC incinerator plant 1 & 2	Pressure☹ -ve)10 mm wc Temp.: 1100°C to 1160°C			
Multi Effect Evaporator Plant						
Evaporation of Liquid waste	-Liquid waste -Steam	VLSs Calandrias	Pressure: (-ve) 660 to 710 mm/Hg Temp. 45°C to 95°C	➢ Fire & explosion in case of positive pressure ➢ Toxic gas release	➢ Auto control SCADA system is provided ➢ Pressure gauges are provided ➢ Regular preventive maintenance	Mr. Bhavesh Pancholi Manager
Centrifugation	-Waste water slurry	CF	40°C to 45°C	➢ Human injury due to disoperation	➢ VFD is provided ➢ Trained operating staff	
	Slurry of Hyflow charged	Centrifuge	under ambient pressure & temp.	➢ Dust May Cause skin & eyes irritation.	Personal protective equipments are being used	

ANNEXURE-7

OTHER HAZARDS AND CONTROLS

Sr. No.	Name of the possible hazard / emergency	Its source & reason	Its effect on persons, property & environment	Place of effect	Control measures provided	In charge person
1	2	3	4	5	6	7
Utilities						
A	**Electrical**					
i	Fire	➢ Loose connections ➢ Weak earthing ➢ Short circuit ➢ Improper Insulation	➢ Electrical power failure ➢ Production Hindrance ➢ Loss of transformer	➢ Transformer ➢ MCC panel	➢ Firefighting equipment's ➢ Gravel bed for oil spillage/soaking ➢ Isolated area for MCC panel & Transformer. ➢ Lightning arrester provided. ➢ Proper Earthling to Electrical Equipment. ➢ Alternate power source by D.G. Set ➢ Periodic checking of joints ➢ Proper insulation	Mr. Mahesh Panchal Manager
ii	Electrical Shock		➢ Electric shock can cause death ➢ Electric short circuit can cause damage to property	➢ Power points ➢ Live wires ➢ Electric Equipments	➢ Skilled manpower ➢ Proper insulation ➢ Proper earthing ➢ PPEs	

iii	Burning		➢ Serious injury or death	➢ Power points ➢ Live wires ➢ Electric Equipments	➢ Skilled manpower ➢ Proper insulation ➢ Proper earthing ➢ PPEs	
B	**Compressed Air**					
i	Injury/Death Due to High Pressure	➢ Air Compressor	➢ Serious injury or death can be caused by quite a small pressure of air especially on delicate parts such as eyes, ear & nose	➢ Compressor house ➢ Service air point	➢ It is ensured that compressed air is not used for cleaning itself. ➢ Direct air is not being used through hose	Mr. A. Hinsu Sr. Manager
C	**Boiler**					
i	Explosion	➢ Boiler	➢ Potential damage to property ➢ Can cause severe injury/death to person.	➢ Boiler House	➢ Continuous monitoring of operating pressures. ➢ Provision of safety valves ➢ Provision of high pr. Alarms & trips for the boiler.	Mr. A. Hinsu Sr. Manager
D	**Structural Failure**					
i	Structural failure	➢ Structure	➢ Potential damage to property ➢ Can cause severe injury/death to person.	➢ Within the factory	➢ Regular cleaning & painting ➢ Periodic structure stability inspection by competent person	Mr. Rajesh Nikose Asst. Manager
E	**Natural Disasters**					

v	➢ Natural Disaster. ➢ Earthquakes ➢ Lightning, storms, ➢ Man-made War. ➢ Sabotage & fire in neighboring industries	➢ Natural	➢ Production hindrance ➢ Trapping under debris. ➢ Death due to toxic releases. ➢ Chemical burn.	➢ Whole factory ➢ Population nearby	➢ Lightning arrester at highest point. ➢ Auto fire hydrant system. ➢ Respiratory protection equipment's. ➢ Siren, Evacuation, rescue & shelter/welfare facility	SMC

ANNEXURE-8

TRADE-WASTE DISPOSALS

Sr. No.	Name of the trade waste	Its generation per day	Place of its generation	Place of its safe disposal	Treatment method of safe disposal	Monitoring & control measures provided	In charge person
1	2	3	4	5	6	7	8
1	Incineration ash	10 to 20 ton	Incinerator plants	Land filling site of BEIL	NR	➢ Immediate disposal to landfill ➢ Waste analyzed ➢ Ground water analysis	Mr. M G Gami Sr. Manager
2	MEE Salt	13 to 17 ton	MEE plant	Land filling site of BEIL	NR	➢ Immediate disposal to landfill ➢ Waste analyzed ➢ Ground water analysis	Mr. Bhavesh Pancholi Manager
3	Leachate	70 to 80 KL	Landfill site	➢ CETP/ETL ➢ MEE plant-BEIL	Treatment Plant	➢ Separate leachate collection & transferring arrangement is provided ➢ Waste analyzed ➢ Ground water analysis	Mr. Rajesh Nikose Asst. Manager
4	Discarded Empty Decontaminated Containers	7 to 8 nos.	All Plant	Approved scrap vendor	NR	➢ GPCB approved Scrap Vendor ➢ On –Site Drum Cleaning Facility before selling to scrap vendor. ➢ AEPS inspection prior to disposal.	Mr. Dinkar Trivedi Manager
5	Discarded Empty	2 to 3 MT	All plant	Approved scrap	Treatment	➢ GPCB approved Scrap Vendor	Mr. Dinkar

	Contaminated Containers			vendor	Plant	➢ Separate storage shed is provided	Trivedi Manager
6	Used oil	0.5 to 0.8 Ltr	All Plant	Used for lubrication/ Registered recycler	NR	Stored in packed drum	Mr. A. Hinsu Sr. Manager

