

RISK AND HAZARDS ASSESSMENT

1.1 RISK ANALYSIS & DISASTER MANAGEMENT PLAN

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 component 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.

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.

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 to incorporate safety measures.

Incineration and allied activities as a part of the Common Hazardous Waste Treatment, Storage and Disposal facilities (TSDFs) are associated with several potential hazards to both the employees and the public. A worker in a TSDF site should be able to work under conditions, which are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. This is possible only when there is adequate safety in TSDF site.

The objective of the Risk Analysis study is to identify vulnerable zones, major risk contributing events, understand the nature of risk posed to nearby areas and form a basis for the Emergency Response Disaster Management Plan (ERDMP). In addition, the Risk Analysis is also necessary to ensure compliance to statutory rules and regulations. Risk assessment methodology is given in **Figure 30** below-

Steps of the risk analysis is as follows-

- Identification of Hazards and Selection of Scenarios
- Effects and Consequence Calculations
- Risk Summation (Risk calculation)
- Risk assessment (using an acceptability criteria)
- Risk Mitigation Measures

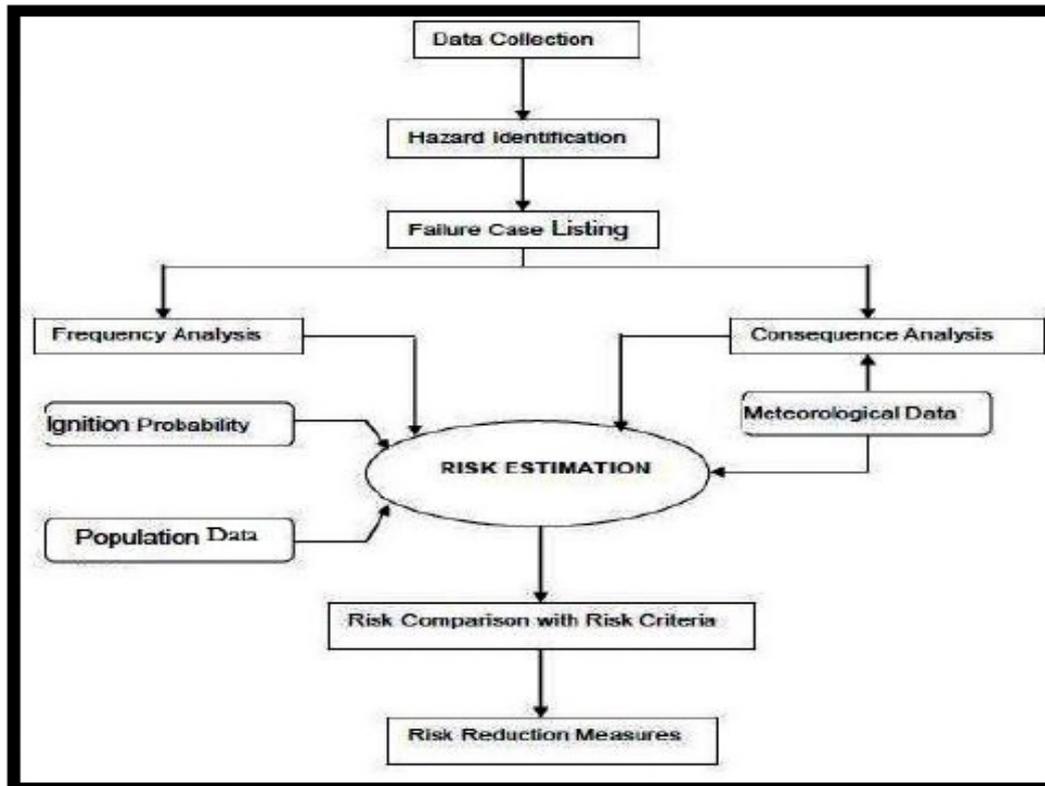


Figure 1: RISK ANALYSIS METHODOLOGY

1.2 HAZARD IDENTIFICATION

Identification of hazards in the project of TSDF which installation of incinerator with allied activities as a part of the Common Hazardous Waste Treatment, Storage and Disposal facilities (TSDFs) is of primary significance of the analysis, and quantification of risk hazard indicates the characteristics of hazardous wastes that pose potential for an emergency in the event of any fire, explosion or spillage and accidental release of hazardous wastes. All the components of a 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.

