RISK ASSESSMENT REPORT OF INTEGRATED WASTE MANAGEMENT FACILITY COMPRISING OF TSDF

PROJECT PROONENT:
ENVOTEC WASTE MANAGEMENT LIMITED
(A SPV OF SMS ENVOCARE LIMITED FOR SETTING UP IWMF IN STATE OF KARNATAKA)

EIA CONSULTANT:
EQMS INDIA PVT. LTD.
304-305, RISHABH CORPORATE TOWER
COMMUNITY CENTRE, KARKARDOOMA
DELHI - 110092
EMAIL: EQMS@EQMSINDIA.ORG
PHONE: +91 11 3000 3200
FAX: +91 11 2237 4775
Risk Assessment and Disaster Management Plan

Introduction

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions). On the other hand, risk analysis deals with identification and computation of consequence and risks. The equipment in the proposed TSDF and personnel are prone to accidents resulting from the hazards present in the site.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. 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 studies. It provides basis for preparation of on-site and off-site emergency plan and also to incorporate safety measures.

Hazard Identification

Identification of hazards at the proposed TSDF 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. All the components of proposed TSDF 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 emergency.

At the proposed TSDF site, following type of hazard wastes may be involved during operation of facility, which can create potential emergency situation in the event of spillage and accidental release of hazardous wastes from the site:

Explosive wastes in form of explosive solid and explosive liquid.

- Flammable wastes
- Corrosive Wastes
- Reactive wastes
- 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 (however in case of TSDF explosion probability is very less as highly reactive materials and pressure vessels are not there). Sometime vapour may be heavier than air and spreads along 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 release toxic fume at the time of burring in the event of fire.
Hazardous Wastes to be handled at the TSDF

Details of Hazardous Waste to be handled at the proposed TSDF site are as given below:

<table>
<thead>
<tr>
<th>Section/Sub Facility</th>
<th>Material</th>
<th>Storage Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used Oil Recycling</td>
<td>Used Oil (Raw Oil)</td>
<td>20 KL X 6 Nos, MS Tanks</td>
</tr>
<tr>
<td></td>
<td>Recycled Oil (Product)</td>
<td>20 KL X 3 Nos, MS Tanks</td>
</tr>
<tr>
<td>Medical Waste Facility</td>
<td>FO / LDO Storage</td>
<td>10 KL X 1 Nos, MS Tank</td>
</tr>
<tr>
<td>E-Waste Recycling</td>
<td>FO / LDO Storage</td>
<td>10 KL X 1 Nos, MS Tank</td>
</tr>
<tr>
<td>Hazardous Waste</td>
<td>Solid Hazardous Waste (Incinerable)</td>
<td>1200 Tons, Packed &amp; Loose Form, Under Shed</td>
</tr>
<tr>
<td>Management Facility</td>
<td>Liquid Hazardous Waste (Incinerable)</td>
<td>20 KL X 3 Nos, SS Tanks</td>
</tr>
<tr>
<td>FO / LDO Storage</td>
<td>10 KL X 1 Nos, MS Tank</td>
<td></td>
</tr>
<tr>
<td>Syn Gas Holder for Plasma Plant</td>
<td>1000 Litres (1.0 M3), MS Tank (Storage Pressure – 300 mmwca)</td>
<td></td>
</tr>
<tr>
<td>Coal Fired Boiler for Steam Generation (for Multiple Effect Evaporator and Used Oil Recycling)</td>
<td>Coal</td>
<td>500 Tons, Top Covered Yard (Monthly consumption 750 Tons approx.)</td>
</tr>
</tbody>
</table>

Hazardous Activities at TSDF Site

During operation of the proposed TSDF, following activities can pose hazards and risk to human and surrounding environment:

- Storage of Recycled Oil/LDO/FO in tanks
- Manoeuvering of Wastes and Manual Handling
- Loading and unloading hazardous wastes on vehicle – mechanical movements
- Removal of bungs from drums, cuts & abrasions
- Contact with hazardous chemicals.
- Chemical reaction – fire, gas
- Access egress – fatigue, chemical exposure
Human Health Risk from TSDF Site

Toxic medical wastes and e- wastes managed and disposed at the proposed TSDF can release Constituents of concern (CoCs) as vapors or particles to the air via wind-blown erosion of disposed hazardous waste or as leachate to the groundwater. 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 though the following sources:

- Emission of particulate matters due to wind-blown erosion of disposed wastes
- Volatization of organic liquid wastes;
- Infiltration of leachate into ground and subsequently contamination of ground water in an unlikely event of damage to the liner system of TSDF site;
- Spillage of contaminated runoff from the TSDF site during heavy rains;
- Bio-accumulation of Constituents of Concern through food and vegetation.