ANNEXURE-9

RECORDS OF PAST INCIDENTS

Sr. No.	Type of incident (Major accident, emergency or disaster)	Date and time of Occurrence	It's place	Duration	Time required in controlling it	Nos. of workers working at that time	Persons affected		Persons died		Subsequent safety measures provided
							Inside factory	Outside factory	Inside factory	Outside factory	
1	2	3	4	5	6	7	8	9	10	11	12
1	Fire	3-04-2008 17:45	Shed no 7	08 Hrs.	08 Hrs	05	Nil	Nil	Nil	Nil	➢ Separate storage sheds with impervious flooring & roofing ➢ Provision of fire extinguishers ➢ Provision of fire hydrant line ➢ Provision of water sprinkler system with Heat & Smoke detectors

2	Fall from height	13-01-2012 13:05	Drum cutting shed	--	--	05	01	Nil	01	Nil	➢ Work permit system implemented strictly ➢ Refresher Training imparted to all contract workers ➢ Strict monitoring
3	Toxic Gas Release	07-12-2015 11:00	Storage tank area	15 min.	15 min.	06	06	Nil	02	Nil	➢ SOP has been revised ➢ Scrubbing system is provided. All storage tank vents connected to the scrubbing system. ➢ Airline respirators provided ➢ HAZOP study has been carried out & implemented all the recommendations

ANNEXURE-10

GAS DISPERSON CONCENTRATION

Assuming leak rate (Q) = 3 kg / sec. i.e. 3 x 106 mg/sec. And velocity (u) = 2 and 5 M/sec. Downwind concentrations of some gases at various distances are calculated and tabulated as follows:

Maximum concentration (PPM) IN DOWNWIND DIRECTION AT DISTANCE X. Wind velocity = 2 M/Sec. for most unstable after-noon weather Condition (A)

Product	100 M	200 M	300 M	400 M	500 M	700 M	1 KM	2 KM	3 KM	4 KM	5 KM
Chlorine	439	110	41	27	21	11	4.11	1.03	0.45	0.26	0.16
Phosgene	315	79	29	20	15	7	2.95	0.74	0.33	0.18	0.12

SO_3	389	97	36	24	19	11	3.65	0.91	0.41	0.23	0.15
Ammonia	1832	458	171	115	89	50	17.18	4.29	1.91	1.07	0.69
PCl_3	254	64	24	16	13	-	2.39	0.60	0.27	0.15	0.09
CSA	279	70	26	17	14	-	2.50	0.63	0.28	0.16	0.10
Note: For other weather condition respective curve should be chosen											
Maximum concentration (PPM) IN DOWNWIND DIRECTION AT DISTANCE X. Wind velocity = 5 M/Sec. for most unstable after-noon weather Condition (B)											
Product	100 M	200 M	300 M	400 M	500 M	700 M	1 KM	2 KM	3 KM	4 KM	5 KM
Chlorine	175	44	16	11	9	5	1.64	0.41	0.18	0.18	0.06
Phosgene	125	31	12	8	6	8	1.18	0.30	0.13	0.07	0.05
SO_3	156	39	15	10	8	4	1.46	0.36	0.16	0.09	0.09
Ammonia	132	183	69	46	36	20	6.87	1.72	0.76	0.43	0.24
PCl_3	111	28	10	7	5	3	0.96	0.24	0.11	0.06	0.04
CSA	112	28	10	7	5	3	1.00	0.25	0.11	0.06	0.04
Note: For other weather condition respective curve should be chosen											

ANNEXURE-11

EVACUATION TABLE

EVACUALTIN TABLE BASED ON PREVAILING WIND OF 6 TO 12 mps (2.7 TO 5.4 m/s)			
Material	**Radius of immediate danger area (KM)**	**Dimension of evaluation area**	
		Downwind (Km)	**Crosswind (Km)**
Acrolein	0.69	8.05	4.83
Acrylonitrile	0.03	0.32	0.16
Ammonia	0.08	0.64	0.48
Carbon dislfide	0.04	0.32	0.16
Chlorine	0.31	3.22	2.41
Dimethylamine	0.14	1.13	1.29
Epichloronydrin	0.05	0.32	0.32
Etylene oxide	0.04	0.32	0.16
Fluorine	0.20	1.61	1.61
Hydrogen chloride	0.24	2.41	1.61
Hydrogen cyanide	0.12	1.13	0.44
Hydrogen fluoride	0.30	3.22	1.61
Hydrogen sulfide	0.15	1.61	0.81
Methyl mercaptan	0.09	1.29	0.48
Monomethylamine	0.14	1.13	1.29
Nitric acid	0.13	1.13	0.64
Nitrogen tetroxide	0.14	1.13	1.29
Oleum	0.35	3.22	1.61
Phosgene	0.75	8.05	4.83
Phosphorous trichloride	0.14	1.21	0.81
Sulfur dioxide	0.13	1.21	0.81
Sulfur trioxide	0.35	3.22	1.61
Sulfuric acid	0.35	3.22	1.61
Trim ethylamine	0.35	3.22	2.41
Source: Emergency Action Guide for selected Hazardous Materials, U.S. Dept. of Transportation, 1978			