Explosive wastes in form of explosive solid and explosive liquid.

1. Flammable wastes
2. Corrosive Wastes
3. Reactive wastes
4. Toxic wastes

Flammable wastes containing solvent residue, can form explosive mixture with air, and heating may cause pressure rise with risk of bursting and explosion. Some time vapour may be heavier

than air and spreads along with the ground, narcotic in high concentrations, gives off toxic or irritant fumes in a fire.

Various type of organic hazardous wastes, paint wastes, waste oil etc are flammable in nature and can catch fire if getting source of ignition. There will be release of toxic fume at the time of burning in the event of fire.

Other Hazard and Control

Human Health Risk from TSDF Site

Toxic wastes and inflammable waste managed and disposed at the proposed TSDF can release constituents of concern (CoCs) as vapors or particles to the air. Hazardous wastes managed in barrels or tanks can release COCs into the atmosphere via volatilization. During the operation of TSDF site, wastes may be entered into the environment through the following sources:

- Emission of particulate matters due to windblown erosion of disposed wastes;
- Volatilization of organic liquid wastes;
- Infiltration of leachate into ground and subsequently contamination of ground water
- Spillage of contaminated run off from the TSDF site during heavy rains;

1.3 RISK MITIGATION MEASURES FOR PROPOSED PROJECT OF TSDF

Risk mitigation measures have been described for the proposed TSDF site as given below:

Collection and Transportation of Hazardous Wastes

Following requirements pertaining to the transportation of hazardous wastes shall be ensured:

- Vehicle used for transportation shall be in accordance with the provisions under the Motor Vehicles Act, 1988, and rules made there under.
- Transporter shall possess requisite copies of the certificate (valid authorization obtained from the PPCB for transportation of wastes by the waste generator and operator of a facility) for transportation of hazardous waste.
- Transporter shall have valid "Pollution under Control Certificate" (PUCC) during the transportation of HW and shall be properly displayed.
- Vehicles shall be painted preferably in blue colour with white strip of 15 to 30 cm width running centrally all over the body to facilitate easy identification.
- Vehicle shall be fitted with mechanical handling equipment for safe handling and transportation of wastes. The words "HAZARDOUS WASTE" shall be displayed on all sides of the vehicle in Hindi, and English.
- Name of the transporter shall be displayed.
- Emergency phone numbers and TREM Card as per HWM Rule as amended shall be displayed properly.
- Vehicle shall be fitted with roll-on/roll-off covers if the individual containers do not possess the same.

- Carrying of passengers shall be strictly prohibited except for the waste haulers. Access to these waste haulers shall be restricted to the cabins only.
- Transporter will carry documents of manifest for the wastes during transportation as required under HWM Rules.
- The trucks shall be dedicated for transportation of hazardous wastes and they shall not be used for any other purpose.
- Each vehicle shall carry first-aid kit, spill control equipment and fire extinguisher.
- HW transport vehicle shall run only at a speed specified under Motor Vehicles Act to avoid any eventuality during the transportation of HW.
- The driver of the transport vehicle shall at least have cleared the SSC exam (10th standard) and shall have valid driving license for heavy vehicles from the State Road Transport Authority and shall have experience in transporting the chemicals.
- Driver(s) shall be properly trained for handling the emergency situations and safety aspects involved in the transportation of hazardous wastes.
- The design of the trucks shall be such that there is no spillage during transportation.

