Risk Assessment

1.0 INTRODUCTION

Industrial activities including process, production, storage, handling, transportation and operational practices presents levels of hazards to workforce, population and environment at large due to accidents, spills, leaks etc. These accidents results in personal and financial loss. The assessment of the threat posed, its control and prevention through good design, management and operational controls is of primal importance. Events like the Bhopal tragedy have emphasized the need to address both on-site and off-site safety. It is against this background that the various Section and Rules under the Environment Protection Act, 1986, the Factories Act, 1948 and other Acts specify the requirements for a safe and reliable working of an industry. These require carrying out various studies and analysis to assess and mitigate hazards prevalent in the industry in line with the above goal of safe and reliable working. These are more commonly known as "Risk Assessment Studies". Risk assessment refers to the technical, scientific assessment of the nature and magnitude of risk and uses a factual base to define the health effects of exposure of individuals or populations or ecological receptors to hazardous contaminants and situations.

This chapter explains the basis of Risk Assessment and its objectives.

1.1 Risk Assessment

Industrial accidents results in great personal and financial loss. Managing these accidental risks in today's environment is the concern of every industry including TSDFs, because either real or perceived incidents can quickly jeopardize the financial viability of a business. Many facilities involve various manufacturing processes that have the potential for accidents which may be catastrophic to the plant, work force, environment, or public.

The main objective of risk assessment study is to propose a comprehensive but simple approach to carry out risk analysis and conducting feasibility studies for industries and planning and management of industrial prototype hazard analysis study.

1.1.1 Risk analysis

Risk analysis deals with identification and computation of consequence and risks. Risk analysis follows an extensive hazard analysis. This requires a thorough knowledge of probability of failure, credible accident scenario, vulnerability of population to exposure etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident scenarios. It provides basis for preparation of on-site and off-site emergency plan and also to incorporate safety measures.

1.1.2 Hazard Identification

Identification of hazards in the proposed project is of primary significance of the analysis, and quantification of risk hazard indicates the characteristics of hazardous wastes that pose potential for an emergency situation in the event of spillage and accidental release of hazardous wastes from the site.

All the components of a system/plant/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

Types of hazardous waste (solid & liquid):

- Flammable wastes
- Corrosive Wastes
- Reactive wastes
- Toxic wastes

Hazard Identification is a critical step in Risk Analysis. A classical definition of hazard states that hazard is in fact the characteristic of system/plant/process that

presents potential for an accident. Hence all the components of a system/plant/process need to be thoroughly examined in order to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

In Risk Analysis terminology a hazard is something with the potential to cause harm. Hence the Hazard Identification step is an exercise that seeks to identify what can go wrong at the major hazard installation or process in such a way that people may be harmed. The output of this step is a list of events that need to be passed on to later steps for further analysis.

1.2 Responsibilities of the facility operator:

- Accepting hazardous wastes at the unit from the generators authorized by SPCB/PCC.
- Establishing a system for optimal movement of hazardous wastes transportation, treatment and disposal operations, which may include resource recovery/recycling as the case may be.
- Fingerprinting analysis to confirm the wastes shall be the responsibility of the operator
- Operating the unit as per conditions stipulated in the authorization
- Ensuring waste treatment and/or disposal as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended
- Undertake cleanup operation in case of contamination resulting from the unit.
- Abatement of pollution and the odour arising out of the unit operations
- Compliance of regulations concerning occupational safety and health of the unit employees
- In the event, there are differences in the analysis results, the generator may either accept the results of operator or send their samples to a mutually agreed third party analysis at their own cost.

1.3 Storage and handling of hazardous materials:

Both hazardous and non-hazardous materials generated within the manufacturing units in the project facility shall be temporarily accommodated in designated storage units within the project facility built/made in line with the safety, health and environmental standards.

