

**GOVERNMENT OF KERALA****Abstract**

Local Self Government Department - Standard Operating Procedure (SOP) for Domestic Hazardous Waste Management - Approved - Orders issued

LOCAL SELF GOVERNMENT(WM)DEPARTMENT

G.O.(Rt)No.119/2025/LSGD Dated,Thiruvananthapuram, 13-01-2025

Read :- Letter No. 3152/C3/2022/SM dated 09/10/2024 of the
Executive Director, Suchitwa Mission

ORDER

As per the letter read above Suchitwa Mission has submitted the Standard Operating Procedure (SOP) for Domestic Hazardous Waste Management, for approval.

Government have examined the matter in detail and are pleased to approve the Domestic Hazardous Waste Management, as attached herewith, and orders issued accordingly.

(By order of the Governor)
ANUPAMA T V
SPECIAL SECRETARY

Co ordinator, Navakeralam Karma Padhathi- 2
Principal Director, Local Self Government Department
Executive Director, Suchitwa Mission
Member Secretary, Kerala State Pollution Control Board
Executive Director, Kudumbasree
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Managing Director,Clean Kerala Company Ltd
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Accountant General (G&SSA/E&RSA), Kerala, Thiruvananthapuram
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Signed by

Manish V V

Date: 15-01-2025 13:15:29

Section Officer

STANDARD OPERATING PROCEDURE
FOR
DOMESTIC HAZARDOUS WASTE MANAGEMENT



November , 2024

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1. Intent

This Standard Operating Procedure (SOP) defines the general rules and good practices required for the effective management of domestic hazardous waste (DHW). It intends to bring in a systematic and scientific management of domestic hazardous waste in the State and is expected to help stakeholders control and reduce the risks associated with processing and disposal of domestic hazardous waste. Central Pollution Control Board requirements are to collect, process and manage the waste in an environmentally friendly manner, and following this SOP helps comply with the requirements.

2. Definition

As per Solid Waste Management Rules 2016, “**Domestic hazardous waste**” means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level.

3. Introduction

Domestic hazardous waste is typically generated in lesser quantities than other waste fractions, however, the potential risks to the environment and human health are disproportionate to its quantum. It becomes especially lethal when given a chance to react with other materials in common landfills. Addressing this waste stream separately through an efficient system of segregation and collection as well as scientific disposal in an environmentally sound manner is very necessary to mitigate the associated risks.

4. Applicable Rules

- a. **Solid Waste Management Rules, 2016**, as amended from time to time.

Domestic hazardous waste is covered under the Solid Waste Management Rules and it may be noted that the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 **shall not apply** to wastes covered under the Solid Waste Management Rules. The hazardous waste apart from the domestic hazardous waste shall be managed in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended from time to time.

- b. **Used batteries** are a common item coming under domestic hazardous waste. Exposing the environment to lead and strong corrosive acids found in batteries can cause hazards.

Battery Waste Management Rules, 2022, and its amendment rule in 2023 shall apply to, –

- (i) Producer, dealer, consumer, entities involved in collection, segregation, transportation, refurbishment and recycling of Waste Battery;
- (ii) **all types of batteries** regardless of chemistry, shape, volume, weight, material composition and use.

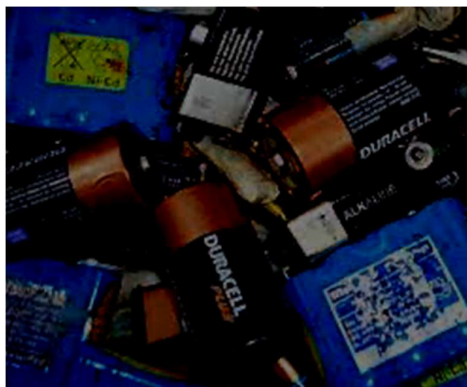


Figure: Used batteries (a common item under domestic hazardous waste)

As per Battery Waste Management Rules, 2022 it will be the **responsibility of the consumer**,
(i) to discard Waste Battery separately from other waste streams especially from mixed waste, domestic waste streams;
(ii) to ensure that Waste Battery are disposed off in an environment friendly manner by giving it to an entity engaged in collection or refurbishment or recycling;

As per Rule 6 of the Battery Waste Management Rules, local body is to hand over collected Waste Battery to the producers or agencies acting on their behalf or the entity engaged in refurbishment or recycling with a view to refurbishment or recycling of those Waste Battery or carry out their recycling or refurbishment themselves.