Storage area (Storage Shed)

- ❖ Flammable, ignitable, reactive and non-compatible wastes should be stored separately and never should be stored in the same storage shed however in this case no such waste will be accepted .
- ❖ Storage area may consist of different sheds for storing different kinds of hazardous wastes and sheds should be provided with suitable openings.
- ❖ Storage area should be designed to withstand the load of waste stocked and any damage from the hazardous waste spillage.
- ❖ Loading and unloading of wastes in storage sheds should only be done under the supervision of the well trained and experienced staff.
- ❖ The storage and handling should have at least two openings/ routes to escape in the event of any fire in the area.
- ❖ Doors and approaches of the storage area should 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 should 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 should be provided with concrete floor or steel sheet depending on the characteristics of waste handled and the floor must be structurally sound and chemically compatible with wastes.
- ❖ All the storage yards should be provided with proper peripheral drainage system connected with the sump so as to collect any accidental spills in roads or within the storage yards as well as accidental flow due to fire fighting.

Storage Drums/Containers

- ❖ The container shall be made or lined with the 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 should be restricted to three high on pallets (wooden frames). Necessary precautionary measures should be taken so as to avoid stack collapse. However, for waste having flash point less than 65.5⁰ C, the drums should not be stacked more than one height.
- ❖ No drums should be opened in the storage sheds for sampling etc. and such activity should be done in designated places out side the storage areas;
- ❖ Drums containing wastes stored in the storage area should be labeled properly indicating mainly type, quantity, characteristics, source and date of storing etc.

Spillage/Leakage Control Measures

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

Fire Protection System

The fire protection system shall comprise of:

- ❖ Fire detection and alarm system for waste storage area
- ❖ Fire Fighting system shall comprises of following major equipment and systems;
- ❖ Electric driven main fire pumps with emergency power from standby Diesel Genset for hydrant network serving of hydrants and hose reels;
- ❖ All necessary pump controls complete with all accessories for the above-mentioned pumps;
- ❖ All necessary sign-posting for the water-hydrant ring system including brackets, complete with accessories;
- ❖ All electrical rooms will be provided with clean agent automatic fire extinguisher systems
- ❖ Complete addressable analogue fire detection system with heat and smoke detectors for various plant area including storages with necessary cabling, interface panels, controllers, sounders, manual call points, sirens, response indicators, and all necessary hardware and accessories; and
- ❖ All necessary electrical equipment, such as LV switch-gear, LV motors, LV power and control cables, control panels with alarm, PBB and interlocks, necessary DC systems, push button stations, cable trays and accessories, cabling, glands lugs, earthing and lightning protection conforming to relevant electrical specifications.

Miscellaneous risk Mitigation Measures

- ❖ Smoking shall be prohibited in and around the storage areas;
- ❖ Good housekeeping needs 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 within 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 conditions of the containers, spillages, leakages etc. should be established and proper records should be maintained.
- ❖ The wastes containing volatile solvents or other low vapor pressure chemicals should be adequately protected from direct exposure to sunlight and adequate ventilation should be provided.
- ❖ Storage sites should have adequate & prompt emergency response equipment systems for the hazardous waste stored on-site. This should include firefighting arrangement based on the risk assessment, spill management, evacuation and first aid.
- ❖ Immediately on receipt of the hazardous waste, it should be analyzed and depending upon its characteristics and storage & disposal should be finalized.
- ❖ Only persons authorized to enter and trained in hazardous waste handling procedures should have access to the hazardous waste storage areas.

Mock drill for onsite emergency should be conducted regularly and records maintained.

Display of Necessary Information at TSDF Site

Necessary information containing the following elements shall be displayed at the site.

- ❖ Waste type (ignitable, toxic, reactive, etc)
- ❖ Approximately quantity of each type of wastes
- ❖ Generation location of waste storage area
- ❖ Evacuation point

General Recommendations

- ❖ All precautions will be taken to attend any emergency due to handling, storage and disposal of such hazardous wastes.
- ❖ Safety measures such as fire fighting system facility already working at TSDF site will be provided during the emergency.
- ❖ Proper handling of hazardous chemical, hazardous wastes, regular cleaning & proper placement of material will be maintained during operational phase.