1.4 Storage area (storage shed)

- Huge quantum of incinerable hazardous wastes (organic wastes) will not be kept haphazardly without any labeling at the location/proposed location of incinerators.
- Automatic smoke, heat detection system will be provided in the sheds. Adequate fire fighting systems will be provided for the storage area, along with the areas in the facility.
- In storage of wastes, general criteria for compatibility of selected waste will be followed while storing or mixing of incinerable wastes to optimise the feed, compatibility of wastes will be considered and tested
- Flammable, ignitable, reactive and incompatible wastes will be stored separately and never should be stored in the same storage shed
- Storage area shall consist of different sheds for storing incinerable hazardous & other wastes and sheds will be provided with suitable openings
- Adequate storage capacity (i.e. 50 % of the annual capacity of the hazardous waste incinerator) will be provided in the premises
- Storage area will be designed to withstand the load of material stocked and any damage from the material spillage
- Storage area will be provided with the flameproof electrical fittings and it will be strictly adhered to
- There will be at least 15 m distance between the storage sheds
- Loading and unloading of wastes in storage sheds will be done under the supervision of the well trained and experienced staff only.
- Fire break of at least 04 meter between two blocks of stacked drums will be provided in the storage shed. Storage capacity of one block of drum will not exceed 300 MT.

- Minimum of 1 m clear space will be left between two adjacent rows of drums in pair for inspection.
- The storage and handling will have at least two routes to escape in the event of any fire in the area
- Doors and approaches of the storage area will be of suitable sizes for entry of fork lift and fire fighting equipment
- The exhaust of the vehicles used for the purpose of handling, lifting and transportation within the facility such as forklifts or trucks will be fitted with the approved type of spark arrester
- In order to have appropriate measures to prevent percolation of spills, leaks, etc. to the soil and ground water, the storage area will be provided with concrete floor or steel sheet depending on the characteristics of waste handled and the floor will be structurally sound and chemically compatible with wastes.
- Measures will be taken to prevent entry of runoff into the storage area
- The storage area will be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
- Floor in the storage area will be provided with secondary containment such as proper slopes as well as collection pit so as to collect wash water and the leakages/spills, etc.
- All the storage yards will be provided with proper peripheral drainage system connected with the sump in order to collect accidental spills, if any, on roads or within the storage yards as well as any accidental flow due to fire fighting.

1.5 Storage drums/containers

- The container will be made or lined with suitable material, which will not react with, or in other words compatible with the hazardous wastes proposed to be stored.
- The stacking of drums in the storage area will be restricted to three high on pallets (wooden frames). Necessary precautionary measures will be taken so as to avoid stack collapse. However, for waste having flash point less than 65.5 OC, the drums should not be stacked more than one height.

- No drums will be opened in the storage sheds for sampling, etc., and such activity should be done in designated places outside the storage areas
- Drums containing wastes stored in the storage area will be labeled properly indicating mainly type, quantity, characteristics, source and date of storing, etc.

1.6 Spillage/leakage control measures

- The storage areas will be inspected daily for detecting signs of leaks or deterioration, if any. Leaking or deteriorated containers will be removed and ensured that such contents are transferred to a sound container
- In case of spills/leaks, dry adsorbents/cotton will be used for cleaning instead of water.
- Proper slope with collection pits will be provided in the storage area in order to collect the spills/leakages.
- Storage areas will be provided with adequate number of spill kits at suitable locations. The spill kits will be provided with compatible sorbent material in adequate quantity.

1.7 Thermal Radiation Hazards

Thermal radiation hazards result from the ignition and subsequent burning of either a flammable liquid or flammable gas. The severity of the hazard is a function of the flame size, heat flux and exposure time. There are two concerns with thermal radiation, namely its impact on humans and the potential for the development of secondary fires. Table below summarizes the risk to humans and the limiting flux for secondary fires.

Table No. 1: Potential Hazards of Exposure to Thermal Radiation

Heat Flux (Q) kW m-2	**Time (t)**	**Effects**
4	15-18 s	Limiting "safe" flux for humans. Threshold of pain and for 2nd degree burns
6.5	~ 20 s	Blistering of skin

8.5	~ 15 s	Blistering of skin
11	~ 10 s	Blistering of skin
20	~ 5 s	Blistering of skin
12.6	~ 40 s	Limiting flux for secondary fires. Pilot ignition of wood, plastics, etc
37.8	~ 1000 s	Hazard to metal tanks

(Source, adopted from HSE, 1981)

1.8 Effects of Pressure/Blast Waves

During operational phase of incinerator, possibility of blast of incinerator cannot be completely denied. The effects of over pressurization generated in a blast can adversely affect either people or structures. Exposure of the body to shock over pressurization from a sudden release of gas at high pressure can produce traumatic effects. The degree of damage depends on both the pressure level and the area of the body exposure. Humans are reasonably resilient to over pressure from explosions, with a peak over pressurization of 34 kPa being the threshold of eardrum damage, 69 kPa being the threshold of lung damage (HSE, 1981). At higher pressure levels death results, the probability of which is expressed in the probit equation (Eisenberg 1975):

$$Y = -77.1 + 6.91 \ln(P_o)$$

where:

Y = is the probit

P_o = over pressurization (P_a)

The probit equation can be converted to tabular form shown in Table below.