- c. **Bio-medical waste generated in households during healthcare activities shall be segregated as per Bio-Medical Waste Management Rules, 2016** (as amended from time to time) and handed over in separate bags or containers to **Local Self Government** waste collectors.

Duties of authorities concerning the management of bio-medical waste shall be as per the rule no. 6 of **Bio-Medical Waste Management Rules, 2016** (as amended from time to time). As per rules, Local Bodies shall have tie up with the common bio-medical waste treatment and disposal facility to pickup this waste from the Material Recovery Facility (MRF) or from the household directly, for final disposal.

As per Bio-Medical Waste Management Rules, on-site treatment and disposal facility shall not be established, if a service of a common biomedical waste treatment facility is available at a distance of seventy-five kilometre. In cases where the service of the common bio-medical waste treatment facility is not available, requisite biomedical waste treatment equipment (like incinerator, autoclave or microwave, shredder) can be setup prior to

commencement of its operation, as per the authorisation given by the prescribed authority (Kerala Pollution Control Board).

Hence, in the absence of the service of a common biomedical waste treatment facility within a distance of seventy-five kilometre, combustible household biomedical waste can be disposed of using a community-level sanitary waste incinerator facility. Combustible household biomedical waste needs to be collected in yellow coloured non chlorinated closed bags through authorized agencies and transported to community level sanitary waste incinerator or to common biomedical waste treatment facility.

- d. **E-Waste Management Rules** shall apply to every manufacturer, producer refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, refurbishing, dismantling, recycling and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts and spares which make the product operational. Fluorescent and other mercury-containing lamps belonging to the category of domestic hazardous waste are covered under this rule. These are to be collected and transported to a common hazardous waste treatment disposal facility.

e. Waste Management Rules 2022, Schedule V emphasise the roles and responsibilities of Local Bodies as follows

(1) To ensure that e-waste if found to be mixed with Municipal Solid Waste is properly segregated, collected and is channelised to registered recycler or refurbisher.

(2) To ensure that e-waste pertaining to orphan products is collected and channelized to registered recycler or refurbisher.

(3) To facilitate setting up e-waste collection, segregation and disposal systems.

(4) Conducting training sessions to develop capacities of the urban and rural local bodies.

5. Domestic Hazardous Waste Collection

- a) It is necessary to collect domestic hazardous waste independently from dry and wet waste and send it to an approved hazardous waste treatment storage and disposal facility (HW-TSDF).
- b) Based on the published collection calendar, authorized collection agencies like Haritha Karma Sena can carry out the door-to-door collection of DHW.
- c) It is recommended to undertake the collection of smaller items like batteries coming under the DHW through a door-to-door collection mechanism and larger and heavy items getting deposited by the generator at the deposition centers (drop points).
- d) As per SWM rules 2016, local bodies shall establish waste deposition centres for domestic hazardous waste and give direction for waste generators to deposit domestic hazardous wastes at this centre for its safe disposal.
- e) These dropping centers to collect domestic hazardous waste are to be established by LSGIs at identified prominent locations.

- f) Such facility shall be established in a city or town in a manner that one centre is set up for the area of twenty square kilometers or part thereof and notify the timings of receiving domestic hazardous waste at such centers.
- g) At the dropping centers, the collection of domestic hazardous waste needs to be done in consultation with the HWTSDF under various categories like waste that can be recycled, waste to be incinerated and waste that needs to go to a hazardous landfill.
- h) The collection of waste at the deposition centers must be undertaken in specific colored bags/containers as stipulated in the rules.
- i) Also, as per the Hazardous and Other Wastes (Management and Transboundary Movement) Second Amendment Rules, 2023, Municipalities and Local Bodies shall facilitate producers and bulk generators or collection agents to set up large number of collection points for collection of used oils in their jurisdictional areas and the used oils so collected can be auctioned or sold to the authorised recyclers.
- j) The deposition centers shall obtain authorization from the State Pollution Control Board.
- k) The deposition centers shall provide the domestic hazardous waste to the actual user or operator of the disposal facility and maintain records of the same in Form 3 and shall file annual return in Form 4 to the State Pollution Control Board.

