

## **RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN**

### **9.1 Risk Assessment**

The proposed land fill site is situated at the outskirts of town. A qualitative assessment of potential hazards posed by landfill site has been summarized in this section.

### **9.2 Geology Landfill Site**

The geophysical investigation indicates the sedimentary basin complex of Assam Shelf and Assam-Arakan. The Assam-Arakan sedimentary basin is a shelf-slope-basinal system. The shelf part of the basin spreads over the Brahmaputra valley. These underground rocks are massive in nature and only top surface exposed to atmosphere is weathered.

The water levels in the area depend upon physiography and Hydrogeological conditions. The general topography of the site is undulating. The slope of the proposed landfill site is more than 10% due to these undulations. The water level of the area is directly related with topographic variations and Hydrogeological conditions. Hence, there is a variation in water level at the site.

### **9.3 Description of Assessment Methodologies**

- a. **Source** - location, nature and likely quantities which has the potential to affect the development.
- b. **Pathway** - the ground and groundwater conditions
- c. **Target** - elements of the development that are sensitive to the effects of landfill

The landfill identified pathway(s), and identified target(s) are then categorized in order to facilitate the assessment process.

### **9.4 Evaluation of Landfill / Estimation of Leachate Quality and Quantity**

On a basis of review of liner systems adopted in different countries, it is recommended that for all MSW landfills the following single composite liner system be adopted (waste downwards) as the minimum requirement.

**A. A leachate drainage layer 30 cm thick made of granular soil having permeability (K) greater than  $10^{-2}$  cm/sec.**

**B. A protection layer (of silty soil) 20 cm to 30 cm thick.**

**C. A geomembrane of thickness 1.5 mm or more.**

**D. A compacted clay barrier or amended soil barrier of 1 m thickness having permeability (K) of less than  $10^{-7}$  cm/sec.**

The liner system adopted at any landfill must satisfy the minimum requirements published by regulatory agencies (MOEF / CPCB).

The liner system may have to be more stringent in free draining alluvial soils at locations where water table level is close to the base of the landfill.

The recommendations for the liner system are not expected to be reduced. However in circumstances where it can be proven by subsoil investigations as well as by hydrological investigations that the leachate will not cause harmful impact to the soil as well as ground water, the norms can be reduced after approval by the regulatory authority.

## **9.5 Migration Pathways**

### ***a. Natural Path***

The geological formation beneath the landfill essentially comprises basaltic rocks. The air permeability of these rocks is considered relatively low.

There may be some layers of rocks underlying the landfill site. Appropriate treatment on bottom and slopes would be provided. Therefore, these layers will not form a natural pathway

### ***b. Man-made Pathways (Utilities)***

There are no man-made pathways (utilities) around the proposed landfill site. Therefore, it is considered that there are no man-made pathways link between the landfill and nearby areas.

### ***c. Targets***

During the operation phase of the landfill, significant excavation will not be carried out for the development of landfill in phased manner due to its topography ( Hilly terrain ) . The excavation is considered not to be a target near the landfill and the deepest excavation will not be undertaken below the existing level. It is anticipated that appropriate structural measures would be taken around the designed excavated area to prevent the ingress of groundwater into the excavations during the course of the development of the landfill site.

## **9.6 Recommendations for Protection Measures**

Some protection measures will be required to protect the proposed landfill site from risks. Recommendations for protection measures to minimize the landfill hazard at the landfill site are proposed and presented as follows :

### ***a. Development Phase***

Smoking, naked flames and other sources of ignition should be prohibited within 15 m of any excavations. Signs such as ‘No Smoking’ and ‘No Naked Flame’ should be in place in the vicinity of excavations.

All electrical equipment to be used in excavations should be intrinsically safe.

Adequate fire extinguisher, fire-resistant clothing and breathing apparatus should be provided on site.

## **9.7 Landfill Fire Management**

Fires in waste on landfill sites are not uncommon and it is important for site operators to be aware of the dangers, how to treat fires and to address the problems associated with them. All fires on-site should be treated as a potential emergency and dealt with accordingly.

The site should have an emergency tipping area set aside from the immediate working area where incoming loads of materials known to be on fire or suspected of being so can be deposited, inspected and dealt with.