Exposure Pathways

Exposure pathways of toxic constituents of concern are either direct, such as inhalation through dispersion in ambient air, or indirect, such as the farm food chain pathways. The exposure pathways considered in this assessment were inhalation of ambient air, ingestion of soil, ingestion of aboveground produce, ingestion of root crops, ingestion of beef and dairy products, ingestion of fish, inhalation of indoor air via contaminated groundwater, and ingestion of drinking water. The groundwater pathways were considered separately from the aboveground pathways for the adult resident and the child resident because the time frame for groundwater exposure is often not consistent with that of other exposure pathways. Furthermore, aboveground receptors are randomly located and do not necessarily coincide with the location of the groundwater plume.

Hazards Due to Loss of Containment

Hazardous waste handled, stored and disposed at the TSDF will be mostly flammable and toxic in nature. In the event of spillage, leakage or accidental release of these there hazardous wastes, it will create localized effects within the short distances inside the site in the form of thermal radiations or toxic fume release. Safety measures including firefighting facilities will be provided at the TSDF to attend any emergency due to handling and storage and disposal of such hazardous wastes.

No toxic gas as hazardous wastes will be handled at the TSDF; therefore, dispersion of toxic vapour cloud is not an issue at the TSDF.

Release of Flammable Wastes

Hazardous wastes containing fraction of organic waste and residue, paint wastes, will be stored in drums and tanks of various sizes for incineration. At the time of leakage, spreading or fixed pool will be formed and in an unlikely event of fire, thermal radiation may cause damage to life and property within short distance.
Fire in Stored Hazardous Wastes at TSDF Sites

At TSDF, hazardous waste will be stored in containers and drums. The hazardous wastes stored may be in solid and semisolid state.

In normal condition, hazardous wastes at TSDF cannot initiate fire. However, in the event of fire, hazardous wastes can burn and sustain fire resulting generation of toxic fumes and smoke. Such toxic fume will complex of suspended particulate matter, shoots, carbon monoxide, carbon dioxide, oxides of nitrogen, and other toxic constituents, etc. In the event of fire, hazardous waste will act as area source of toxic gas emissions and disperse in to the atmosphere and responsible for deterioration of ambient air quality, subsequently, adverse impacts on the heath due to inhalation of toxic gases.

Hazardous Conditions Due to Release Hazardous Wastes

Explosion/Flash Fire

If released flammable liquid hazardous waste is not ignited immediately, the vapours will spread in the surrounding area toward wind direction. The drifting vapour cloud will mix with air. As long as the vapour concentration is below the IDLH value or between the lower and upper explosion limits, the toxic impact will be less dangerous or the vapour cloud may be set on fire by an ignition source. In case of delayed ignition of a vapour cloud, two physical effects may occur: a flash fire over the whole length of the flammable vapour cloud; a vapour cloud explosion which results in blast wave, with typical peak overpressures circular around the ignition source. For generation of overpressure effects, some degree of confinement of the flammable vapour cloud is required. The extent of injury to people & damage to property or environment depends on the vapour cloud size, explosive mass in the vapour cloud and the degree of confinement at the time of ignition.

Delayed Ignition & Explosion

In case of delayed ignition of a flammable vapour cloud, two physical effects may occur:

- flash fire over the whole length of the explosive vapour cloud;
- vapour cloud explosion that results in blast wave, with typical peak overpressures circular around the ignition source. For generation of overpressure effects, some degree of confinement of the flammable cloud is required.
- TNO Multi-energy method can be used to calculate the blast overpressure.

Table below gives an illustrative listing of damage effects caused by peak overpressure.