1.4 DISASTER MANAGEMENT PLAN (DMP)

The objective of disaster management plan is to localize a disaster and to the maximum extent possible contain it to minimize the impact on life, the environment and property. The disaster management plan may be broadly divided into following steps as given in Figure 31 below-

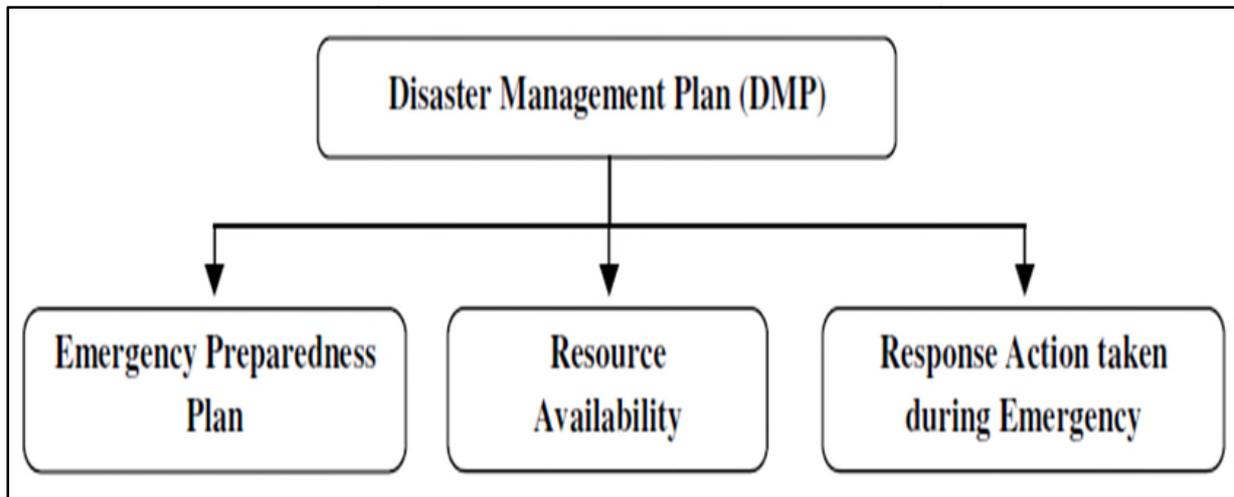


Figure 2: STEPS FOR DMP

Objectives of DMP

- Minimization of the risks to lives and safety of proposed TSDF operators on-site and of the neighboring community.
- Coordination for appropriate and effective actions with outside regulatory agencies during and after their involvement in on-site emergencies.
- Containing and minimizing environmental damage, to surroundings, and to site property, and equipment, which could occur from emergency or accidental situation beyond the normal operation of the TSDF.
- Maintaining effective trained personnel capable of performing the established emergency response procedures when it is required.

The risk involved during the hazardous waste transportation, storage and disposal site will involve hazardous consequences due to the toxicity of the waste, flammability of the waste or explosively of the waste.

Priority in Emergency Handling

The general order of priority for involving measures during the course of emergency would be as follows:

- Safeguard life
- Safeguard environment
- Safeguard property

Classification of emergencies

Emergency is a general term implying hazardous situation both inside and outside the plant/installation premises. Thus, the emergencies termed "onsite" when it confines itself within the plant/installation even though it may require external help and "off-site" when emergency extends beyond its premises. It is to be understood here, that if an emergency occurs inside the proposed of TSDF and could not be controlled properly and timely, it may lead to an "off-site" emergency.