Table No. 2: Effect of Overpressure

Peak Overpressure (kPa)	Probability of Death
100	0.01
120	0.1
140	0.5
175	0.9
200	0.99

Source: Eisenberg, N.A. 1975. NTIS Report AD-A015-245, Springfield, VA

At lower over-pressures, human effects will be associated with casualties resulting from structural damage. The effects of peak over-pressure on structures are summarized in table below, along with a casualty estimate (%C - the percentage of people becoming casualties, including fatalities) associated with each type of structural damage.

Table No. 3: Potential Hazards of Over Pressurization

Peak Over Pressurization (kPa)	%C	Structural Damage
<7	-	Window Breakage
7 – 12	10	Walls Collapse
21 – 34	25	Reinforced structures distort. Unpressurized storage tanks fail
34 – 48	70	Plant items overturn
>48	95	Extensive Damage

1.9 Safeguards Taken in Design Stage

Safety shall be given prime importance in the design of the incinerator. Right from the layout of the plant to the selection of the material of construction of the equipments, care shall be taken to incorporate safety considerations. The following would be some of the safety considerations in the design.

- All the waste handling vehicles in the plant premises shall be provided with spark arresters at the exhaust
- Emergency dump stack shall be provided next to the secondary chamber, in order to vent out the gases by passing the subsequent systems in case of emergency
- Provision of standby arrangement for all critical equipments and pumps
- Provision of standby ID fan

The main feature of the facility is the safe design of the equipment and pipelines. Equipment is designed, inspected stage wise, tested and certified by an independent third party in accordance with relevant codes and standards. Intrinsic safety is largely built in into the design itself through use of time tested standards and codes, which inherently incorporate a good margin of safety. Apart from the equipment design and selection (only well known, reputed vendors with proven safe and trouble free track record in similar service will be selected), there are other features related to safety in the layout, operation, and shutdown systems etc. that are provided.

Fire fighting system: A fire hydrant system is proposed to be laid that shall cover the entire plant area. MS C class pipes will be used for laying the system. All accessories such as valves, hose boxes, hose pipes, nozzles, single/double hydrants, foam monitors and pumps will be complying to their respective IS standards. Pump room will be nearer to water storage tank which has capacity of 200m^3 for water storage. The capacity of water storage tank is considered in such a way as to suffice pumping for 1.5 hours by main electric/diesel pump (Flow: 137 m^3/hr). Proposed layout for firefighting system is provided in the figure below.

Pumps: Pumping sets shall be multi stage horizontal centrifugal single outlet with cast iron body and bronze dynamically balanced impellers connecting shaft shall be stainless steel with bronze sleeve and grease lubricated bearings. Pumps shall be connected to the drive by means of spacer type love joy couplings, which shall be individually balanced dynamically and statically. The coupling joining the prime movers with the pump shall be provided with a sheet metal guard. Pumps shall be provided with approved type of mechanical seals. Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

Table No. 4: Details of Pumps

Sr. No	Pumps	Capacity

1.	Electric Driven Pump	Flow: 137 m^3/hr, Head: 70 Meter
2.	Diesel Driven Pump	Flow:137 m^3/hr, Head: 70 Meter
3.	Jockey Pump	Flow: 10 m^3/hr, Head: 70 Meter

Along with the above measures provided both in design and operational phase for control of risk due to proposed activities, GMB will ensure through its operator that probability of risk will be avoided if not then minimized through proper management of the facility.

1.10 Risk due to adjacent settlement

The proposed project is located in an industrial area. The unit is surrounded by vacant plots on both left and right sides; however a shed is present on the right side of the plot. There is a similar kind of industry at the opposite side of the unit on the other side of the road. Risks associated with operational phase of incinerator also include spillage of hazardous waste during transportation if the vehicle carrying waste meets with an accident. Suitable safety measures are taken to address possible risk during operational stage of incinerator i.e. safeguards taken during design stage, management of hazardous waste during transportation, handling and storage, GPS tracking of all the vehicles involved in transportation of hazardous waste so that during emergency situation respective vehicle can be tracked and necessary actions are taken to control the emergency situation.