ANNEXURE-12

ENVIORNMENTAL IMPACT ASSESSMENT

Sr. No	Distance (radius) from the factory	Environment	Population	Possible consequence & Assessment			Control measures Provided
				Type of risk & effect possible	Duration of risk	Risk assessment Frequency of the hazard (i.e. one such incident in what time)	
1	2	3	4	5	6	7	9
1	Upto 1000 Mt.	GIDC Area	3000	Gas exposure due to fire	1 to 4 hrs.	Rarely	➢ All the storage sheds are covered with fire hydrant system, automatic sprinkler system is provided in all the sheds, Smoke & heat detectors are installed in all the sheds, Fire extinguishers are also provided. ➢ Mechanical seal for transferring pump. ➢ N2 blanketing system for high CV liquid storage tanks. ➢ Provision of Fire Hydrant System & Extinguishers. ➢ Proper Grounding of storage vessel to earth pit. ➢ Safety work permit system is in place. ➢ Tanks are provided with dip pipe. ➢ Proper Earthing & bonding before Loading/Unloading operations.
2	1.9 Km	Jitali	3900	Gas exposure due to fire	1 to 4 hrs.	Rarely	
3	2.5 Km	Dadhal	3100	Gas exposure due to fire	1 to 4 hrs.	Rarely	
4	2.6 Km	Sarangpur	12600	Gas exposure due to fire	1 to 4 hrs.	Rarely	
5	3.4 Km	Motali	700	Gas exposure due to fire	1 to 3 hrs.	Rarely	
6	3.6 Km	Kosamdi	5400	Gas exposure due to fire	1 to 3 hrs.	Rarely	
7	4.2 Km	Gadkhol	1100	Gas exposure due to fire	1 to 2 hrs.	Rarely	

ANNEXURE-13

WEATHER CONDITIONS

Sr. No.	Period of the year		Temp. °C		Wind Vel. KM/Hrs.	Wind Direction		Weather Conditions	Pasquill Classification A TO F
	Dates								
	From	To	Max.	Min.		Day	Night		
1	2	3	4	5	6	7	8	9	10
1	1st Jan.	31st Jan.	26.7	11.9	1.19	SE/NE	NE/NW	Cold & Stable	D
2	1st Feb.	28/29 Feb	31.0	14.5	1.19	SE/NE	W/NW	Dry & Stable	D
3	1st Mar.	31st Mar.	35.7	18.6	1.19	NE/NW	W/NW	Dry & Stable	D
4	1st Apr.	30th Apr.	39.0	23.6	1.19	NW/W	W/NW	Dry & Stable	D
5	1st May	31st May	44.0	26.0	1.19	NW/W	SW/W	Hot	D
6	1st Jun.	31st Jun.	43.0	27.0	1.19	SW/W	SW/W	Moist & Hot	D
7	1st July.	31st July	35.0	25.0	1.19	SW/W	SW/W	Hot & Rainy	D-F
8	1st Aug.	31st Aug.	31.0	24.0	1.19	SW/W	SW/W	Hot & Rainy	D-F
9	1st Sep.	30th Sep.	33.0	24.0	1.19	S/NW	SW/W	Hot & Rainy	D-F
10	1st Oct.	31st Oct.	35.0	21.0	1.19	NE/W	NE/NW	Moist	D
11	1st Nov,	30th Nov	33.0	16.0	1.19	NE/E	NE/E	Dry	D
12	1st Dec.	31st Dec.	29.0	12.0	1.19	NE/E	NE/NW	Cold &Stable	D

ANNEXURE-14

INCIDENT CONTROLLERS

Shift	Incident Controller's				
	Name	**Designation**	**Qualification**	**Place of availability**	**Res. Add.**
1	2	3	4	5	6
First & General	Mr. Dinkar Trivedi	Sr. Manager	B.Sc	Plant Office	Ankleshwar
	Mr. Jagdish Taral	Manager	B.Sc.	Control Room	Ankleshwar
Second	Mr. Denish Patel	Executive	B.Sc.	Control Room	Ankleshwar
Third	Mr. Shailesh Patel	Officer	B.Sc.	Control Room	Ankleshwar
Holiday	Mr. Kevin	officer	M.E	Inci Control Room	Ankleshwra

ANNEXURE-15

DEPUTY INCIDENT CONTROLLERS

Shift	**Deputy Incident Controller's**				
	Name	**Designation**	**Qualification**	**Place of availability**	**Res. Add.**
1	2	3	4	5	6
First & General	Mr. Jagdish Taral	Manager	B.Sc.	Inci Control Room	Ankleshwar
	Mr. Kevin	Officer	M.E	Inci. Control Room	Ankleshwra
Second	Mr. Denish	Officer	Diploma chemical Engineer	Inci Control Room	Ankleshwar
Third	Mr. Janak Prajapati	Officer	B.E.	MEE Plant	B-302, Amidhara complex, Nr. ragini cinema, Bhadkodra, Ankleshwar
Holiday	Mr. Viral patel	Executive	DME	Plant Office	Ankleshwar

ANNEXURE-16

SITE MAIN CONTROLLERS

Sr. No.	Site Main Controller's						
	Name	**Designation**	**Qualification**	**Place of availability**	**Res. Add.**	**Phone No.**	
						Factory	**Resi.**
1	2	3	4	5	6	7	8
1	Mr.B D Dalwadi	CEO	B.E.	ADM	408/9, Sardar Patel Society, GIDC, Ankleshwar	02646-226591	9909994959
2	Mr. Manoj Patel	G.M.	B.E.	ADM	Shantiniketan Society, Ankleshwar.	02646-226591	9909994907

ANNEXURE-17

KEY PERSSONEL

Sr. No.	KEY PERSON'S				NEXT PERSON'S	
	Dept.	**Name**	**Designation**	**Phone No.**	**Name & Designation**	**Phone No.**
1	2	3	4	5	6	7
1	Safety	Mr. Sanjay Joshi	Sr. Manager	7575001962	Mr. Parth Jani	7575008116
2	Security	Mr. Manoranjan Das	Incharge	9558091288		
3	Pollution control	Mr. Sathish Gaddam	Sr. Manager	8238088363	Mr. Dipak Meghapara	990999161
4	Medical	Mr. Arjun	Nurse	7041563584	Mr. Tiwari	8511318648
5	Engineering	Mr. A.Hinsu	Sr. Manager	9909994944	Mr. Dharmesh Patel	
6	Production	Mr. Dinkar Trivedi	Sr. Manager	9978996347	Mr. Jagdish Taral	9909994993
7	Technical Services	Mr. B R Trivedi	GM	9979997106		
8	Stores	Mr. Anant Raval	Manager	9909992978		
9	Ware House	Mr. Viral Patel	Executive	9925497837	Mr. Nikung Rana	