<table>
<thead>
<tr>
<th>Peak Overpressure (Bar)</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.005</td>
<td>5 % Window Shattering</td>
</tr>
<tr>
<td>Peak Overpressure (Bar)</td>
<td>Failure</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>0.02</td>
<td>50 % Window Shattering</td>
</tr>
<tr>
<td>0.07</td>
<td>Collapse of a roof of a tank</td>
</tr>
<tr>
<td>0.07-0.14</td>
<td>Connection failure of paneling</td>
</tr>
<tr>
<td>0.08-0.1</td>
<td>Minor Damage to Steel Framework</td>
</tr>
<tr>
<td>0.15-0.2</td>
<td>Concrete block wall shattered</td>
</tr>
<tr>
<td>0.2</td>
<td>Collapse of Steel Framework</td>
</tr>
<tr>
<td>0.2-0.3</td>
<td>Collapse of self-framing Steel panel building</td>
</tr>
<tr>
<td>0.2-0.3</td>
<td>Ripping of empty oil tanks</td>
</tr>
<tr>
<td>0.2-0.3</td>
<td>Deformation of a pipe bridge</td>
</tr>
<tr>
<td>0.2-0.4</td>
<td>Big trees topple over</td>
</tr>
<tr>
<td>0.3</td>
<td>Paneling torn off</td>
</tr>
<tr>
<td>0.35-0.4</td>
<td>Piping failure</td>
</tr>
<tr>
<td>0.35-0.8</td>
<td>Damage to Distillation Column</td>
</tr>
<tr>
<td>0.4-0.85</td>
<td>Collapse of pipe bridge</td>
</tr>
<tr>
<td>0.5</td>
<td>Loaded Train Wagon overturned</td>
</tr>
<tr>
<td>0.5</td>
<td>Brick walls shattered</td>
</tr>
<tr>
<td>0.5-1.0</td>
<td>Movement of round tank, failure of connecting piping</td>
</tr>
</tbody>
</table>

(Source: TNO)

**Pool Fire**

A leak or spill of sufficient size of flammable liquid hazardous will result in an accumulation of flammable liquid on the ground or in bund. If ignited, the resulting fire is known as spreading or fixed pool fire. Objects coming in contact with the flame above the pool will be severely damaged or destroyed and personnel exposed to flame will suffer extensive burn injuries. Objects and personnel outside the actual flame volume may also be affected or injured by radiant heat. The extent of damage or injury depends on the heat flux and duration of fire and exposure. If a large area of the body receives second and third degree burns, it can result in fatalities.
The extent of injury to people depends on the heat flux and duration of exposure. The extent of damage to property or environment depends on the size of the pool and the duration of fire.

**Thermal Effects**

In case of fire, thermal effect is likely to injure or damage to people and objects from incident outcomes. A substantial body of experimental data exists and forms the basis for thermal effect estimation.

The consequence caused by exposure to heat radiation is a function of:

- The radiation energy onto the human body [KW/m²];
- The exposure duration [sec]; and
- The protection of the skin tissue (clothed or naked body).

The following damage distances for thermal radiation have been used:

<table>
<thead>
<tr>
<th>Radiation Energy [KW/m²]</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>Damage to process equipment. 100% lethality in 1min. 1% lethality in 10sec.</td>
</tr>
<tr>
<td>12.5</td>
<td>First degree burn for 10 sec exposure</td>
</tr>
<tr>
<td>4</td>
<td>First degree burn for 30 sec exposure</td>
</tr>
</tbody>
</table>

At this stage, precise characteristics of hazardous wastes and storage type (container size) are not known, therefore, computation of consequence analysis are not possible.

At the proposed hazardous wastes disposal sites, waste oil, recycled oil, liquid hazardous wastes will be stored mostly in tanks. Consequence analysis has been done for following scenarios:

<table>
<thead>
<tr>
<th>Sn.</th>
<th>Release Scenarios</th>
<th>Capacity of Tanks</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rupture of LDO Tank</td>
<td>10 KL Capacity</td>
<td>Fire and Explosion</td>
</tr>
</tbody>
</table>

**Consequence Analysis**

**Scenario: Rupture of Recycled Oil Tank**

At the TSDF site LDO will be stored in 10 KL capacity tanks. As there is no source of ignition in the storage area, possibility of fire and explosion is negligible. For worst case, 10 KL capacity tanks filled with LDO has been considered ruptured for calculation of damage distances.