1.11 Disaster Management Plan

Emergency prevention through good design, operation, maintenance and inspection are essential to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such Emergency and restoration of normalcy at the earliest.

Disaster is a catastrophic situation in which the day-today patterns of life are, in many instances, suddenly disrupted and people are plunged into helplessness and suffering and as a result the need for clothing, shelter, medical and social care and other necessities of life will be of paramount importance.

The disasters such as:

- Disasters resulting from the natural phenomena like earthquakes, volcanic eruptions, storms, surges, cyclones, tropical storms, floods, landslides, forest fires and massive insect manifestation. Also in this group, violent draught will cause a creeping disaster leading to feminine, disease and death must be included

- Second group includes disastrous events occasioned by man or by man's impact upon the environment such as armed conflict, industrial accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents, aircraft crashes, collisions of vehicles carrying flammable materials, oil spills at sea and dam failures

The overall objective of a disaster management plan is to make use of the combined resources at the site and outside services to achieve the following:

- To localize the emergency and if possible eliminate it;
- To minimize the effects of the accident on people and property;
- Effect the rescue and medical treatment of casualties;
- Safeguard other people;
- Evacuate people to safe areas;
- Informing and collaborating with statutory authorities;
- Provide authoritative information to news media;
- Initially contain and ultimately bring the incident under control;
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency;
- Investigating and taking steps to prevent reoccurrence

The DMP has therefore to be related to the identification of sources from which hazards can arise and the maximum credible loss scenario that can take place in the concerned area. The plan takes into account the maximum credible loss scenario - actions that can successfully mitigate the effects of losses/ Emergency need to be well

planned so as they would require less effort and resources to control and terminate emergencies, should the same occur.

1.11.1 Emergency Equipment

The site controller will maintain a list of emergency handling equipment including details of fire extinguishers, protective clothing, and personal protective equipment for emergency handlers etc. Details of fire management services of Bhavnagar city and neighboring hospitals will be available with site controller in his operating checklist.

1.11.2 Fire Fighting Arrangements

The complex is provided with storage of water and various types of portable fire extinguishers namely Dry Chemical Powder type and CO2 type & Foam Type to face any emergency arising due to the occurrence of fire.

Water Reservoir

1. Over ground water reservoir capacity: 2 Nos. X 5 m^3
2. Water reserved for fire: 10 m^3

Fire Extinguishers

Sufficient number of dry Chemical Powder type and CO_2 type portable fire extinguishers are installed on each floor of the plant. Suitable fire extinguishers are also provided in all MCC room, PCC room & ETP, storage area & Security gate.

1.12 ACTUATION OF THE PLAN

Any emergency starts as a small incident that may become a major accident if not controlled in time. At the initial stages, the fire organization chart (would be prepared separately for each facility) shall need to be put into action. If the incident goes beyond control, the Main Incident Controller will need to actuate the on-site plan at the appropriate stage as considered necessary. During idle shift/ holidays, the security personnel will combat the incident as per the fire organization chart below and at the same time inform various emergency controllers for guidance and control the

situation. An emergency organization chart is prepared by appointing key personnel and defining their specific duties that will be handy in emergency, details of the chart is provided in the next section.

1.12.1 Emergency Organization Chart

No plan will succeed without effective emergency organization. Emergency organization is a part and parcel of a good onsite and offsite emergency plan, without which all resources, facilities etc. even available with us, cannot be put into services as the right time is the key factor for management of an emergency. It is not possible to envisage and detail every action which should be taken in emergency and to harness the basic elements of emergency preparedness such

as gravity of the emergency, communications of information, onsite action for process and emergency controls, mobilization of internal and external resources for fire and toxic release control, warning people at right time, evacuation, medical preparedness, pollution control etc. Emergency organization is set up specifying duties and responsibilities of all to make best use of all resources to avoid confusion while tackling the emergency. Figure below provided detailed information on emergency organization chart.