10	Civil	Mr. Rajesh Nikose	Manager	9909994933	Mr. Pratik Shah	7567146695
11	Electrical	Mr. Mahesh Panchal	Manager	9978447294	Mr.Manish Parekh	9909994988
12	Instrument	Mr. Bhavin Modi	Assistant Manager	9879141402		

ANNEXURE-18

ESSENTIAL WORKERS

Sr. No.	Name & Designation	Trained for work	Place of availability	Phone No.
1	2	3	4	5
1	Mr. Naresh Patel	Gas Leakage	Maint. room	241
2	Mr. Jigar Trivedi	Gas Leakage	Instrument Office	222
3	Mr. Nitin Patel	Gas Leakage	ADM	104
4	Mr. Mahendra Solanki	Fire Fighting	Safety Office	100
5	Mr. Chetan Tadvi	Fire Fighting	Safety Office	100
6	Mr. Dharmendra Chavda	Fire Fighting	Safety Office	100
7	Mr. Pravin Patel	Fire Fighting	Safety Office	100
8	Mr. Sanjay Mistry	Fire Fighting	Safety Office	100
9	Mr. Javed Patel	Building Collapse	Plant	219
10	Mr. Chirag Patel	Building	Instrument	222

		Collapse	Office	
11	Mr. Arjun Patel	First Aid	OHC	108
12	Mr. Laxminarayan Tiwari	First Aid	OHC	108
13	Mr. Parth Jani	Evacuation & Search Operation	Safety Office	100
14	Mr. Samim Khan	Evacuation & Search Operation	Ware House	239
15	Mr. Hetal Shah	Spill & Leak control	Main Gate	9727433160
16	Mr. Patil	Spill & Leak control	Shed No. 04	9727675348
17	Mr. DG Patel	Heavy vehicle arrangement	-	9825060239

ANNEXURE-19

ASSEMBLY POINTS

Sr. No.	Location	Accommodation Capacity	At the time of emergency Person incharge's		
			Name & Designation	Place of availability	Phone No.
1	2	3	4	5	6
1	Main Gate	200	Mr. Ashish Gurjar	ADM	Ext. 106
2	Incinerator plant Office	100	Mr. Janak Prajapati	MEE Plant	Ext. 136
3	New Land filling behind Phase III	200	Mr. Rajesh Nikose	ADM	Ext. 107

ANNEXURE-20

EMERGENCY CONTROL CENTRE

Location of Centre: Main Adm. **Telephone No. of the ECC:** 105			
Sr. No.	**Items kept in the center**	**Quantity**	**Notes**
1	2	3	4
1	SCBA set	01	
2	Cartridge mask	05	
3	Rubber hand gloves	10 Pairs	
4	PVC Hand Gloves	20 pairs	
5	Dust mask	100	
6	Gum Boot	05 pairs	
7	Safety Helmet	05	
8	Safety Goggles	10	
9	Onsite Emergency Plan	01	
10	List of Emergency Phone No.	01	
11	Plant Lay out copy	01	

ANNEXURE-21

FIRE AND TOXICITY CONTROL ARRANGEMENTS

- **TAC APPROVED FIRE HYDRANT SYSTEM**
- **WATER STORAGE CAPACITY : 1000 K L**
- **FIRE PUMPS**

Primary electricity driven pump : 273 M3/Hr

Diesel Driven pump : 273 M3/Hr

Secondary electricity driven pump : 173 M3/ Hr

Jockey pump : 03 M3/Hr

- **DETAIL OF FIRE HYDRANT POSTS & MONITORS**

SHP : 57 Nos.

Monitors : 26 Nos.

- **DETAIL OF FIRE EXTINGUISHERS**

Sr. No.	Location	Type	Capacity
1	2	3	4
1	ADM OFFICE	CO_2	09 Kg.
2	ADM OFFICE	CO_2	4.5 Kg.
3	ADM OFFICE	CO_2	4.5 Kg.
4	OHC	CO_2	4.5 Kg.
5	NEW LAB	CO_2	4.5 Kg.

6	NEW LAB	CLEAN AGENT	02 Kg.
7	NEW LAB	CO_2	02 Kg.
8	NEW LAB	CLEAN AGENT	02 Kg.
9	NEW LAB	CO_2	02 Kg.
10	D.G. ROOM	CO_2	4.5 Kg.
11	D.G. ROOM	CO_2	4.5 Kg.
12	D.G. ROOM	CO_2	4.5 Kg.
13	D.G. ROOM	CO_2	09 Kg.
14	D.G. ROOM	M.FOAM	45 LIT.
15	PUMP HOUSE	CO_2	4.5 Kg.
16	CHARGING AREA	DCP	05 Kg
17	CHARGING AREA	DCP	05 Kg
18	CHARGING AREA	M.FOAM	45 LIT.
19	CHARGING AREA	DCP	05 Kg
20	CHARGING AREA	DCP	05 Kg
21	BUNKR AREA INCI PLANT 01	DCP	05 Kg
22	MCC ROOM INCI PLANT 01	CO_2	09 Kg.
23	MCC ROOM INCI PLANT 01	CO_2	4.5 Kg.
24	INCI PLANT 01 GF	M.FOAM	45 LIT.
25	INCI PLANT 01 GF	DCP	05 Kg
26	INCI PLANT 01 GF	DCP	05 Kg
27	INCI PLANT 01 GF	DCP	10 Kg