**UFL & LFL Concentrations**

In the event of rupture of LDO tank of 10 KL capacity, pool fire will be take place and vapour cloud may be formed. Concentration of vapour within UFL, LFL and LFL Fraction with respect to distance will be as given below:
Concentration  | F, 1 m/s | F, 2 m/s | D, 3m/s | B, 3m/s  
---|---|---|---|---
UFL       | 30.1489 | 20.3769 | 16.9846 | 14.5724  
LFL       | 69.8906 | 52.0082 | 51.0684 | 47.067   
LFL Fraction (50% of LFL) | 86.3225 | 69.9759 | 71.1602 | 66.2165  

Note: All values are in m.

**Flash Fire Envelope**

Vapours of LDO will result in flash fire on getting source of ignition. Furthest extent (5534.71 ppm) distance of flash fire will be as given below:

| Flash Fire Distance | Stability Class, Wind Speed |
|---|---|---|---|---|
| --- | F, 1 m/s | F, 2 m/s | D, 3m/s | B, 3m/s |
| Furthest Extent (5534.71 ppm) | 86.3225 | 69.9759 | 71.1602 | 66.2165 |

Note: All values are in m.

Flash fire envelope for rupture of tank is shown in Figure 1.1.
Late Pool Fire Heat Radiation

In the event of ignition in pool of LDO, thermal radiation of various intensity will be experienced at different distances.

<table>
<thead>
<tr>
<th>Thermal Radiation Level</th>
<th>Thermal Radiation Level Distances (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 m/s - F</td>
</tr>
<tr>
<td>37.5 kW/m²</td>
<td>Not Reached</td>
</tr>
<tr>
<td>12.5 kW/m²</td>
<td>14.2102</td>
</tr>
<tr>
<td>4 kW/m²</td>
<td>36.9799</td>
</tr>
</tbody>
</table>

Note: All distances are m.

Late pool fire thermal radiation radii and distances are shown in Figure 1.2 and Figure 1.3, respectively.

![Intensity Radii for Late Pool Fire](image)
Risk Mitigation Measures for Proposed TSDF

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

Collection and Transportation of Hazardous Wastes

- Transportation of waste by covered vehicles.
- Regular training to drivers to handle emergency situation during transportation of waste.
- Implementation of TREM card.

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.
- Storage area may consist of different sheds for storing different kinds of incinerable hazardous wastes and sheds should be provided with suitable openings.

Figure 1.3: Radiation vs Distance Late Pool Fire
- Adequate storage capacity (i.e. 50% of the annual capacity of the hazardous waste incinerator) should be provided in the TSDF premises.
- Storage area should be designed to withstand the load of waste stocked and any damage from the hazardous waste spillage.
- Hazardous waste storage area should be provided with the flameproof electrical fittings and it should be strictly adhered to.
- Automatic smoke, heat detection system should be provided in the sheds. Adequate firefighting systems should be provided for the storage area and boundary of TSDF.
- There should be at least 15 meter distance between the storage sheds.
- Loading and unloading of wastes in storage sheds should only be done under the supervision of the well trained and experienced staff.
- “Fire break” of at least 04 meter between two blocks of stacked drums should be provided in the storage shed. One block of drum should not exceed 300 MT of waste.
- Minimum of 1.5/>2.5 meter clear space should be left between two adjacent rows of pallets in pair for movement of personnel and or fork lift and inspection.
- 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 firefighting 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.
- Measures should be taken to prevent entry of runoff into the storage area. The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
- The storage area floor should 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 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 firefighting.
- Special care should be taken for storing medical wastes. It should be kept totally isolated from other wastes:
  - All care should be taken so that infectious material should not leak and infection spread.
  - All personnel these wastes should take all care while handling these wastes.
  - Medical wastes should be immediately treated and made harmless.
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 65.5 oC, 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 outside 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:

- Pressurized Hydrant System - For waste storage, PGVR plant, administration building area and other areas also;
- Transformer rooms, consumer 11KV SSU, generator set room and UPS room will be outfitted with CO2 total flooding system;
- Plasma torch power supply rooms, MCC/PCC room and PLC/Control Room will be outfitted with FM200 Total Flooding System;
- Fire detection and alarm system for waste storage area, PGVR plant, power plant block and administration building area;
- Firefighting system shall comprise 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 buried piping and over-ground pipes, fitting, valves, automatic actuators, supports etc. for fire water distribution networks;
• 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.
• Tanks for storage of liquids waste should be properly dyked and should be provided with adequate transfer systems.
• 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.