Waste that burn on delivery should be doused with water or more preferably covered progressively with adequate supplies of damp soil/cover followed by cooling and finally removal to its disposal point. It should not normally be allowed to burn itself out as this will give rise to nuisance from smoke & odour and may constitute a health risk. Fire fighting techniques shall be appropriate for the waste type.

Fires within the operational areas are either surface fires or deep seated fires. The former usually occur in recently deposited and as yet uncompacted materials adjacent to the current working areas, whilst the latter are found at depth in material deposited weeks or months earlier. Site operators shall have a plan to deal with each type of fire and have a code of practice for their operations stating exactly how to tackle any outbreak. Regardless of the circumstances, no individual should ever tackle a landfill fire

alone. Deep-seated fires require expensive remediation techniques including vertical cut-offs.

## **9.8 Disaster Management Plan**

Disaster management is one of the most important key for the safe operation of landfill site, more so that due to the complex nature of the operations involved. Disaster can be defined as the sudden occurrence of such magnitude as to affect normal pattern of life in the landfill and vicinity causing extensive damage to life and properties. Disaster is an emergent situation which affects or has the potential to affect personnel working therein, resulting in extensive damage to the property, loss of life and disruption of work. Localised accidents, however, are not to be mixed up with or misunderstood as a disaster.

The development of an effective disaster management plan ensures that unforeseen identified impacts of the proposed development are minimised. In addition, it guarantees an effective basis to assess the source and extent of impacts, if they occur. If the disasters are foreseeable, the efforts to mitigate those disasters can be planned in advance.

At landfill site, an emergency can take place at any time due to disaster by nature or by major accident in the site, despite the installation of various safety devices. The causes of these accidents include:

- Fire
- Explosion

Unlike natural disasters, these can be prevented by proper plan and in case of accident the effect can be minimised by proper emergency response method. An important prerequisite for disaster planning is to foresee an accident scenario, which leads to major fire, explosion, toxic release, their spread or extent and their damage potential.

## **9.9 Objectives of the Plan**

The important elements of Disaster Management planning can be classified as :

- Identifying the disaster potential scenarios and advance planning to combat and minimise the damage.
- Vulnerable zone delineation.
- Assessment of loss probability and its severity.

- To deal with such emergencies expeditiously.
- To act during disaster phase i.e. warning, protective actions like evacuation of personnel.
- To provide rescue relief, assistance to the people affected in the works, community, based on the actual needs and the information collected locally.
- To contain the disaster by isolating the area, fire fighting etc.
- To make efforts to return to normal condition when the situation is controlled.

### **9.10 Disaster Plan**

It is a strategy well evolved, organised and rehearsed to contain the adverse effects of a possible disaster. It aims to mobilise the internal resources and use these with minimal dependence on external agencies for the following purposes:

- To control and contain incidents.
- To safeguard employees and people in the vicinity.
- To inform employees, the general public and the authorities about the hazards/risks assessed, safeguards provided, residual risk, if any, and the role to be played by them in the event of disaster.
- To effect rescue and treatment of casualties.
- To prevent recurrence of such a disaster.
- To establish machinery for review, rectification/modification of the emergency/disaster plan in the light of actual experience.
- To ensure safety of works before personnel re-enter and resume work.
- To work out a plan with all provisions to handle disaster and to provide for emergency preparedness and the periodic rehearsal of the plan.

### **9.11 Classification of Disaster**

Disasters have been classified into three different categories

#### **Industrial:**

Following type of disasters are classified in this category:

- Accidental Leakage of methane or other toxic materials.
- Major fire occurrences in landfill site.

#### **National :**

Following type of disasters are classified in this category:

- Enemy invasion
- Bomb explosion
- Air raids
- Riots etc.
- Terrorists Acts

**Natural:**

- Earthquake
- Floods
- Lightning
- Heavy rains (downpour)

**9.12 Rescue Team**

A rescue Team under the direct supervision of landfill site in-charge is planned. The team will consist of Security personnel, Safety and Services (Maintenance) and Welfare officer. This team will be responsible for prevention as well as for dealing with any kind of disaster. The activity of the team will be as given below:

- To identify various types of disasters/emergencies to which landfill site will be prone to.
- To plan and augment area wise safety and other related facilities, if required, so as to match with the needs.
- To periodically organise mock exercise with respect to disaster plan to check the awareness and preparedness of the concerned agencies/personnel to meet the emergency.
- To prepare a general course of action to be adopted for any disaster/emergency. Further identification of specific steps that need to be taken unique to each type of disaster/emergency.
- To organise rescue operations during and after the emergency/disaster.
- To review the progress status on various activities relating to the compliance of Safety Rules, and communicate to all concerned for compliance.