28	INCI PLANT 01 FF	DCP	05 Kg
29	INCI PLANT 01 FF	DCP	10 Kg
30	INCI PLANT 01 FF	DCP	05 Kg
31	INCI PLANT 01 SF	DCP	05 Kg
32	INCI PLANT 01 SF	DCP	10 Kg
33	INCI PLANT 01 SF	DCP	05 Kg
34	INCI PLANT 01 TF	DCP	10 Kg
35	INCI PLANT 01 TF	DCP	10 Kg
36	INCI PLANT 01 TF		
37	SCRUBBER INCI PLANT 01 GF	DCP	05 Kg
38	SCRUBBER INCI PLANT 01 FF	DCP	05 Kg
39	SCRUBBER INCI PLANT 01 FF	DCP	05 Kg
40	SCRUBBER INCI PLANT 01 SF	DCP	05 Kg
41	SCRUBBER INCI PLANT 01 SF	DCP	05 Kg
42	SCRUBBER INCI PLANT 01 TF	DCP	05 Kg
43	MCC ROOM INCI PLANT 02	CO_2	4.5 Kg.
44	MCC ROOM INCI PLANT 02	DCP	05 Kg
45	CONTROL ROOM INCI PLANT 02	CO_2	4.5 Kg.
46	CONTROL ROOM INCI PLANT 02	CO_2	4.5 Kg.
47	CONTROL ROOM INCI PLANT 02	CLEAN AGENT	02 Kg.
48	CONTROL ROOM INCI PLANT 02	CO_2	4.5 Kg.
49	CONTROL ROOM INCI PLANT 02	CO_2	4.5 Kg.

50	INCI PLANT 02 GF	DCP	10 Kg
51	INCI PLANT 02 GF	DCP	05 Kg
52	INCI PLANT 02 GF	M.FOAM	45 LIT.
53	INCI PLANT 02 FF	DCP	05 Kg
54	INCI PLANT 02 FF	DCP	05 Kg
55	INCI PLANT 02 FF	DCP	10 Kg
56	INCI PLANT 02 SF	DCP	05 Kg
57	INCI PLANT 02 SF	DCP	10 Kg
58	INCI PLANT 02 SF	DCP	10 Kg
59	INCI PLANT 02 TF	DCP	05 Kg
60	INCI PLANT 02 TOP	DCP	10 Kg
61	SCRUBBER INCI PLANT 02 GF	DCP	05 Kg
62	SCRUBBER INCI PLANT 02 GF	DCP	05 Kg
63	SCRUBBER INCI PLANT 02 FF	DCP	05 Kg
64	SCRUBBER INCI PLANT 02 SF	DCP	05 Kg
65	SCRUBBER INCI PLANT 02 TF	DCP	05 Kg
66	BOILER	DCP	05 Kg
67	BOILER	CO_2	02 Kg.
68	BOILER	M.FOAM	45 LIT.
69	MEE PLANT GF	CO_2	4.5 Kg.
70	MEE PLANT GF	M.FOAM	45 LIT.
71	MEE PLANT GF	DCP	05 Kg

72	MEE PLANT FF	DCP	05 Kg
73	MEE PLANT SF	DCP	05 Kg
74	MEE PLANT TF	DCP	05 Kg
75	MEE PLANT PANEL ROOM	CO_2	4.5 Kg.
76	COMPRESSOR ROOM	CO_2	09 Kg.
77	COMPRESSOR ROOM	DCP	05 Kg
78	SHED NO. 01	DCP	10 Kg
79	SHED NO. 01	M.FOAM	45 LIT.
80	SHED NO. 01	DCP	05 Kg
81	SHED NO. 01	M.FOAM	135 LIT.
82	SHED NO. 02	M.FOAM	45 LIT.
83	SHED NO. 03	M.FOAM	45 LIT.
84	SHED NO. 03	DCP	10 Kg
85	SHED NO. 04	DCP	05 Kg
86	SHED NO. 04	DCP	05 Kg
87	SHED NO. 04	DCP	05 Kg
88	SHED NO. 05	M.FOAM	45 LIT.
89	SHED NO. 05	M.FOAM	45 LIT.
90	SHED NO. 06	M.FOAM	45 LIT.
91	SHED NO. 06	M.FOAM	45 LIT.
92	SHED NO. 07	M.FOAM	135 LIT.
93	SHED NO. 07	DCP	05 Kg

94	SHED NO. 07	M.FOAM	45 LIT.
95	SHED NO. 07	ABC	10 Kg
96	SHED NO. 08	DCP	10 Kg
97	SHED NO. 08	M.FOAM	45 LIT.
98	SHED NO. 08	M.FOAM	45 LIT.
99	SHED NO. 09	M.FOAM	45 LIT.
100	SHED NO. 09	DCP	10 Kg
101	SHED NO. 09	M.FOAM	45 LIT.
102	SHED NO. 10	M.FOAM	45 LIT.
103	SHED NO. 10	DCP	10 Kg
104	SHED NO. 10	M.FOAM	45 LIT.
105	SHED NO. 10	M.FOAM	45 LIT.
106	CANTEEN	CO_2	02 Kg.
107	CANTEEN	CO_2	4.5 Kg.
108	GAS STATION	DCP	10 Kg
109	STABILIZATION PLANT	ABC	4.0 Kg
110	STABILIZATION PLANT	ABC	4.0 Kg
111	STABILIZATION PLANT	ABC	9.0 Kg
112	STABILIZATION PLANT	ABC	9.0 Kg
113	STABILIZATION PLANT	CO_2	4.5 Kg
114	CONCRET PAD	ABC	4.0 Kg
115	CONCRET PAD	ABC	4.0 Kg