The main objectives of emergency management system are the following;

- ❖ Identification, control and containment of the hazardous situation.
- ❖ Minimizing the impact of event/accident prevention of damage to Men, Materials and Property

To achieve the above stated objectives of emergency planning, the critical elements are:

- ❖ An early detection of an emergency and careful planning
- ❖ Co-ordination and response organization structure along with efficient trained personnel
- ❖ Availability of resources for handling emergencies
- ❖ Appropriate emergency response actions
- ❖ Effective notification and communication facilities
- ❖ Regular review and updating of the ERP
- ❖ Proper training of the concerned personnel

The emergencies at the proposed TSDF can be broadly classified into three levels:

- Level 1:** The emergency, which is containable within the factory premises. Emergency may be due to spillage of liquid or solid hazardous wastes, small fire in flammable hazardous wastes, etc. which can come under this category.
- Level 2:** The emergency, which is containable within the factory premises. Emergency may be due to fire in flammable hazardous wastes, filling of water in due to heavy rain, etc. which can come under this category.
- Level 3:** An incident at the proposed of TSDF may occur, causing a severe hazard or a large area which poses an extreme threat to life or property.

1.5 LEGAL AUTHORITY AND RESPONSIBILITY

On-site emergency planning

The provisions of the Hazardous Chemicals Rules, Section 41 B(4) of the Factories Act, 1948 (as amended) requires that every occupier is to draw up an on-site emergency plan with detailed disaster control measures and to educate the workers employed.

The obligation of an occupier of hazardous chemicals installation to prepare an emergency plan is also stipulated in Rule 13 of the 'Manufacture, Storage and Import of Hazardous Chemicals Rule, 1989 and subsequent amendments.

Off-site emergency planning

Under the 'Manufacture, Storage and Import of Hazardous Chemicals Rules' preparation of 'Off-site Emergency Plan' is covered in Rule No.14. The duty of preparing and keeping up to date the Off-site Emergency Plan as per this Rule is placed on the District Emergency Authority. Also, occupiers are charged with the responsibility of providing the above authority with such information, relating to the industrial activity under their control, as they may require for preparing the off-site emergency plan.

Off-site emergency response needs actions by various Government agencies over which the operating company has no control. The proponent's role and responsibility is to provide material, manpower, and knowledge support under the overall charge of the off-site control administration.

7.4.3 Organization Structure of Emergency Management System

The management structure includes the following personnel's;

- ❖ Chief Emergency Controller
- ❖ Site Main Controller
- ❖ Incident Controller
- ❖ Key Personnel's
- ❖ Essential Workers

The following are earmarked in the plant

- ❖ Assembly points
- ❖ Emergency control center
- ❖ Firefighting arrangements
- ❖ Medical facilities
- ❖ Other arrangements

In case of an emergency, the On-site Emergency Plan of the proposed project of TSDF will come into action. Effective on-site emergency plan requires that in the event of an accident, nominated functionaries be given specific responsibilities, often separate from their day-to-day activities.

The emergency organization follows the usual pattern of the hierarchy. The senior-most functionary available during an emergency at the proposed of TSDF takes charge as Chief Emergency Coordinator (CEC) and will locate himself at the designated Primary Command Post. The senior most functionaries for each emergency service will act as coordinator and shall report at the Primary Command Post unless otherwise instructed by the Chief Coordinator.

The senior most persons in the shift will be designated as the Site Incident Controller (SIC). The SIC will take charge of the incident site and take the overall command. He shall be supported by other key persons representing various emergency services. Key

persons are personnel available at the site on round the clock basis. It is to be appreciated that the key persons remain the front-line fighters. The role of various coordinators is to assess the situation from time to time, take appropriate decisions in consultation with the CEC and to provide timely resources to the key persons to fight the emergency.

Table 1: AUTHORITIES AND RESPONSIBILITY

1	Incident Controller	For the safe shut down of Plant. To review & assess the actions. Provide information to other Plants.
2	Fire & Safety	For the supply of P.P.E., F.F.E. etc.
3	Medical Officer	For the medical treatment & hospitalization
4	Security	For Visitors, manpower Movement, traffic control, firefighting, rescue operations.
5	Administration.	Evacuation of persons/causalities, outside shelter, information to the relatives of injured person, welfare of in plant affected persons, information to local authorities, statutory authorities, records of affected persons, press etc.
6	Environment	Environment monitoring /Controlling / safe disposal
7	Maintenance	For safe shut down of plant. Availability of Utilities, electrical isolation etc.
8	Stores	Availability of Engg. Spares, PPE etc.

