

Waste Disposal Criteria and Disposal Pathways

In preceding issue we saw particular of legal framework for hazardous waste management. Further in perpetuation; with current article would like to highlight waste disposal criteria and disposal pathways. Especially would try to cover secured landfill in current issue. Subsequently other aspects of disposal pathways will be sheltered in imminent issues.

Outline: As per CPCB Bulletin Vol-I, July 2016 the present status of generation and management of hazardous waste in the country is as below:

- No of HW generating industries: **43938**
- Total generation of HW: **7.467 Million Tons Per Annum**
- Land fillable waste: **3.416 Million Tons Per Annum**
- Incinerable waste: **0.695 Million Tons Per Annum**
- Recyclable waste: **3.356 Million Tons per Annum**

Overview: DISPOSAL PATHWAYS

- **Recyclable / Re-useable**
- **Direct Land filling**
- **Stabilization – Land filling**
- **Other Alternatives**
 - **Recovery/ Reuse of liquids**
 - **Recovery/ reuse of solids**
- **Incineration**



Distinct highlight of the article:

Secured landfill is the part of waste management facility. This place is final graveyard for the hazardous wastes. In the cell impermeable line will be installed to collect the leachate. Any leachate that is collected will be pumped out and treated. Monitoring wells are required to check the quality of ground water in that area. Secure landfill will be prepared as cells. These cells will have bottom, side liners and top liners. The impermeability and reactivity of these liners is of prime importance. Once the bottom and side liners are complete, waste is dumped in it. On complete filling of waste the top liners are placed and packed. In other words it is encapsulation of waste.

Criteria for hazardous waste landfills:

These guidelines provide mainly criteria for location, site selection, site investigation, planning & design, requirements of landfill liner & cover, construction & operation, inspection, monitoring & record keeping, apart from requirement of post – closure financial assurance as well as contingency plans for emergencies.

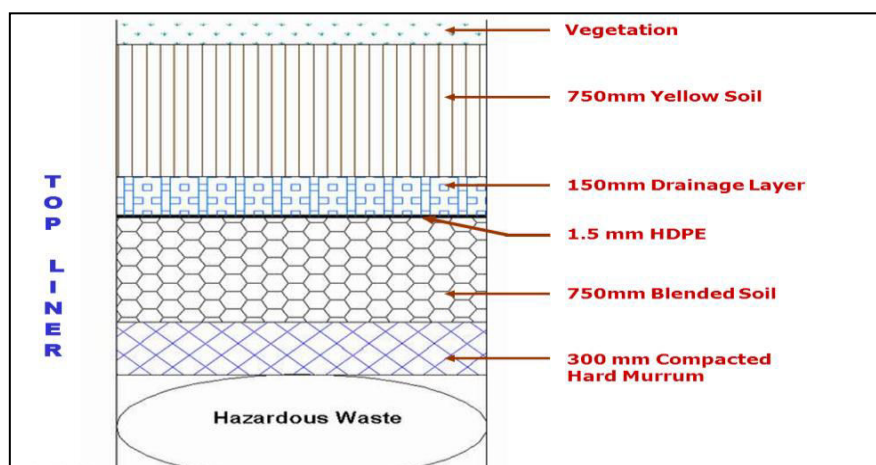
These guidelines also emphasize adoption of single liner system or double liner system depending upon the rainfall, type of sub-soil and the water table beneath the base of the landfill. In a place where rainfall is high and/or sub-soil is highly permeable (e.g. gravel, sand, salty sand) and/or the water table is within 2.0 m to 6.0 m, the guidelines suggest to adopt double composite liner.

Constructional features:

The construction of landfill and development phase requires proper planning and proper selection of the earthwork/lining material. The containment system of landfill is proposed with double liner system with a view to avoid the leach ate infiltration into the ground.

Liner: Top Liner

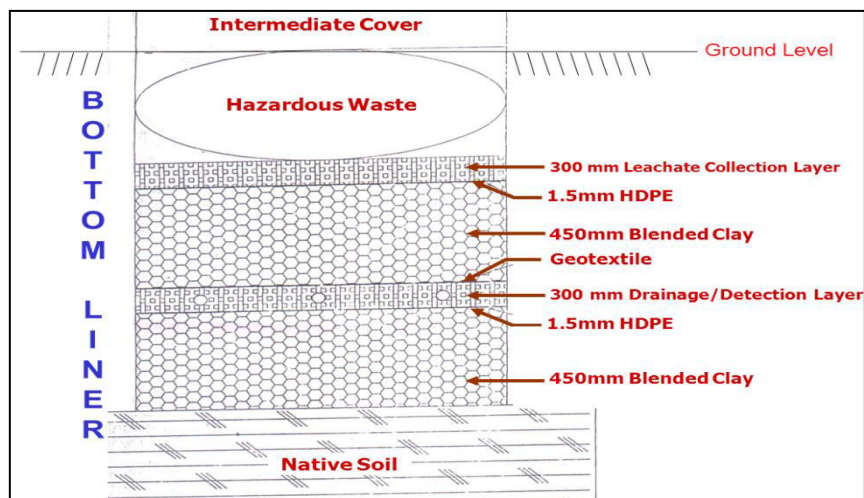
The top liner is provided with parabolic shape to allow drainage of surface run-off. HDPE liner of 1.5mm thickness will be provided over which drainage layer of 150mm will be laid. The bottom of liner will have 750mm layer of blended soil. The drainage layer will be covered with top yellow soil of 750mm thickness. Uniform vegetative cover will be provided to protect the top liner from erosion during heavy rains and dust blow due to heavy winds. A section of top liner is shown in **Figure** given below:



Bottom Liner:

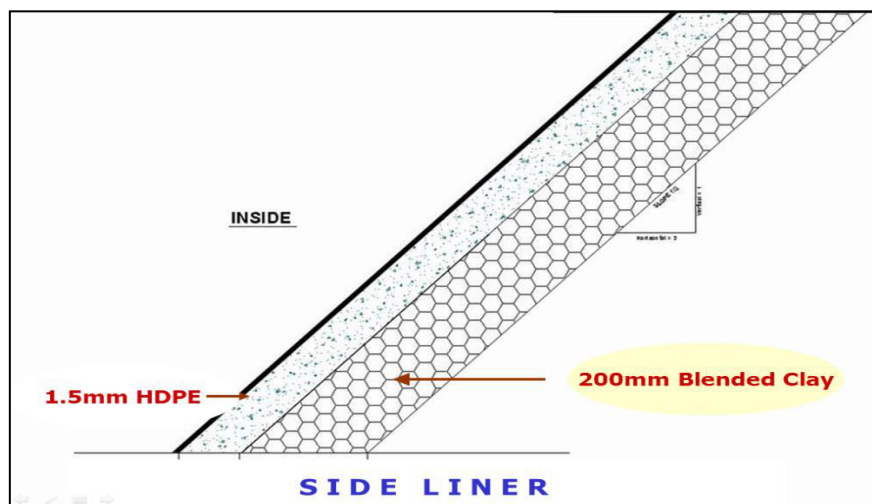
The construction of landfill and development phase requires proper planning and proper selection of the earthwork/lining material. The containment system of landfill is proposed with double liner system with a view to avoid the leachate infiltration into the ground. The primary (top) membrane of 1.5mm HDPE liner will be laid over 450mm thick clay layer. Over the HDPE layer 300mm thick perforated granular layer is laid for leachate collection. Leachate contribution is mainly due to release of entrapped liquid waste in the solid waste and any unseasonal rainfall likely to occur.

The bottom layer of secondary membrane of 1.5mm HDPE liner will be laid over 450mm thick clay layer resting on subsoil. Over the HDPE layer 300 mm drainage/detection layer. The secondary membrane shall comprise of geotextile membrane laid over 300 mm drainage/detection layers. The section of the bottom liner is shown in **Figure** given below:



Side Liner:

The side layer of secondary membrane of 1.5mm HDPE liner will be laid over 200mm thick blended clay layer resting on subsoil. The side layer will have a slope of 1:3 (1 vertical to 3 horizontal). The section of the sideliner is shown in **Figure** given below:



The secondary membranes shall have suitable resistance properties to ward itself from soil bacteria / fungus, compatible with waste being filled, ample water resistance. The mechanical strength should be adequate to withstand the load conditions, soil pressure, compaction, seismic stresses, strain due to anchor trench etc. The membrane shall have permeability $< 10^{-12}$ cm/sec or its equivalent.

The clay liner is formed with varying preparation of hydrated Aluminium silicate (e.g. Keolinate, bentonite etc.). The properly compacted layer with the required compounds form a soil mass giving low hydraulic conductivity. Proper permeability test shall be carried out to achieve suitable clay layer to minimize the leachate.

The construction detail of cross section of secured landfill is shown in Figure below. The construction guidelines shall suit the following criteria:

- The sub-grade material shall meet specified grading, moisture content and density requirements.
- The material shall meet acceptance and conformance testing as per manufacturers' guidelines.
- The integrity of the seams shall be maintained.
- The membrane on installation shall be covered with layer of soil or geo-synthetic as soon as possible after quality activities are completed.
- The maximum hydraulic conductivity shall be 1×10^{-7} cm/sec. The soil used in the liner shall meet the following minimum criteria:
- The soil shall be classified under the United soil classification system CL, CH, SC and OH (ASTM standard D248769)
- The soil shall allow greater than 30% passage through no. 200 sieve (ASTM test D 1140)
- The soil shall have a liquid limit equal to or greater than 30 units (ASTM test D 423)
- The soil shall have plasticity greater than or equal to 15 units (ASTM test D 424)
- The soil shall have pH of 7.0 or higher.
- The soil may be pre-processed for carrying out water adjustment, removal of oversized materials, pulverization of any clumps, homogenization of the soils and introduction of additives such as bentonite.

We shall come up with many more such interesting issues.....till then happy reading.