116	CONCRET PAD	ABC	9.0 Kg
117	HELIPAD	CO_2	4.5 Kg
118	PLASTIC PLANT	ABC	4.0 Kg
119	PLASTIC PLANT	ABC	4.0 Kg
220	PLASTIC PLANT	ABC	4.0 Kg
221	PLASTIC PLANT	ABC	9.0 Kg
222	PLASTIC PLANT	ABC	4.0 Kg
223	PLASTIC PLANT	ABC	4.0 Kg
224	PLASTIC PLANT	CO2	2.0 Kg
225	PLASTIC PLANT	CO2	4.5 Kg
226	STORE	CO2	4.5 Kg
227	AMBULANCE VAN	ABC	1.0 Kg

- **Two nos. of mobile foam trolley having 200 Lit. capacity are also available**

ANNEXURE-22

MEDICAL ARRANGEMENTS

Sr. No.	Name & Location	Incharge Person		Facilities & Equipment	Anti-dotes available	First aiders available	Ambulance van or alternate arrangement		
		Name	Phone No.				Place of availability	Capacity	Incharge
1	2	3	4	5	6	7	8	9	10
1	OHC Nr. Main Gate	Mr. Parth Jani	116	First Aid treatment facility	Atropin Avil Methelene Blue Snake bite PAM DNS TT	Mr. Arjun Mr. Tiwari	Main Gate	Ambulance-2 Maruti Van-2 person Car-2 person	Mr. Ashish Gurjar

Mutual Aid Arrangements

Name & address of the factories & Hospitals	Approximate distance	Phone No.	Facilities available				
			Accommodation	Doctors	Equipments	Antidotes	Ambulance
11	12	13	14	15	16	17	18
Patel Multi specialty Hospital	7 KM	246535	50	Available	All type	Available	1
Jayaben Modi Hospital	5 KM	222220	100	Available	All type	Available	2

UPL Unit # 1	5 KM	251223	-	Available	First aid	Available	1
UPL Unit # 2	3 KM	250578	-	Available	First aid	Available	1
UPL Unit # 3	2 KM	251189	-	Available	First aid	Available	1
Rallis (Agro)	1 KM	251284	-	Available	First aid	Available	1
Asian Paints (Paints Division)	2 KM	220218	-	Available	First aid	Available	1
Coromandel	1 KM	222471	-	Available	First aid	Available	1

ANNEXURE-23

TRANSPORT & EVACUATION ARRANGEMENTS

Sr. No.	Type of vehicle	Capacity	Place of availability	Incharge	Phone No.
1	2	3	4	5	6
1	Ambulance van	2 persons	Main Gate	Mr. Ashish Gurjar	107
1	Maruti Van	2 persons	Main Gate	Mr. Ashish Gurjar	107
2	Car	2 persons	Main Gate	Mr. Ashish Gurjar	107

ANNEXURE-24

POLLUTION CONTROL ARRANGEMENTS

Water Pollution Controls					**Air Monitoring**					
Type & capacity of effluent treatment plant	**No. of sample monitoring centers & its frequency**	**Other control measures**	**Log book & records**	**Incharge person's name address & phones**	**No and place of sample monitoring centers**	**Type parameters & frequency of tests**	**Wind direction & velocity meters**	**Instruments available**	**Log Book & records**	**In charge person's name address & phones**
1	2	3	4	5	6	7	8	9	10	11
MEE Plant 15 MT/Hr.	01 Daily	Pumping system for W/W transferring	Available	Mr. Janak Prajapati	Nr. Laboratory	As per CCA	Weather monitoring system	Available	Form No. 37	Sathish
Waste water sent to CETP (ETL) for treatment					Nr. Bore well No. HB 05	As per CCA	Weather monitoring system	Available	Form No. 37	Sathish

STACK MONITORING				**SCRUBBERS**			**Pollution control Board**	
No. & Location of sample places	**Type Parameters & frequency of tests**	**Instruments provided**	**Log book & records**	**Location**	**Type & capacity**	**Incharge person**	**Permission obtained?**	**Conditions fulfilled**
12	13	14	15	16	17	18	19	20
Incinerator-1 & 2	As per CCA	Online continuous monitoring system	Available	Incinerator-1 & 2	Packed bed 75 m3/hr.	Mr. Gami	Yes	Yes

ANNEXURE-25

OTHER ARRANGEMENTS

Sr. No.	Type and name of arrangements available	Qty.	Place of availability	Incharge person's	
				Name & designation	Phone
1	2	3	4	5	6
1	JCB / Dozzer	05	Landfill site	Mr. Rajesh Nikose Manager	9909994933
2	Forklift	06	Plant	Mr. Dinkar Trivedi Sr. Manager	9978996347
3	Transporters for Material	03	Landfill Site	Mr. Rakesh Rohit Sr. Manager	9099064266
4	DG Sets	02	Plant	Mr. Mahesh Panchal Manager	9978447294
5	Fire Trailer Pump	01	Plant	Mr. Sanjay Joshi Sr. Manager	7575001962
6	Mechanical Foam	1 KL	Plant	Mr. Sanjay Joshi Sr. Manager	7575001962
7	Mobile Foam Trolley	02	Plant	Mr. Sanjay Joshi Sr. Manager	7575001962
8	NABL & MoEF approved Test Facilities	01	QC	Mr. Sathish Gaddam Sr. Manager	8238088363