Hazard Analysis and Safety Audit

During operation of TSDF, a preliminary hazard analysis should be conducted. Safety Audit should be conducted internally by the operator every year & externally once in two years by a reputed expert agency and same should be submitted to the regulatory agencies. Conditions stipulated by SPCBs while
granting authorization under Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 to the TSDF operation should be complied.

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 at

Disaster Management Plan

M/s. SMSIL will develop emergency management system to tackle any emergency situation for proposed TSDF. The details of disaster management plan (DMP) are discussed in the following section.

The disaster management plan (DMP) provides for a framework of actions to handle various emergency situations at the SMSIL. It also provides for on-site resources and appropriate outside assistance in case of any incident at the facility. The ERP will be in place before the commencement of operations at site, and all personnel will have undergone a comprehensive training in emergency response.

The primary objectives of the DMP are:

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

Assessment of environmental risk of continuous emissions often involves consideration of multiple chemicals being released in variable quantities over long time periods. Accidents at hazardous waste treatment facilities are rarely, if ever, of a magnitude that classifies them as “major” accidents owing to the absence of any likely event such as BLEVE, UVCE, acute toxic material release, which can cause extensive far reaching damage.

A numerical criterion for societal or group risk is difficult to define. The other approach is “what if”.

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.
Defining the Nature of Emergency

An Emergency can be defined as an “Occurrence of such magnitude so as to create a situation in which normal pattern of life within a facility is suddenly disrupted, adversely affecting not only the personnel and property within the facility, but also in its vicinity”. Such an occurrence may result in On Site implication like:

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

- Road accident during transportation of Hazardous waste
- Slop Failure of landfill
- Water accumulation at landfill due to heavy rain
- Breakage of Liner due to de-settlement of landfill pit
- Fire at flammable hazardous waste at TSDF
- Fire and LDO/FO tanks

The capping activity will be also carried out immediate once the hazardous 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. Only present active cells are only under operation so failure of slop is also minimize. To prevent the failure of slop during the operation, compacting will be done with dozer and roller. Temporary bund wall will also be constructed to prevent any sliding of waste during operation.

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

Classification of Emergencies

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

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

Level 1: The incident at proposed TSDF is confined to a small area and does not pose an immediate threat to life or property. Spillage of liquid or solid hazardous wastes, small fire in flammable hazardous wastes, etc. can come under this category.

Level 2: An incident at the proposed TSDF involving a greater hazard or larger area which poses a potential threat to life or property. Fire in flammable hazardous wastes, filling of water in disposal pit due to heavy rain, etc. can come under this category.
Level 3: An incident at proposed TSDF involving a severe hazard or a large area which poses an extreme threat to life or property. Breakage in slop and liner system due to de-settlement/earth quake, subsequently contamination of soil and ground water.

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

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’s, 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. SMSIL role and responsibility is to provide material, manpower, and knowledge support under the overall charge of the off-site control administration.

Organization Structure – Duties and Responsibilities

In case of an emergency, the On-site Emergency Plan of the proposed 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 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 will 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.

Duties and responsibilities of various emergency functionaries have been described in following sub sections.

**Duties and Responsibilities for Functionaries**

The duties and responsibilities of the functionaries for unlikely event of emergency are given below:

**Crises Coordinator**

The Head of TSDF will work as Crisis Coordinator:

- He will assess the situation and instructs the Chief Emergency Co-ordinator to sound the siren. This will inform the employee that an emergency situation has siren arisen and that the proposed TSDF should be shut down and evaluated.
- All the personnel/part of the proposed TSDF need to be evacuated and employees other than given responsibility assemble at the assembly points.
- He will approve release of information to press, TV and Government agencies as required.

**Chief Emergency Coordinator (CEC)**

The General Manager of TSDF will work as Chief Emergency Coordinator.

He will report at the command post and will assume overall responsibility of the works and its personnel. His duties will be:

- To assess the magnitude of the situation and decide whether a major emergency exists or is likely to develop, requiring external assistance. To inform District Emergency Authority (DEA) (i.e. District Collector) in case on-site emergency escalates into off-site emergency.
- To contact Crisis Cell of the Ministry and inform about the incident, magnitude of disaster, combating operations and number of casualties, if any.
- To exercise direct operational control over areas in the proposed TSDF other than those affected.
- To assess the magnitude of the situation and decide if personnel need to be evacuated to identify safe places.
- To continuously review in consultation with the other coordinators.
- To liaise with senior officials of police, fire brigade and Factories Inspectorate and pass on information on possible effects to the surrounding areas outside the factory premises.
To liaise with various coordinators to ensure casualties are receiving adequate attention and traffic movement within the proposed TSDF is well regulated.