6. Domestic Hazardous Waste Processing

Domestic hazardous waste requires a higher degree of containment. Ideally, this waste fraction should be sent to the nearest hazardous waste treatment storage and disposal facilities (HWTSDF). In case this is not possible the SLF should have a special storage area for domestic hazardous waste, to be transported to the nearest HWTSDF periodically.

Components of domestic hazardous waste can be managed/disposed of scientifically in the common hazardous waste treatment storage and disposal facilities. These are dedicated facilities equipped with state-of-art technologies for environmentally sound management/disposal of hazardous waste. These facilities comprise of secured (engineered) landfills or incinerators (equipped with air pollution control devices) or a combination of both (integrated HW-TSDF).

Figure: Storage and movement of domestic hazardous waste consignment within TSDF based on waste disposal criteria

Domestic hazardous waste transported to a hazardous waste treatment and disposal facility will be categorized and processed as below based on its characteristics:

- i) Waste that can be recycled
- ii) Waste that can be incinerated
- iii) Non-recyclable, non-incinerable waste that needs to go to a hazardous landfill.

6.1 Recyclable waste

Some domestic hazardous waste can be recycled for a different purpose or may contain material, which can be extracted for use in manufacturing other products. For example, fluorescent bulbs and tubes can be utilized following the norms of E-waste Management Rules. Reportedly, all the components of fluorescent tubes aside from the fluorescent powder have been reported to be reused (Ref: CSE,2022).

Domestic hazardous waste that can be recycled includes **used batteries, recyclable contaminated waste, broken or discarded glassware, fluorescent bulbs and tubes** etc. (CFL, tubes should go to HW TSDF where a registered recycling facility is not available) Recyclable domestic hazardous waste will be processed as described below:

Figure: Flow Diagram of recyclable Domestic Hazardous Waste

As per Battery Waste Management Rules, **Waste Battery** collected by the Producer shall be sent for recycling or refurbishing and shall not be sent for landfilling or incineration. The recycling of Waste Battery means recycling of Battery materials such as lead, nickel, lithium, nickel, cobalt, plastics, rubber, glass, etc.

Contaminated recyclable waste generated at households like wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vacutainers with their needles cut, gloves and need to be collected using **red coloured** non-chlorinated plastic bags or containers. This collected waste needs to be sent to Bio-medical Treatment Storage and Disposal Facility (BM-TSDF). Treatment options for the contaminated recyclable waste is by autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites. Local bodies need to have a tie-up with authorized agencies/common biomedical waste treatment facility having the required infrastructures.

Glasswares needs to be collected through cardboard boxes with **blue colored** marking. Broken or discarded non-contaminated glasswares can be sent for recycling. However, broken or discarded and contaminated glass except those contaminated with cytotoxic wastes need to be disinfected by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment or through autoclaving or microwaving or hydroclaving and then sent for recycling.

Waste sharps including metals like **needles, syringes with fixed needles, blades, or any other contaminated sharp object** that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps. This waste must be collected through White translucent puncture proof, leak proof, tamper proof containers. Treatment option for this type of waste include autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Board) or hazardous landfill or designated concrete waste sharp pit.

6.2 Combustible Waste

Thermal oxidation through incineration at hazardous waste treatment disposal facility is one of the proven technologies for the destruction of hazardous waste in all its forms—solid, semi-solid, liquid and gaseous based on the feeding system—so as to render it innocuous in the form of non-toxic and non-hazardous residue. This method is suitable for waste such as **expired medicines, soiled waste, insecticides, pesticides, paints** etc. Discarded paint drums, pesticide cans shall be deposited in the waste deposition centre for its safe disposal at Hazardous Waste Treatment Storage and Disposal Facility (HWTSDf).

Figure: Flow Diagram of Combustible Domestic Hazardous Waste

Household biomedical waste like items contaminated with blood, body fluids need to be collected in **yellow coloured** non-chlorinated plastic bags or containers and disposed through Incineration or Plasma Pyrolysis. (In absence of above facilities, autoclaving or micro-waving/hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.)

Expired or Discarded Medicines need to be collected in **yellow coloured** non-chlorinated plastic bags or containers and shall be either sent back to manufacturer or disposed by incineration. (Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature $>1200^{\circ}\text{C}$ or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at $>1200^{\circ}\text{C}$ Or Encapsulation or Plasma Pyrolysis at $>1200^{\circ}\text{C}$.)