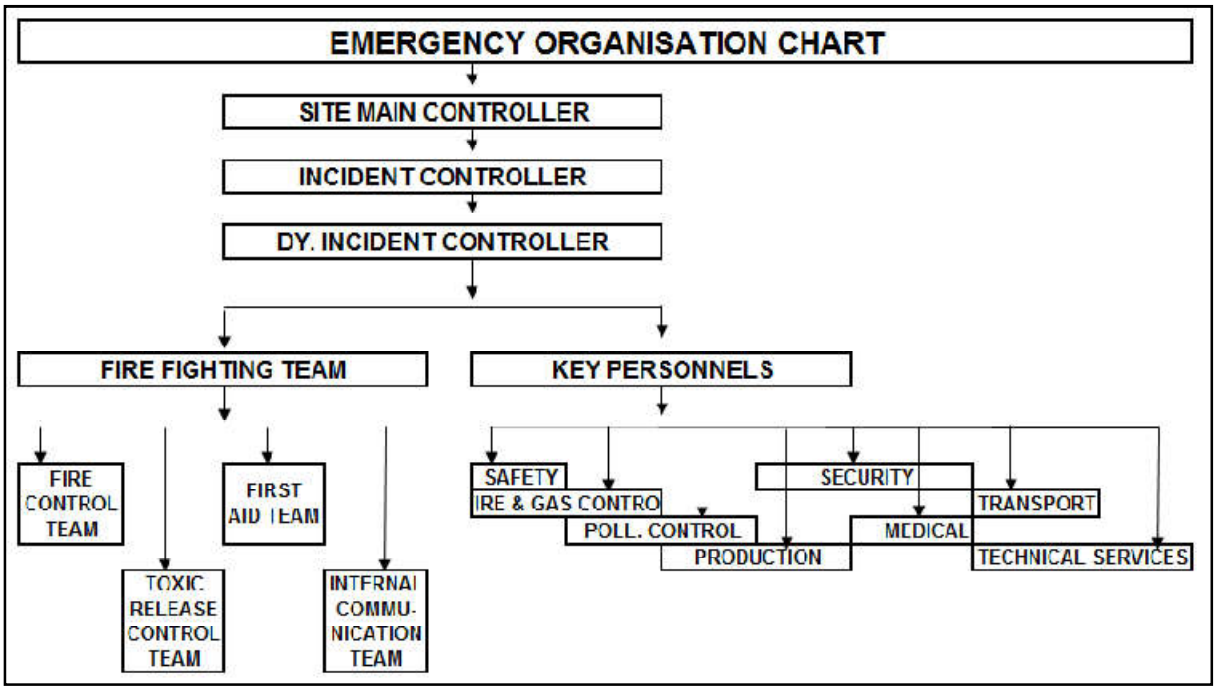

Fig. 1: Emergency Organization Chart

Onsite emergency plan highlights the flow of information and correlation among various action groups within the factory. Offsite emergency plan indicates various action groups at district levels which will get engaged in case of offsite emergency.

1.12.2 Offsite Emergency Plan

The off-site emergency plan prepared herein will deal with those incidents identified in the onsite plan, which have the potential to harm persons or the environment outside the boundary of the factory premises. In the recent past, in spite of the safety planning there have been accidents in the Common Hazardous Waste Treatment, Storage and Disposal Facilities in the Country.

Whenever such an emergency occurred there is a great need to control and isolate the danger and to minimize the adverse affect to the greatest extent possible. This plan has been drawn up with the District Contingency plan for an effective system of command in control in combating the emergency.

1.12.2.1 Main purposes of the offsite emergency plan are:

- To provide the local / district authorities, police, fire brigade, doctors, surrounding industries and public, the basic information of risk and environmental impact assessment and to appraise them of the consequences and the protection / prevention measures and control plans and to seek their help to communicate with the public in case of a major emergency
- To assist the District Authorities for preparing the off-site emergency plan for the district or any particular area and to organize rehearsal on regular basis and initiate corrective action based on the lessons learnt.

Structure of the Off-Site Emergency Plan

The offsite emergency plan should be integrated properly with the District Contingency Plan to tackle any kind of emergency. The site main controller will keep liaison for this purpose with the District authorities. External telephone facilities from site to Fire Brigades, Other units and Hospital, have been established for quick and instantaneous communication. The names of the key persons have been defined to establish contacts and co-ordinate Disaster Management Centre.

In case of an occurrence of any major emergency:

In case of the occurrence of any off site emergency information shall be received first by the Police Control Room on telephone No. 100 or by Fire Brigade. The Police/Fire Brigade Control Room shall in turn inform the Police Commissioner, Collector and Municipal Commissioner. The safety department and individual plant have the list of quantities of the resources like breathing air sets, rescue masks, fire extinguishers, water resources etc. available with various industries in the vicinity which can be spared under Mutual Aid System to deal with emergencies after receiving call from our factory.