To arrange for a log of the emergency to be maintained in control room.

To release authorized information to press through the media officer designated.

To control rehabilitation of the affected persons and the affected areas after the emergency.

To obtain assistance from Mutual Aid partners.

### Site Incident Controller

The In-change waste storage will work as Site Incident Controller.

He will take overall control of handling the emergency at the plant. His first task will be the isolation of the source of containment loss to the extent feasible. Simultaneously, in case of fire, he will organize appropriate fire response to get the situation under control and to prevent escalation.

On arrival at the site, he will assess the scale of emergency and judge if a major emergency exists or is likely to develop and will inform the control room accordingly asking for assistance and indicating the kind of support needed. His duties and responsibilities will include:

- To coordinate the activities of other key persons reporting at the incident site, under his overall command.
- To direct all operations within the affected areas giving due priorities for safety of personnel and to minimize damage to environment, proposed TSDF and property.
- To provide advice and information to Fire & Safety personnel and other fire services as and when they arrive.
- To ensure that all non-essential workers and staff within the affected area are evacuated to appropriate assembly points and those areas are searched for casualties.
- To organize rescue teams for any casualties and to send them to safe areas/medical centre for first aid and medical relief.
- To setup communication points and establish contact with control room.
- To seek additional support and resources as may be needed through the control room.
- To seek decision support from the control room for decisions such as activation of mutual aid plan etc.
- To preserve all evidence so as to facilitate any inquiry into the cause and circumstance, this caused or escalated the emergency (to arrange photographs, video, etc.)
- To arrange for a head count after the emergency is over with respect to the personnel on duty in the affected areas.

### Fire and Safety Function

The Manager-Fire & Safety along with firefighting team will work as fire and safety functionary.

The main responsibilities of fire and safety functionary are:
• To immediately take charge of all firefighting operations upon sounding of the alarm.
• To instruct the telephone operator to immediately inform all essential personnel not residing within the audible range of the emergency siren.
• To guide firefighting crew and provide logistics support for effectively combating the fire.
• To barricade the area at appropriate locations in order to prevent the movement of vehicular traffic.
• To assist in rescue and first aid operations.
• To operate the Mutual Aid Scheme and call for additional external help in firefighting via the control room.
• To organize relieving groups for firefighting.
• To inform the Crises Controller and give "All Clear" signal when the fire emergency is over.

**Media Function**

The Human Resource Manager will work as Media Function. He will under the direction of the CEC, coordinate the following:

• To liaise with various media and release written statements to the press through prior concurrence of Crises Controller.
• To handle media interviews with various media. Make arrangements for televising the information about the incident, if public interest warrants.
• Inform State and Central Governments & statutory bodies of the nature and magnitude of the incident, the number of casualties, etc.
• To locate himself such that media personnel/third parties do not need to go past the proposed TSDF security gates and that adequate communication links exist.
• Media personnel often insist on visiting the incident scene.
• To escort media team(s) if the Crises Controller approves such visits.

**Communication Function**

The Manager - Laboratory will work as communication functionary. He should perform the following duties:

• To ensure all available communication links remain functional.
• To quickly establish communication links between incident site and the control room
• To ensure that previously agreed inventory of various types of communication equipment is maintained in working condition and frequent checks carried out and records maintained.
• To maintain voice record of significant communications with timings received/passed from the primary control room.
**Medical Function**

The Manager – Occupational Health will look after medical function. He will perform the following:

- To arrange for the First Aid team to treat the affected personnel.
- To arrange for treatment in the hospital.
- To liaise with the local medical authorities and hospitals, if the casualties are more and the situation demands treatment at more/other medical centers.
- To liaise with the transport coordinator for transporting the victims to various hospitals.
- To arrange for ambulances.
- The Medical Coordinator should ensure the upkeep of agreed medical supplies, antidotes and equipment that should always be kept in stock for treating victims of burns.
- To liaise with the Media coordinator for release of news to the press.