Discarded linen, mattresses, beddings contaminated with blood or body fluid must be collected through non-chlorinated **yellow** plastic bags or suitable packing material. Treatment options for these types of waste include non-chlorinated chemical disinfection followed by incineration or Plasma Pyrolysis or for energy recovery. (In the absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery).

6.3 Waste Disposal in Hazardous Landfill

Certain domestic hazardous waste cannot be recycled and should not be incinerated and it needs to be sent to a hazardous/sanitary landfill for disposal. This waste needs to be collected and transported to hazardous landfill.

Figure: Flow Diagram of non-recyclable, non-incinerable Domestic Hazardous Waste

Ash generated from community-level sanitary waste incinerators is an example of waste that needs to go to hazardous landfills.

6.3.1 Stabilisation of hazardous waste before landfill

Most commonly used pre-treatment techniques include decanting of empty bottles containing hazardous liquids, solidification, stabilisation, chemical fixation and encapsulation. Pre-processing techniques such as solidification and stabilisation can be used for immobilisation of contaminants like heavy metals, but they can also be used for different waste streams including glass pieces and asbestos waste. Various methods for treating waste before final disposal in secured landfills are as follows:

- **Solidification:** Solidification is a process that involves mixing of additive material in waste in order to convert the waste mix into a solid monolith like structure. It includes physical dewatering of waste and the improvement of physical properties such as strength, compressibility and permeability. It is generally applied to waste in which there is high moisture content but low heavy metal concentration.
- **Stabilisation:** Stabilisation includes dewatering/solidification as well as chemical bonding of the additive material/particles with the contaminants. The contaminants are thus made chemically more stable. It is usually done for waste containing toxic metals such as lead, chromium, mercury and nickel.
- **Encapsulation:** Encapsulation is defined as the enclosure or entrapment of waste by some material—such as packing it into a plastic bag.

6.3.2 Secured landfills for DHW disposal

Secure landfill is suitable for industrial and hazardous solid waste which are pretreated to the stabilisation and solidification stage before entering the landfill.

The stabilisation and solidification of solid waste mean that the waste is pre-treated with a specific process to the minimum or non-hazardous stage. The process will generally remove

the acidity or alkalinity stage to the neutralised stage, then process the waste to solid stage and secure the waste using appropriate options. The secured waste is safe for transportation and landfilling.

Each type of waste will require a different stabilisation processing method. Therefore before the stabilising process, each waste will be tested in the laboratory to find its specific property before treatment. For example, the Hg waste will be neutralised by sodium-sulphide. Then it will be mixed with cement to become solid form before disposing to the secure landfill.