ANNEXURE-26

ALARMS & SIRENS

Sr. No.	Location of Sirens	Type of the alarm or siren	Period of checking	Type of emergency	Type of Siren	Duration Of sounding
1	2	3	4	5	6	7
1	Main adm	Electrical	Weekly	Fire or Other	Interrupted	10 sec. ON & 5 sec. OFF three times
				Gas leak	Interrupted	15 Sec. ON & 15 Sec. OFF four times
2	Incinerator Plant	Electrical	Weekly	All clear	continuous	1 min. continuous
				Testing	continuous	1 Min. Continuous on every Wednesday

ANNEXURE-27

INTERNAL PHONES

Sr. No.	Name of the plant / department	Intercom number	Person available on this phone		
			Name	Designation or duty under 0n-site / off-site emergency plan, if any	Residence Phone No.
1	2	3	4	5	6
1	ADM	101	Mr. B D Dalwadi	SMC	9909994959
2	ADM	104	Mr. Manoj Patel	SMC	9909994907
3	Production	121	Mr. Atul Agrawal	IC	9909994908
4	Incinerator	129	Mr. Dinkar Trivedi	IC	9978996347
5	MEE	136	Mr. Janak Prajapati	Key Personnel	7016795874
6	Ware House	120	Mr. Viral Patel	Dy. IC	9925497837
7	QC	114	Mr. Sathish Gaddam	Key Personnel	8238088363

8	Maintenance	117	Mr. A. Hinsu	Dy. IC	9909994906
9	Electrical	123	Mr. Mahesh Panchal	Key Personnel	9978447294
10	Safety	116	Mr. Sanjay Joshi	Key Personnel	7575001962
11	Instrument	141	Mr. Bhavin Modi	Key Personnel	9879141402
12	HR	106	Mr. Ashish Gurjar	Key Personnel	9913064336
13	Civil/Landfill	142	Mr. Rajesh Nikose	Key Personnel	9909994933
14	Marketing	140	Mr. Rajeev Mathur	Key Personnel	8238040998
15	Security	112	Mr. Manoranjan Das	Key Personnel	8758201814
16	OHC	118	Mr. Arjun Patel	Key Personnel	7041563584
17	Store	119	Mr. Anant Raval	Key Personnel	9909992978

ANNEXURE-28

EXTERNAL PHONES

Sr. No	Name	Office Phone No
1	2	3
1	UPL Unit # 1	251223 / 250336
2	UPL Unit # 2	250578 / 250563
3	UPL Unit # 3	251189
4	Fire Station	220229 / 226101 / 257201
5	UPL Unit # 5 Jhagadia Fire Station	02645 – 226012 / 226014
6	GPCB Local Office, Ankleshwar	02646 – 222932 / 222933
7	Rallis (Agro)	251284
8	Asian Paints (Paints Division)	220218 / 220268
9	Coromandal International	222471
10	GIL	251472 / 222271
11	Agrevo India (Hoechst)	221113 / 221358
12	Gujarat Lyka	222785
13	GEB	256703
14	Railway Station, Ankleshwar	131
15	State Transport Office	257030
16	Dr A K Patel	256535
17	Dr Mahesh Mistry	9825282789
18	Smt Jayaben Modi Hospital	222220 / 224550
19	GIDC Police Station	225551
20	Mamlatdar Ankleshwar	246603
21	Sub Divisional Magistrate	242649
22	DPMC	226101 / 220229
23	AEPS	253802
24	Ankleshwar Nagar Palika	247137
25	District Collector, Bharuch	02642 – 244500 / 240600
26	Ankleshwar Industries Association	221000 / 222000

Sr. No	Name	Office Phone No
1	2	3
27	Enviro Technology Ltd	223569 / 252768
28	President, Ankleshwar Industries Association	251155
29	District Industries Center	02642 – 240981 / 243478
30	Senior Inspector of Factories, Bharuch	02642 – 240421 / 225838
31	Industrial Solvent	251173 / 239551
32	GGCL	246121 / 246122 / 246125

ANNEXURE-29

NOMINATED PERSONS TO DECLARED MAJOR EMERGENCY

Sr. No.	Name of the plant/ location	Name & designation of the nominated persons to declare major emergency	Duty of designation given if any under the on-site/off-site emergency plan	Phone No.	Residence	
					Phone No.	Address
1	2	3	4	5	6	7
1	ADM	Mr. B D Dalwadi (CEO)	SMC	252768/ 223569	9909994959	408/9 Sardar Patel Society, GIDC Ankleshwar
2	ADM	Mr. Manoj Patel (GM)	SMC	226591/ 225228	9909994907	11-Shantiniketan Society, GIDC Ankleshwar

ANNEXURE-30

A FORM TO RECORD EMERGENCY TELEPHONE CALLS

PART A: ESSENTIAL INFORMATION		
Details of call as reported		
Caller's Name & designation _____ Date _____ Time _____ phone No. _____		
Purpose of call Is any particular advice required immediately?		
Name of Chemicals To be spelt out clearly		
Brief description of incident Fire / Explosion / Liquid Spill / Gas release Quantity involved Packaging / storing / handling / using details Location of incident Cause, if known, in brief		
PART B: INFORMATION TO BE OBTAINED IF READILY AVAILABLE		
Has anyone been injured?	Yes / No	If yes, how many?
Affected by chemicals?	Yes / No	If yes, how many?
What first-aid had been given?		
Has anyone been taken to hospital? If yes, address of the hospital		Yes / No
Is the road blocked? Closed to		Yes / No
Who owns the chemicals? Has the owner been informed?		Yes / No

If caused by vehicle, Vehicle Number _____ Name & address of the Owner_____ Has the owner been informed? Yes / No To whom was the load consigned?