**Transport Function**

The Waste Transportation Manager will work as Transport Function. He shall perform the following duties:

- Arrange for transport of victims to hospital/dispensaries.
- Mobilize all available vehicles available at the proposed TSDF for emergency use, along-with the drivers.
- Arrangement for the duty rotation of the drivers to meet with the emergency situation.
- To direct refueling of vehicles, if not topped up.
- To arrange for vehicles from other sources.
- To liaise with the CEC for evacuation of personnel and transportation of victims.

**List of Names of Functionaries**

List of name of various functionaries with designation and telephone numbers are given below.

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<th>Type of Coordinator</th>
<th>Name</th>
<th>Designation</th>
<th>Telephone Numbers</th>
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<td>Crisis Coordinator</td>
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<td>Chief Emergency (CEC)</td>
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<td>Site Incident Controller</td>
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**Emergency Response Procedures**

**Background**

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

- Road accident during transportation of Hazardous waste
- Slope Failure of landfill
- Water accumulation at landfill due to heavy rain
- Breakage of Liner due to de-settlement of landfill pit
- 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 at the time of emergency

When You Notice Fire

or

Leakage

Please DO (✓)

- Immediately inform the control room.
- Act to control the incident as per the instructions.
- Reach the assembly point.

Please DO NOT (X)

- Get panicky or spread rumors.
- Approach control room without work.
- Engage telephone or loud phone continuously.

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 particular 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.

**Ensuring Health and Safety at Incident Scenes**

The results of hazard analysis will be used to identify the vulnerable zones. Based on incident-specific factors, the exact size and configuration of hazard control zones will be determined. The Hazard Control Zones have been defined below.

The CEC will formulate safe operating procedures for a site safety and health program that addresses the following.

- The use of appropriate protective gear and equipment
- Utilizing the most experienced personnel for the most hazardous tasks.
- Positioning a backup team to assist or rescue personnel.
- Providing medical surveillance for personnel.
- Monitoring (visually and through communications contact) the welfare of personnel operating within the emergency zones.
- Ensuring that all personnel understand their assignments.
- Ensuring that responders do not ingest contaminants through eating, drinking, or inhaling.
- Replacing fatigued personnel with “fresh” personnel.
- Adjusting hazard control zones to reflect changing conditions.

**Evacuation**

- In case of an On-site emergency, the order to evacuate to a safe place will be given by the Chief Coordinator in consultation with other coordinators.
- In case of an Off-site emergency, the order to evacuate to a safe place will be given by the District Emergency Authority in consultation with Chief Coordinator in consultation with other coordinators.
- Accident scenarios covered in ‘Risk Assessment study’ can be a key source of information for evacuation planning where specific facilities are known to pose a threat.
- Evacuation and shelter-in-place decisions are incident specific and must be made at the time of an actual release. Guidance obtained from consequence analysis may be considered a starting point for the decision process.
- Only personnel in close vicinity and affected by heat radiation or pressure wave need be evacuated to safe distances. Non-essential personnel will usually be evacuated from the incident
area and also from adjacent areas. Evacuation should be to a predetermined assembly point in a safe part of the plant. Assembly points marked on the plot plan should be appropriately displayed.

- For serious injury cases, evacuation to hospital will be carried out by the response personnel.
- Chief Coordinator should designate one individual to record all personnel arriving at the assembly point so that the information can be passed to the Primary Command Post.
- At the Primary Command Post, a nominated person should collect the lists of personnel arriving at the assembly points with those involved in the incident. These should then be checked against the roll of those believed to be on-site, updated with known changes for that day. Where it is possible that missing people might have been in the area of emergency, the site incident controller should be informed and arrangements made to organize a further search.

**Fire Response**

- All available firefighting resources will be mobilized in minimum time by head of firefighting services at the time of emergency. The firefighting arrangements including manpower and resources have been organized to deal with worst scenarios like the largest tank in Pump station on fire.
- Fire department need to be well prepared and experienced in rescuing people from fire and explosion situations.

**Health Care**

- Requisite medical resources will be mobilized under the overall charge of the Health and Medical functionary.
- The operational response will be coordinated from the control room.

**Personal Protection**

- Specific skills need to be developed for the safe use of protective clothing through training and experience.
- The CEC will arrange for rapid availability of appropriate protective clothing in the event of an emergency.

