BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

APPEAL NO. 12/2025 (WZ)

IN THE MATTER OF: -

SAMITA RAJENDRA PATIL — **APPELLANT**

VERSUS

UNION OF INDIA & ORS. — **RESPONDENT(S)**

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Pratik D. Bharne
(Scientist 'E' & Regional Director)

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पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
M/o Envt. Forest & Climate Change, Govt. of India
सर्वे नं. ११०, हीराबाई धनकुडे हॉल, बाणेर रोड, बाणेर, पुणे - 411045
Sr. No. 110, Hirabai Dhankude Hall, Baner Road, Baner, Pune-411[illegible]

Place: Pune
Date: 05/03/2025

NOTARY * GOVERNMENT OF INDIA *
MANISHA SAMEER CHITNIS (MAHARASHTRA) PUNE REGD. NO. 20258 EXP. DATE 07/03/2025

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

APPEAL NO. 12/2025 (WZ)

IN THE MATTER OF: -

SAMITA RAJENDRA PATIL — **APPELLANT**

VERSUS

UNION OF INDIA & ORS. — **RESPONDENT(S)**

REPLY ON BEHALF OF RESPONDENT NO. 05, CENTRAL POLLUTION CONTROL BOARD (CPCB)

1. That, the Hon'ble National Green Tribunal, Western Zone Bench (WZ), Pune (hereinafter referred to as "Hon'ble NGT") vide its order dated 27/01/2025 in Interim Application (hereinafter referred to as "IA") No. 30/2025 (WZ) in Appeal No. 12/2025 (WZ) has sought the reply of Central Pollution Control Board (hereinafter referred to as "CPCB") in the instant matter. Thereby, the reply is made in succeeding paragraphs.

2. That, at the outset, the Answering Respondent deny all claims, contentions, allegations and averments against the Answering Respondent i.e. CPCB in the above Appeal contrary to anything stated or submitted in this reply. Nothing in the IA and Appeal may be deemed to have been accepted or admitted by the Answering Respondent for want of a specific denial, save and except any averment which has been expressly admitted hereinafter.

3. That, CPCB has been constituted under Section 3 of the Water (Prevention and Control of Pollution) Act, 1974 (hereinafter referred to as "Water Act, 1974"). It performs the functions under the Water Act, 1974, the Air (Prevention and Control of Pollution) Act 1981 (hereinafter referred to as "Air Act, 1981") and the Environment (Protection) Act, 1986 (hereinafter referred to as "E(P) Act, 1986") and the rules made therein. However, within the

federal structure in the Country, there are State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs) in every State/Union Territory constituted under section 4 of the Water (Prevention and Control of Pollution) Act, 1974 and section 6 of the Air (Prevention and Control of Pollution) Act, 1981 and are responsible for implementation of the provisions of both the Acts.

4. That, for effective management of hazardous waste, the Ministry of Environment Forest and Climate Change (hereinafter referred to as MoEF&CC) has notified Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (hereinafter called as HOWM Rules, 2016) vide G.S.R No. 395 (E) on 04/04/2016 in supersession of the earlier Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and the Hazardous Waste (Management & Handling) Rules, 1989. As per the prevailing HOWM Rules, 2016, CPCB has been entrusted with responsibility for preparation and updation of guidelines/SOPs for management of hazardous waste and monitoring of compliance of the regulations/guidelines issued are among the duties of the concerned State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs).

5. That, the MoEF&CC has notified Environment Impact Assessment Notification, 2006 (EIA Notification, 2006) which mandates requirement of prior environmental clearance for the activities listed under the said notification from the concerned authority as stipulated therein.