**9.13 Pre-Disaster Stage**

The prevention of disaster is of vital importance and is the moral responsibility of each and every individual employed in the landfill site. It can be prevented by observance of

precautionary and preventive measures. During pre-disaster stage following points will be followed to avert the occurrence of disaster:

- The emergency operation procedures of the landfill site will be written down so that no confusion is caused in the event of emergency taking place.
- To reduce the probabilities of accidental leakage of methane.
- Smoking will be prohibited in the areas where handling of landfill will be done. **NO SMOKING** boards will be prominently displayed in Local Language ie Mizo and English languages.
- All electrical wiring, fittings, cables, equipment will be checked periodically. Temporary wiring will not be permitted to be installed inside the landfill area. No inflammable material including papers, Oils, wooden racks will be stored within 1 meter of any electrical fittings. No unauthorised person will be allowed to tamper with electrical fittings.
- Welding, Burning, cutting, Chipping, Soldering work, etc will only be carried out by authorised person.
- Necessary compliance with various Statutory Guidelines and other relevant instructions as issued from time to time will be done.
- Safety Department will arrange to educate all concerned regarding operational hazards of non-compliance of the safety guidelines. They will also provide necessary guidance and support in proper implementation of the programmes. They will also arrange mock exercises periodically.
- Safety Department will display at prominent places important telephone numbers and instructions, in Mizo & English languages.

The Security Control Room located at the landfill site will be equipped with the following -

- Sufficient number of copies of On-Site Disaster/Emergency Management Plan.
- Master plan of the landfill site indicating vital locations and possible sources of disaster. .
- Important Telephone numbers
- Emergency lights (portable) and Wireless sets ( if required and possible).
- First Aid boxes
- Stretchers, blankets and other essential items at the fire station under the charge of Fire Services **Dep't.**

#### **9.14 Disaster Stage**

The most probable disaster which may occur at landfill site is because of accidental leakage and fire. To control leakage and fire the following measures/precautions will be taken at the landfill site:

**a. Fire Fighting System**

The guidelines as given below for the protection of fire will be followed :

- The landfill's fire protection will consist of structural solutions, fire extinguishing systems and fire alarm systems. The fire extinguishing system will consist of the fire system with fire pumps, distribution pipelines, hydrants and fire hoses and the portable extinguishers.
- The fire alarm system will be a part of the primary systems and take care of the places which are unmanned or will not have any fixed fire extinguishing system.
- The major operation areas shall be equipped with fixed smoke detectors, CO2 extinguisher near the door in the control room.
- All the rooms in the office shall be equipped with fixed smoke detectors.
- The ventilation rooms shall be equipped with fixed smoke detectors. One CO2 extinguisher will be located near the door to ventilation room.
- The fire alarm and detection system shall be designed, installed, maintained and tested according to relevant standards.
- The water for fire fighting shall be stored in the fire water tank (water reservoir).
- CO2 fire extinguishers contain extinguishing carbon dioxide which either by it or under expected conditions of use gives off CO2 to prevent fire.
- Dry fire extinguishers contain extinguishing medium which either by itself or under expected conditions of use will give fine powder to prevent fire to get oxygen.
- As soon as a fire/disaster/emergency takes place inside the premises of landfill, action to be taken by various persons/officials will be as follows :

**1. The person noticing a disaster/emergency situation will :**

- Raise the alarm by shouting.
- Give message to Safety department on telephone/personally giving full and clear message of accident.
- If the emergency/disaster is small enough for tackling by person alone, immediate attempts to control it by using nearby control equipment.

**2. The person arriving next on scene will :**

- Inform respective control room on telephone.

- Attempt to control the disaster with due care of personal danger.
- Make sure that exit routes are free and road for approach for rescue vehicles is clear and unobstructed.

**3. By other persons of Disaster Area :**

- All required persons would not leave the place of disaster and continue their functions and operate essential equipment and emergency systems till ordered to evacuate considering the building/section and the immediate surroundings.
- All other non-essential persons would be evacuated safely and would be collected in safe place of assembly under an executive and should act in accordance with his instructions.