Emergency response procedures

The following possible accident scenarios may occur in a hazardous waste TSDF:

- ❖ Road accident during transportation of Hazardous waste
- ❖ Fire at flammable hazardous waste disposal site

The Command Post is to be promptly established at safest place at the proposed TSDF Site. It shall be the nearest office/place having communication facilities to be manned continuously.

The response planning topics covered in this chapter are as follows:

- ❖ Initial Notification of Release
- ❖ Establishment and Staffing of Command Post
- ❖ Formulation of Response Objectives and Strategy at the incident site
- ❖ Ensuring Health and Safety at Incident Scenes
- ❖ Evacuation
- ❖ Fire Response
- ❖ Health Care
- ❖ Personal Protection

- ❖ Public Relations
- ❖ Documentation and Investigative Follow-up
- ❖ Training

The accident scenarios for planning response procedures and carrying out mock drill should be considered based on the risk analysis study.

Initial Notification of Releases

In the event of emergency, alarm will be raised in control room. Otherwise, any person noticing a fire, explosion or the release of hazardous materials should shout "spillage" or "Fire and. He will also inform the control room on the nearest telephone and the panel officer will inform SIC.

Action by Individual Employee in case of Emergency

- ❖ Do immediately inform the control room.
- ❖ Do act to control the incident as per the instructions
- ❖ Do reach the assembly point.
- ❖ Do not get panicky or spread rumors.

Establishment and Staffing of Command Post

- ✓ Quickly establish a command post near the scene of incident. The minimum that is necessary is a continuously manned communication system close to the incident site.
- ✓ It is the responsibility of the response personnel at the Command Post to restrict the entry or movement of people into the Hazard zone. The first step of a response action must be restriction of access to the leakage site and other hazardous areas.
- ✓ Security and access control at Command Post and Primary Command Post need to be provided.

Formulation of Response Objectives and Strategy at the Incident Site

- ✓ It is the responsibility of the CEC to decide on the appropriate response strategy specific to the situation prevailing. It is important to assess each incident before taking action.
- ✓ CEC in consultation with the Site Incident Controller will formulate realistic response objectives. The assessment should be based on resource requirement i.e. trained personnel and protective gear.
- ✓ Upon completion of the incident assessment, command personnel will be in a better position to determine whether their response strategy should be defensive or offensive in nature. A defensive posture is best taken when intervention may not favorably affect the outcome of the incident or is likely to place emergency response personnel in significant danger, and/or may possibly cause more harm than good. An offensive posture (i.e., one requiring response personnel to work well within the boundaries of hazard zones) is best taken when intervention is likely to result in a favorable outcome without exposing personnel to undue danger and without causing new and potentially more severe problems

Communication system & action on the site

Communication System

- ❖ Any person noticing an emergency should be able to raise or cause to be raised the first-floor level emergency alarm. All employees must be trained to operate such emergency alarms. There should be an adequate number of points from which the alarm can be raised either directly, by activating an audible warning of individual signal or message to a preliminary manned location. This has the advantage of permitting the earliest possible action to be taken to control the situation, which in turn may avoid the development of a major emergency. All such points must be distinctively marked and known to all employees.

- ❖ The alarm should be audible in every part of the plant. In areas of high noise level, it may be advantageous to provide an alternative to an audible alarm e.g. flashing light. Alarm systems vary and will depend on the size of works. On small sites a simple alarm system should suffice which provides the means whereby the persons hearing the incident can warn others of the danger and summon assistance. On large sites a staged warning system may be more appropriate. The person discovering the incident should warn all those in the vicinity who should either evacuate or take other immediate action according to the predetermined plan. Automatic alarms may be appropriate on some sites. To communicate disaster hooter will be useful for proposed project of TSDF area and public in surrounding area.