Communication and Warning by Disaster Management Center

When any disaster occurs, the industry affected by the disaster will immediately inform the Disaster Management Center (DMC). With all available information, the DMC will act as per the Contingency Plan and also will immediately communicate to the District Collectorate.

Role of the Factory Management

A copy of the Onsite / Offsite emergency plan has been given by the site Main Controller to the Factory inspectorate who is acting as an Ex-officer Security to the District Contingency Plan. The plan has to be continuously updated and necessary changes have to be incorporated.

1.12.3 EMERGENCY RESPONSE

A. Dangerous Situations

These are defined as the following:

- Any fire or explosion in the facility
- Any smoke outside/inside installation
- Strong persisting smell of H_2S within the facility
- Any fire in the service buildings
- Fire or explosion in the process area
- Fire in the hazardous waste storage area

B. Emergency Response for Incinerator Plant

Basic Actions:

- Immediate action is the most important factor in the emergency control because the first few seconds count.
- Take immediate steps to stop fire and raise alarm simultaneously.
- Stop all operations and ensure closure of all isolation valves.
- As fires develop and spread quickly, so all out efforts should be made to contain the spread of fire.
- Plant personnel without any specific duties should assemble at the nominated place.

- All vehicles except those that are required for emergency use should be moved away from the operating area in an orderly manner at pre nominated route.
- Electrical system except the lighting and fire fighting system should be isolated.
- If the feed to the fire cannot be cut off, the fire must be controlled and not extinguished.
- Start water spray systems in the areas involved in or exposed to secondary fire risks.
- Block all roads in the adjacent area and enlist police support for the purpose, if warranted.

Actions in the Event of Fire:

Basic actions as detailed above.

- Extinguishing fires: A small fire at a point of leakage should be extinguished by enveloping with a water spray or a suitable smothering agent such as CO2 or DCP.
- Fire fighting personnel working in or close to un-ignited vapour clouds or close to fire, must be protected continuously by water sprays. Fire fighters should advance towards the fire downwind if possible- BE CAREFUL TO AVOID H_2S EXPOSURE.
- In case the only valve that can be used to stop the leakage is surrounded by fire, it may be possible to close it manually. The person attempting the closure should be continuously protected by water sprays, fire entry suit, water jet blanket and SCBAs etc. The person must be equipped with a safety belt and a manned lifeline. In case of rapid increase in decibel level, evacuate the area, as there would have been over pressurization.

C. Post Emergency Follow Up

- All cases of fire occurrence, no matter how small, must be reported promptly to the Coordinator for follow up.

- Under no circumstances should fire extinguishing equipment once used be returned to its fixed location before it is recharged/ certified fit by the Fire chief/ Safety Manager.
- Used fire extinguishers must be laid horizontally to indicate that they have been expended.

1.12.4 Communication System

As Effective and immediate communication of emergency is vital in the process of emergency handling. It helps to mobilize the resources at the earliest and attack on the emergency at its incipient stage. Under section 41B of the factories act, the disclosure of information regarding chemicals & their hazards to the workers, general public, local authority and the factory Inspectorate is compulsory. Such communication is at the District level. This information is already given.

Communication system at site has been divided into four parts as mentioned below:

1. Internal communication for informing the emergency
2. To outside key personnel, emergency services and authorities
3. To neighboring factories and public in the vicinity.
4. The communication for declaring the emergency.

The communication system with regard to raising the alarm, declaring the major emergency and procedures to make it known to other is explained below in brief

Alarm System

When the area of the site and the number of installations are more, siren has to be installed for general communication to the people. It can be used for declaring the Onsite as well as Offsite emergency and making the emergency known to the people. The siren is installed at security gate for declaring the emergency.

- SMALL FIRE: No Siren

- MAJOR FIRE: A wailing Siren for two minutes. Sirens will be sounded three times for thirty seconds with an interval of 15 seconds in between
- EMERGENCY: Same type of Siren as in case of major fire but the same will be sounded for three times at the interval of two minutes.
- ALL CLEAR (For Fire): Straight Run Siren for two minutes.
- TEST: Straight run Siren for two minutes.
- Siren system is being tested every WEDNESDAY at 11.00 A.M.