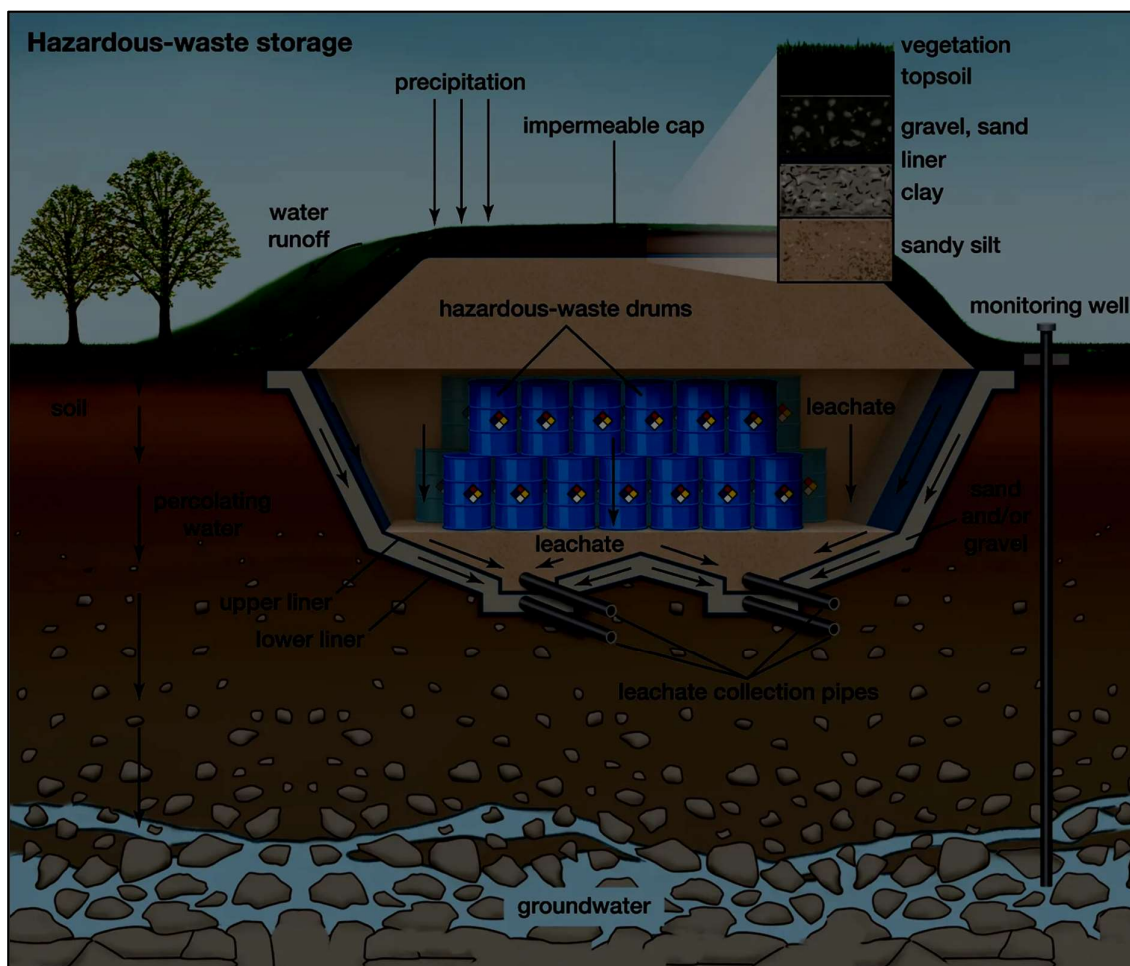


Figure : Schematic diagram of a hazardous-waste landfill with a double leachate collection system

Hazardous waste landfills are defined as waste disposal units, which are designed and constructed in such a way that they cause minimum possible impact to the environment. These landfills have to be designed and constructed as per the guidelines of pollution control authorities. Components of secured engineered landfill are liner system, leachate collection and removal system, leak detection system, daily/intermittent cover, gas removal system, capping and closure system, storm water drainage system and redundant liner at bottom.

It is important to understand that the design of secured landfills is similar to that of sanitary landfills (for municipal solid waste rejects). However, there are double protective layers in case of secured landfills such as primary and secondary leachate collection systems and double liner systems. Waste with no leachable toxic metals is directly disposed into the secured landfills at the HW-TSDFs.

Waste with leachable contaminants is first treated by certain methods to render it harmless prior to disposal in secured landfills. Un-stabilized waste may potentially contribute to the generation of hazardous leachate, which can contaminate the groundwater system. The hazardous contaminants in waste must be physically and chemically bound by some material so that there would be no risk of consolidated stress and leaching.

Diagrammatic representation of double liner composite secured landfill is shown in Figure below.