- ❖ The alarm should alert the site controller who should assess the situation and implement appropriate emergency procedures.

- ❖ Separate alarms may be necessary to warn of different types of emergency such as fire and the beginning of the emergency as different procedure may be required. Care must be taken, however to avoid a multiplicity of alarms which would cause confusion. In case of total electricity failure and the alarms, telephones and intercom system not working, help of runners/messengers shall be taken. One (or more) big bell (independent power) and magnetic telephones with fire and emergency services may also be useful.

- ❖ Public address system or internal telephones throughout the proposed TSDF will be useful for quick communication. The alarm system should be checked periodically to test efficiency.

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. Because of scale of activity which will be activated after the declaration of major emergency. A person should be selected on the basis that their knowledge and experience

equips them to recognize the fact of a major emergency or the potential for it. Such nominated persons will advise the Crises Controller, declare the emergency and it will be declared accordingly through him.

The joint decision to declare major emergency may be taken but it should be as early as possible and without wasting the time.

Telephone Message

After hearing the emergency alarm and emergency declaration or even while fast receiving the emergency message on phone, a telephone operator (or Communication Officer) must play an important role. He should be precise sharp, attentive and quick in receiving and noting the message and then for immediate subsequent action of further communication.

Communication of Emergency

There should be an effective system to communicate emergency

- a) Inside the proposed TSDF i.e. to the workers including key personnel and essential workers, on duty and inside during normal working hours
- b) To the key personnel and essential workers not on duty and outside during normal working hours.
- c) To the outside emergency services and the government authorities and
- d) To the neighboring firms and the public in the vicinity. Key points are suggested below:

Communication to outside Emergency Services and Authorities

- ❖ Once the declaration is made, it is essential that the outside emergency services if they have not already been called in, be informed in the shortest possible time. Liaison at local level will help to determine the best means of achieving this, for example, direct line or automatic alarm to the fire brigade or by any emergency system. Predetermined code words to indicate the scale and type of the emergency may be useful.
- ❖ The emergency must be immediately communicated to the Government Authorities such as local Factory Inspectorate, Collectorate, Police and District Emergency Authority.
- ❖ The statutory information to above authorities must be supplied beforehand so that they can be well prepared to operate their offsite emergency control (contingent) plan. As per their advice to consultation, onsite plan should be modified and updated

7.3.6 STATUTORY COMMUNICATIONS

Under the statutory provisions, information is required to be given to the following:

- ❖ The workers
- ❖ The public and neighboring firms
- ❖ District Emergency Authority.
- ❖ Factory Inspectorate

Services and control

Public Address System

Public Address System will be installed at selected points in the plant, which shall be used for announcement/ information to be given.

Telephones

Adequate facility for internal telephones to be installed in the different offices in the proposed TSDF shall be used to communicate any emergency to personnel. Emergency telephone numbers of responsible persons to be maintained with each department and emergency control centers. A list of all external authorities, their address and telephone nos. will be maintained

Fire Fighting Equipment

Fire extinguishers depending upon the type of fire shall be used. List of location & type of fire extinguisher will be maintained with each department. A quarterly check for extinguisher shall be done and recorded.

Mock Drill

For reviewing and assessing the level of emergency preparedness, mock drills will be conducted once in six months. Simulating the covered emergencies and will maintain records of the trails.

Review & Revision

All accidents/emergency situations shall be recorded in accident report. This shall be produced in the Safety Committee meeting to review & revise the emergency preparedness and response.

Implementation of Liabilities for Environmental Damages due to handling & disposal of Hazardous Waste

As per the Guidelines of CPCB published in Jan 2016 , the operator of the facility shall maintain prescribed Corpus in terms of finances to meet the liability of any damage due to fire accident, spillage of hazardous waste, contamination of site & surrounding environment etc. The operator of the facility shall also take Insurance under Public Liability Insurance Act.