1.12.5 Declaring the Major Emergency

The declaration of major emergency puts many agencies on action and the consequences may be serious, therefore, such declaration should be based on careful thoughts and matured judgment. Because of the scale of activity which will be activated after the declaration of the emergency, it is advisable to restrict the authority to declare it. In our case, Site Main Controller shall declare major emergency. In case of extra ordinary emergency Incident Controller/Dy. Incident Controller can take decision for declaring the emergency.

1.12.6 Emergency Control Centre (Ecc)

The Emergency Control Centre is at Security Office. The emergency control center or room is a place from where the operation to handle the emergency are directed, coordinated and monitored. It will be attended by the site Main Controller and senior officials of fire Dept., Police Dept., Factory Inspectorate, District Authorities and emergency Services. Emergency control center is located in the security office building. All communication facilities and other required facilities are provided. ECC is located in the area having minimum potential to any risk and is close to the road to allow for easy access by the external agencies.

The Emergency Control Centre should have the following resources available:

- Copies of the DMP
- Layout Plan of the complex
- Information regarding Safety Equipment, Fire Fighting material
- A list of telephones of key and essential staff of the company along with their residential numbers.
- Copies of the local Telephone Directories.
- A list of important telephone numbers like those of neighbouring industries, Fire Brigade, Hospitals etc.
- Personal Protective Equipment.
- First – Aid Kit.
- Communication equipment – Internal and External telephones and other communication equipment.
- Requisite stationary items
- Personnel to act as messengers
- The communication equipment is checked periodically to ensure that they are functional. The ECC is capable of being activated within a few minutes upon declaration of an emergency.

1.12.7 Emergency Evacuation

Evacuation is an expedient option that depends on sufficient warning time to get away from an impending emergency. The evacuation should establish clear and detailed procedures for carrying out complete or partial evacuations from work areas in an organized and consistent manner. A disorganized evacuation can result in confusion, injury, and property damage. During natural or man-made disaster following points will be considered in the emergency evacuation:

A clear chain of command and designation of the person in the facility authorized to order an evacuation

- In case of disaster, all non-essential technical workers (who are not assigned any emergency duty) shall evacuate the area and report at the assembly point
- The need to evacuate the non-essential technical workers will be determined by the gravity of the emergency and assessment of the emergency by the Dy. Incident Controller
- With a view to accommodate the evacuated personnel from the affected plants/departments and also to make the evacuation safe, we have clearly marked an assembly point which has been displayed conspicuously by boards at various locations in the premises
- The assembly point is located near the Security Gate. The assembly point is approachable from all the plants and departments
- Security supervisor/guard are available round the clock and shall monitor the assembled personnel
- Before reaching the assembly point, it is required to pass through an affected area, suitable personal protective appliances including masks, respirator etc. are to be used which is available in the plants. For a short duration even a wet handkerchief will be useful
- In our case, Site Main Controller shall declare major emergency.

1.12.8 Medical Resources

The medical management for the possible emergency situations essentially consists of treatment for burns and maybe some asphyxiation cases. They could cause burns injuries. Material Safety Data Sheets and other relevant information is available at the facility to enable ready treatment of any casualty, should the unfortunate need

arise. It is also proposed to circulate any important Health and Toxicology material available through the latest research to all Doctors.

1.12.9 Record keeping and maintenance

Proper records will be maintained for

- Industry-wise type of waste received,
- Characteristics of waste,
- Location of waste storage area,
- Waste treatment and disposal methods

1.12.10 Other safety precautions to be taken:

- Smoking to be prohibited in and around the storage areas
- Only those vehicles with spark proof to be allowed
- Good housekeeping to be maintained around the storage areas
- Signboards showing precautionary measures to be taken in case of normal and emergency situations should be displayed at appropriate locations
- To the extent possible, manual operations with in storage area are to be avoided. In case of manual operation, proper precautions need to be taken, particularly during loading/unloading of liquid hazardous waste in drums.
- A system for inspection of storage area to check the condition of containers, spillages, leakages, etc., will be established and proper records will be maintained
- The wastes containing volatile solvents or other low vapor pressure chemicals will be adequately protected from direct exposure to sunlight and adequate ventilation will be provided

- Tanks for storage of liquid waste will be properly dyked and will be provided with adequate transfer systems
- Storage sites will have adequate and prompt emergency response equipment systems for the hazardous waste stored on-site. This will include fire fighting arrangement based on the risk assessment, spill management, evacuation and first aid
- Immediately on receipt of hazardous waste, it will be analyzed and depending upon its characteristics its storage will be finalized.
- Only authorized personnel trained in hazardous waste handling procedures should have access to the storage site
- Mock drill for on-site emergency should be conducted regularly and records should be maintained.