**4. Sectional In-charge of the disaster area :**

- On hearing the alarm or on receipt of message regarding accident in his area, he will immediately proceed to the scene of the accident in his area.
- He will ensure that Safety Department is informed about the accident and if required, should inform Main/Control Gate Security for sounding hooter.
- He should ensure that all important documents, precious material are salvaged / removed to safe place with the help of his section staff.
- He should decide in consultation with other senior officers present and arrange to switch off power/gas/air or any other equipment or system if so warranted to control the situation.
- He will give top priority to the calls of accident and immediately inform the location of the disaster to the following :
  - Chief Executive Officer
  - Safety Department
  - Main Gate/Safety Officer
  - Welfare Officer
- He will take all necessary steps required in the emergency situation regarding operational control of the landfill site.
- He will guide/assist rescue staff in combating the disaster/emergency situation.
- He will mobilize all spare trained personnel to help in tackling the jobs such as fire, rescue, moving of casualties & salvage operations.

**5. All persons of the area Not affected by accident :**

- On hearing the alarm sounded or Siren, work in the building and landfill site, will

not be stopped, unless specifically told by In-charge of the section.

- All persons of the section are available at their respective work place for any assistance that may be called for till all clear is sounded.
- They will extend their fullest co-operation to meet the situation if called for by affected section.

#### **6. Rescue team :**

- On arrival at the scene of the accident, In-charge of rescue team will enquire about the details of accident, quickly size up the situation. Rescue team will immediately operate fixed fire fighting systems or initiate other appropriate action according to situation.
- He will also take action for calling the additional fire brigades from town administration, if required, and co-ordinate with them.
- He will make sure that the necessary water, foam compound, dry powder, carbon dioxide gas, or any other fire fighting agents equipment required according to situation are readily available at the fire spot.
- He will take appropriate action simultaneously to protect the unaffected areas.
- He will direct the fire fighting rescue operations till all clear is given.

#### **7. Security Main Gate:**

Security guard of Main Gate on receipt of message of emergency/fire will immediately sound the alarm on Siren in Wavering sound for 5 minutes.

- He will not permit any one to leave/enter Main gate except essential persons of the landfill after thorough check and verification.
- He will arrange to keep the main gate road clear for outside assistance.
- On receipt of ALL CLEAR message from concerned officials of landfill site conducting Emergency/Fire fighting operations, he will sound ALL CLEAR siren by continuous blast of one minute.

#### **8. Security in-charge:**

- He will immediately rush to the place of incident and arrange for Security Cordoning.
- He will see that no unwanted personnel approach the place of incident. He will also take charge of security of landfill site's property.
- He will inform police in case of serious accident when casualties are involved in consultation with In-charge (Landfill Site).

- If casualties are involved he will make arrangement to shift them to town Hospital by ambulance or any other available vehicle.

#### **9. Safety Officer:**

Safety Officer and his personnel will make available all safety gadgets and personnel protective equipment etc according to the situation at the scene of incident.

- He will see that all persons entering the place of occurrence are wearing protective equipment.
- He will ensure that fire fighting personnel and other persons while fighting emergency/fire is in safe place/position.
- He will make complete note of the incident inform about the incident to the concerned authorities as per statutory provision in consultation with Engineer-in - charge of landfill site.
- He will make arrangement for evacuation of staff if necessary in consultation with Executive Engineer (Landfill Site).

#### **10. Welfare Officer**

- He will manage the availability, quality and quantity of canteen Tea, Snacks and Food facilities for staff of the landfill site.
- He will arrange the uniforms for the workers of the landfill site.
- He will co-ordinate the sports activities for the employees of the landfill site.

#### **9.15 Post Disaster Stage**

After the incident a report will be prepared regarding occurrence of event/losses incurred and recommendations thereof for restoration of normalcy.

#### **9.16 Reporting of Accidents**

Situation in totality will be studied thoroughly, investigated with respect to the cause of the incident, extent of loss of life and property and a detailed report prepared by the individual/team nominated by landfill site authorities for this purpose.

Based on the investigation report, rescue team would finalise time bound programmes for implementation of corrective measures proposed and regularly monitor the progress thereafter. Rescue, medical and welfare operations would be continued by the concerned agencies.

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