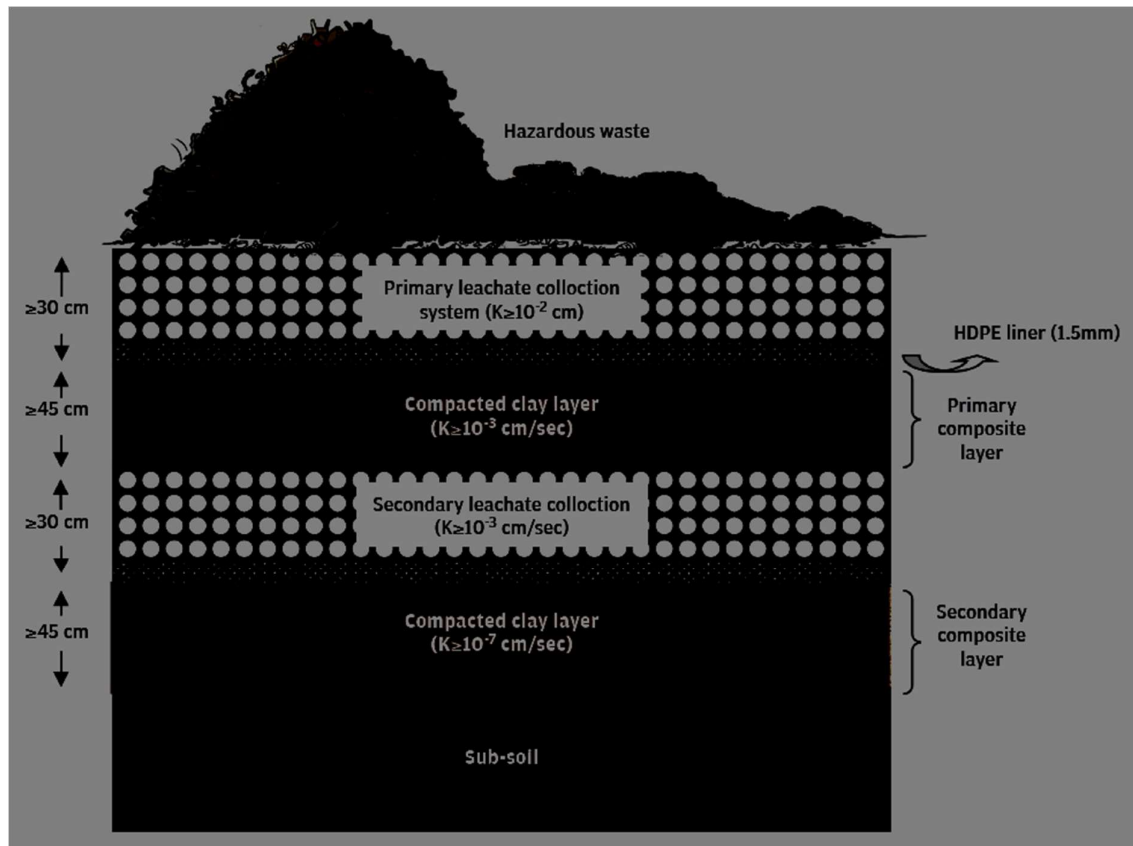


Figure : Cross-section of double-liner composite system in a secured landfill (CSE,2022)

The specifications of a double-liner composite system in a secured landfill are as follows:

- a). Primary leachate collection layer of thickness 30 cm or more and co-efficient of permeability in excess of 10^{-2} cm/sec.
- b). A primary composite liner comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more
 - ii). A compacted clay (or compacted amended soil) layer of thickness 45 cm or more having a coefficient of permeability of 10^{-7} cm/sec or less
- c). A secondary leachate collection layer (also called leak detection layer) of thickness 30 cm or more and co-efficient of permeability in excess of 10^{-3} cm/sec
- d). A secondary composite liner comprising of
 - i). A HDPE geomembrane of thickness 1.5 mm or more
 - ii). A compacted clay layer of thickness 45 cm or more having a co-efficient of permeability of 10^{-7} cm/sec or less

7. Domestic Hazardous Waste Management Aspects

- a. The household shall be responsible for properly handing over the domestic hazardous waste to authorized agencies for safe and environmentally sound management of the same.
- b. Every waste generator shall segregate and store the domestic hazardous waste generated by them in separate streams in suitable bins/covers and handover segregated wastes to authorised waste collectors/deposit the waste at deposition centers (drop points) as per the direction or notification by the local authorities from time to time.
- c. Local bodies shall ensure safe storage and transportation of the domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the State Pollution Control Board.
- d. Authorized agencies shall send the collected waste to approved hazardous waste processing facilities like Kerala Enviro Infrastructure Limited (KEIL) or any other approved facilities.
- e. Local bodies shall create public awareness through information, education and communication campaign and educate the waste generators to practice segregation of waste at the source
- f. Proper data should be kept and maintained by the local bodies on the quantity of domestic hazardous waste being collected & managed and shall be made available to regulating authorities for verification.

8. References

1. Solid Waste Management Rules, 2016
2. Battery Waste Management Rules, 2022

3. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
4. Hazardous and Other Wastes (Management and Transboundary Movement) Second Amendment Rules, 2023
5. Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2024
6. Bio-Medical Waste Management Rules, 2016
7. E-Waste (Management) Rules, 2022
8. Richa Singh 2022, Domestic Hazardous Waste: An Approach Towards Scientific Collection, Treatment and Disposal in India, Centre for Science and Environment, New Delhi, 2022.