1.13 OCCUPATIONAL HEALTH MANAGEMENT PLAN

Industries, in general, where different activities are involved during construction, erection, testing, commissioning, operation and maintenance, employ men, materials and machines as the basic inputs. Occupational Health needs attention both during construction and erection and operation and maintenance phases. However, the problem varies both in magnitude and variety in the above stages

Construction and Erection Phase

The problems envisaged at demolition, construction and erection stage can mainly be due to accident, fugitive dust emissions and noise. To overcome these hazards, the contractors in charge of construction and erection activities have to maintain noise levels within threshold limit values and the workers should be provided with personnel protective equipment. Mobile water sprinkler and wet drilling will be used to control dust emissions.

Operation and Maintenance Phase

The problems envisaged during the operation and maintenance phase are accident, exposure to heat, noise, fire etc. Suitable personnel protective equipments should be provided to all employees, likely to be exposed to these situations. The working personnel should be given the personnel protective equipment as listed in table below. In addition, medical facilities should be made available round the clock for attending any medical emergency during construction and operation phases.

Table No. 5: Personnel Protective Equipment

Protection For	Equipment	Protection Against
Head	Fire Helmet	Fall of objects / hitting against objects during construction, maintenance, etc.
	Electrical resistance helmet	Electrical Shock
	Welder's leather cap	Splashing of liquid etc.
Eye	Panorama goggles with clear plastic vision	dust & high temperature
Ear	Ear plugs or muffs	High noise level
Nose	Dust masks	Fine dust particles
	Light fume mask	Acid fumes, vapours and gases (2.0%)
Body	Asbestos apron	Heat radiation
Hand	Leather gloves	Cuts due to handling
	Asbestos gloves	Heat radiation
Leg	Leather safety boots	Striking by objects, fall of objects and stepping on sharp or hot objects.
	Gum boots	Chemically hazardous area

1.13.1 Noise

Noise will be regularly monitored at plant boundary for checking compliance against environmental noise parameters as per CPCB norms. It will also be monitored near

noise generating equipment and corrective action (maintenance) taken to ensure that all noise generating equipment do not emit noise in excess of the statutory norms.

All workmen will be provided with required set of PPEs like ear plug, ear muff etc. where noise levels in excess of 80 db (A) are regularly generated.

Preventive maintenance of noise generating equipment shall be regularly carried out to ensure that noise levels are minimized to the extent possible. To the extent feasible, equipment will be purchased considering noise generation as one of the parameters.

1.13.2 Heat

The project does not envisage conditions that could lead to excess heating. Consequently, special requirements for protection against heat stress are not anticipated. However, the following shall be carried out:

- Ventilation shall be provided to take care of heat evacuation.
- Drinking water availability shall be ensured at several locations within the plant to ensure workers have easy access to the same.
- In case of occasional handling of heated equipment or materials, suitable PPEs such as heat resistant gloves will be used.

1.13.3 Dust, Other Chemicals being suspended in the Environment

- The possibility of suspended particles going into the body of the workmen, either in the form of inhalation, ingestion or through skin absorption are least and negligible as because the entire operation at the plant will be performed under closed loop condition, right from charging till discharging, hence it's a rare possibility that the workmen will come in direct contact with raw material or final goods.
- At the same time the level of SPM and RPM will definitely be of least and nominal value. But even though the same will be under closed monitoring and periodical surveillance as per EIA norms and applicable legislations and any minor deviation from the same will be dealt immediately and will be corrected.

- Further to this all of the workmen will be provided with complete set of appropriate PPEs, like dust masks, gloves, helmet, protective uniform and clothing, eye protections etc.

1.13.4 Occupational Hazards Specific Pre-placement and Periodic Health Monitoring

There will be routine observation of health of the workers. All the employees shall be required to undergo a medical checkup before joining the facility. Medical checkup will be conducted on regular basis and the health conditions will be monitored. First aid facilities required to attend immediately for meeting emergency situations shall be made available at the facility.

The following practices will be adopted to ensure good health condition of employees.

- Pre- employment check-up
- Awareness programme
- Routine check-up
- Periodic vaccination programme etc.

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