**Public Relations**

- CEC will designate one specific individual as the Media Officer.
- The designated Media Officer only will speak to media personnel. The Media officer should ensure orderly and accurate dissemination of information. The “do’s” and “don’ts” on how to deal with the media are discussed below.
- The CEC should understand the need to relay up-to-date “status reports” to the Media Officer on a regular basis.
**Things to Do:**

- Accommodate the media as much as possible; make the news available to them.
- Schedule news conferences and preferably avoid written releases.
- Be direct and specific.
- Have news conferences immediately after any meeting from which the media or public have been barred.
- Send a press representative to the primary control room.
- If safety permits, allow the media to take pictures of the accident site.

**Things Not to Do:**

- Do not permit arguments among public officials or press officials from different organizations in front of the press. Do, however, permit statements of dissenting opinions.
- Avoid giving gut opinions or conjecturing.
- Do not be evasive. If the answer to a question is not known, refer the question to someone who has the appropriate answer.
- Do not be critical in a personal manner; i.e., avoid personal remarks about other people at the accident scene.
- Do not be philosophical. These kinds of discussions are extremely susceptible to being quoted out of context.
- Do not make off-the-record comments. They may end up in print with later retractions buried in the back pages.
- Avoid friendly chats with media people. Casual comments may appear in print.
- Avoid bad or foul language.
- Do not hide from the media. They can sense this and form an unfavorable opinion of the Media Officer as a credible source of news.
- Do not answer questions beyond personal knowledge or expertise.
- Do not permit media persons to attend emergency response team meetings.

**Documentation and Investigative Follow Up**

- CEC will assign responsibility to a functionary for real-time and post-incident documentation of the accident and resulting response actions.
- The responsible person will adopt appropriate reporting forms and procedures giving detailed records of what happened and what actions were taken in response.

Detailed records of what happened and what actions were taken in response can help in:

- Attempting to recover response costs and damages from the party responsible for the incident.
- Setting the record straight where there are charges of negligence or mismanagement resulting from the incident.
- Reviewing the efficiency and effectiveness of response actions.
Preparing for future incident responses.
Verifying facts, actions, injuries, equipment used, etc. for the purpose of legal proceedings, insurance claims, budget requests, and public inquiries.

Training

- Training sessions need to be provided in which personnel are briefed on their specific duties in an emergency.
- To provide training to all emergency responders. The concerned personnel are shown how to wear and properly use personal protective clothing and devices.
- Periodic drills to be conducted to test the overall efficiency and effectiveness of the emergency response plan and emergency response capabilities.

The types of training required for emergency response personnel with responsibilities in any or all phases of the response is based upon the types of incidents most likely to occur and the related response and planning activities.

Responsibility, Frequency and Procedure for Evaluation

The CEC is responsible for evaluating the effectiveness of the on-site emergency plan. Emergency mock drill should be conducted at an interval of six months. Experts should be invited to observe the mock drill in order to know their response and opinion. The recommendations following the discussions will help to identify the loopholes in the plan and response capability of the organization. Such periodic recommendations of the mock drill should be kept in order to update the plan.

The CEC will be responsible to update their on-site emergency plan regularly. A regular review of the plan at least once in a year should be carried out to replace outdated information or to incorporate the results of mock drill.

Communication System & Action on the Site

Communication System

- Any person noticing an emergency should be able to rise 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 lights. Alarm systems vary and will depend on the size of works. On small sites a simple alarm system should be suffice which provide 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 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. It is advisable to restrict the authority to declare it. However, it is not necessary to limit this authority to the Incident Controller and his appointed deputy. The need is to have as early a declaration as is possible person. Particularly on large works, may be closer to the incident when it occurs and capable of making the necessary judgment. It may be advisable, therefore, to invert the authority to declare a major emergency in a number of nominated people. They 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) has to 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 general public in the vicinity. Key points are suggested below:

**Communication to the 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 off-site emergency control (contingent) plan. As per their advice to consultation your onsite plan should be modified and updated.

**Statutory Communications**

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

- The workers
- The general public and neighboring firms
- Distract Emergency Authority.
- Factory Inspectorate

**Services and Control**

**Public Address System**

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

**Telephones**

Adequate facility for internal telephones already 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.
In case of Failure of Telephone

In case of failure of telephone numbers, security guards shall work as runners/messengers. Vehicle being detained round the clock will be used for sending message, in case of emergency and to bring people to work for additional help to deal with emergency.

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.

A list showing location of the fire hydrant points, its type will be available at all departments. A monthly check of each fire hydrant point 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 in order to review & revise the emergency preparedness and response.