ANNEXURE-31

STATUTORY COMMUNCATION

Statutory information to be given to:	**Periodicity of such information to be given (statutory or self-decided)**	**Date of last information given**	**Suggestions received if any**
1	2	3	5
The workers	Regular through training, leaflets etc.	Regular training and information	--
The general public & neighboring firms	As & when required	02.05.2017	--
District Emergency Authority	As & when asked for	--	--
Factory Inspectorate	a) Prior approval for Construction, production b) During expansion c) Change of process/ Organization structure d) Updated information As & When Required	02.05.2017	--

ANNEXURE-32

SEPERATION DISTANCES

Sr. No.	Substance	Tank / Storage shed		Separation Distance (M)
		Capacity (T)	Nos.	
1	2	3	4	5
1	Hazardous Waste	--	10	15

ANNEXURE-33

EMERGENCY INSTRUCTION BOOKLET

Sr. No.	Role to be played as	His emergency duties / functions	Also refer	He should report at
1	2	3	4	5
1	Incident Controller	1. Assess the scale of the emergency and decide if a major emergency exists or is likely. On his decision, he will activate the on-site emergency plan and if necessary the off-site emergency plan 2. Assume the duties of the Site Main Controller pending the latter's arrival. For this purpose, he will depute his deputy on the scene and he will go to the control center. Particularly he will- a) Direct the shutting down and evacuation of the plant and areas likely to be affected by the emergency. b) Ensure that the outside emergency services, including mutual aid, have been called in. c) Ensure that key personnel have been called in. 3. Direct all operations within the affected area with the following priorities: a) Secure the safety of the personnel. b) Minimize damage to plant, property and the environment. c) Minimize loss of material. 4. Direct rescue and firefighting operations until the arrival of	Emergency Duty Card	The Incident Place

		the outside Fire Brigade, when he will relinquish control to the Fire Brigade. 5. Search for casualties. 6. Evacuate non-essential workers to the assembly points. 7. Set up a communications point and establish radio/telephone/messenger contact as appropriate with the Emergency Control Centre. 8. Give advice and information as requested to the Head of the Fire Brigade and other Emergency Services. 9. Brief the site main controller and keep informed of developments. 10. Preserve evidences that will be necessary for subsequent inquiry in to the cause of the emergency and concluding preventive measures.		
2	Site Main Controller	1. Relieve the incident controller of responsibility for overall main control. 2. On consultation with the incident controller decide whether major emergency exist and on declaration of a major emergency, ensure that the outside emergency services and mutual help are called, the off-site plan activated and if necessary, nearby factories and population are informed. 3. Ensure that the key personnel are called in. 4. Exercise direct operational control of those parts of the works outside the affected area. 5. Continually review and assess possible developments to	Emergency Duty Card	Emergency Control Center

		determine the most probable course of events. 6. Direct the safe close down and evacuation of plants in consultation with the incident controller and key personnel. If necessary, arrange for evacuation of neighboring population. 7. Ensure that casualties are receiving adequate attention. Arrange for hospitalization of victims and additional help, if required. Ensure that the relatives are advised. 8. Inform and communicate with the chief officers of the fire and police service. District emergency authority and with the factory inspectorate and experts on health and safety. Provide advice on possible effects on areas outside the factory. 9. In case of prolonged emergencies involving risk to outside areas by windblown materials. Contact the local meteorological office to receive early notification of impending changes in weather conditions. 10. Ensure the accounting for personnel and rescue of missing persons. 11. Control traffic movement within the factory. 12. Arrange for a chronological record of the emergency to be maintained. 13. Where the emergency is prolonged, arrange for the relief of personnel and the provision of catering facilities. 14. Issue authorized statements to the news media. Where necessary, inform head office.		

		15. Ensure that proper consideration is given to the preservation of evidence. Arrange for photographs/videos. 16. Control rehabilitation of affected areas and victims on cessation of the emergency. Do not restart the plant unless it is ensured safe to start and cleared by authorities.		
3	Key Personnel	As necessary, they will decide the actions needed to shut down plants, evacuate personnel, carry out emergency engineering work, arrange for supplies of equipment, utilities (fuel, water, power, etc.) carry out atmospheric tests, provide catering facilities, liaise with police, fire brigade, emergency planning authority, factory inspectorate, hospitals, neighboring industries find population, assembly points, outside shelters, mutual aid centers, relatives of casualties, press and so on, under the direction of the site main controller.	Emergency Duty Card	Emergency Control Center
4	Essential workers	1. Firefighting, gas leak and spill control till a fire brigade takes the charge. 2. To help to the fire brigade and mutual aid teams, if it is so required. 3. Shutting down plant and making it safe. 4. Emergency engineering work e.g. isolating equipment, materials, process, providing temporary by-pass lines, safe transfer of material, urgent repairing or replacement, electrical work etc. 5. Provision of emergency power, water, lighting, instruments, equipments, material etc. 6. Movement of equipment, special vehicle and transport to or	Emergency Duty Card	The Incident Place

		from the site of the incident. 7. Search evacuation, rescue, and welfare. 8. First-aid and medical help. 9. Moving tankers or other vehicles from areas of risk. 10. Carrying out atmospheric test and pollution control. 11. Manning of assembly points to record the arrival of evacuated personnel. Manning for outside shelters and welfare of evacuated persons there. 12. Assistance at casualties' reception areas to record details of casualties. 13. Assistance at communication centers to handle outgoing and incoming calls and to act as messengers if necessary. 14. Manning of works entrances in liaison with the police to direct emergency vehicles entering the work, to control traffic leaving the works and to turn away or make alternative safe arrangements for visitors, contractors and other traffic arriving at the works. 15. Informing surrounding factories and the public as directed by the site main controller. 16. Any special help required.		