6. That, the present Appeal has been filed by the Appellant challenging the impugned Environmental Clearance (EC) dated 09/10/2024 granted by the Respondent No.3 i.e. State Environment Impact Assessment Authority (SEIAA) to the Respondent No.9 i.e. M/s Arihant Superstructures Pvt. Ltd., through its Director and Respondent No.10 i.e. The Director, M/s Arihant Aashiyana Pvt. Ltd., for the proposed residential project "Arihant Adarsh" situated at Survey No. 43/3/2, 59/2, 60/1/2B, 35/1+2/1(2), 35/1+2/1(3) and 35/1+2/1(4) at Village – Ghot, Taluka – Panvel, District – Raigad. It is alleged that the impugned EC has been granted on false and incorrect information provided by the Respondent No. 9 & 10. Further, it is mentioned that the said

land bearing survey numbers upon which the proposed development of building project undertaken by the Respondent No. 9 & 10, falls within 500 m i.e. within the `no development buffer zone' of the Common Hazardous Waste Treatment Storage Disposal Facility (hereinafter referred to as "CHWTSDF"), which is in violation of the guidelines published by CPCB "Criteria for Hazardous Waste Landfills, 2001"; Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities, 2017, amended Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities, 2019 as well as Protocol for Assessing Proposals of Development Projects in Buffer Zone of Closed CHWTSDF, 2021 respectively. Also, it is alleged that despite the Hon'ble NGT vide its order dated 21/08/2023 in Appeal no. 39 of 2022 (WZ) and Appeal no. 40 of 2022 (WZ), "Taloja Manufactures Association Vs. Union of India & Ors." had directed to set aside the ECs granted to the residential projects being developed by the Respondent No.9 i.e. M/s Arihant Superstructures Pvt. Ltd., the SEIAA, Maharashtra has granted a fresh EC to one of the alleged residential project, which falls within no development buffer zone of CHWTSDF (i.e. based on the revised plot area submitted by the Respondent No. 9 for consideration of fresh EC).

PRELIMINARY SUBMISSIONS

7. That, it is humbly submitted for effective management of hazardous waste, the MoEF&CC has notified Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (hereinafter called as HOWM Rules, 2016) vide G.S.R No. 395 (E) on 04/04/2016 in supersession of the earlier Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and the Hazardous Waste (Management & Handling) Rules, 1989. As per the HOWM Rules, 2016, CPCB has been entrusted with responsibility for preparation and updating of guidelines/SOPs for management of Hazardous Waste. The concerned SPCBs/PCCs are the prescribed authority for implementation of the Rules and the CPCB guidelines and also taking action against the violations of these Rules. It is also further submitted that as per the Schedule VII read with Rule 21 of the HOWM Rules 2016, the State Government has been entrusted with the duty

of identification and notification of sites for CHWTSDF.

8. That, it is humbly submitted that CPCB has published Guidelines "Criteria for Hazardous Waste Landfills" 2001, and under Section 2 i.e. Locational Criteria of the said guidelines, it is stipulated that:

"2.0 LOCATIONAL CRITERIA

HW Landfills shall not be located within of the following lakes, ponds, rivers, wetlands, certain distance habitation, critical habitat area, water supply wells, Airports, flood plains, highways, coastal zone, absolutely essential to site a landfill within the restricted zone, then appropriate design measures are to be taken and prior permission from the SPCB/PCC should be obtained.

(a) ...

(b) ...

(c) ...

(d) ...

(e) ***Habitation: A landfill site shall be at least 500m from a notified habitation area. A Zone of 500 m around a landfill boundary should be declared a no-development buffer zone after the landfill location is finalized.***

(f) Public parks: No landfill shall be constructed within 500 m of a public park.

(g) ...

..."

Copy of the said guidelines is annexed and marked as "**Annexure- R5-I**".

9. That, it is also submitted that the provision for no development buffer zone of 500 meters has been specified in the guidelines "Criteria for Hazardous Waste Landfills", 2001 to safeguard human health in case of any adverse impacts from the landfills. The said section 2 also stipulates that "If it is absolutely essential to site a landfill within the restricted zone, then appropriate design measures are to be taken and prior permission from the

SPCBs/PCCs should be obtained."

10. That, it is humbly submitted that the Amended Guidelines on provision for buffer zone referred is related to waste processing and disposal facilities for Municipal Solid Waste (MSW), the CPCB guidelines "Criteria for Hazardous Waste Landfills, 2001" is applicable for buffer zone of CHWTSDF.

11. That, it is humbly submitted that Taloja Manufactures Association had filed a separate Appeal before the Hon'ble NGT (WZ) in Appeal no. 39 of 2022 (WZ) and Appeal no. 40 of 2022 (WZ), "Taloja Manufactures Association Vs. Union of India & Ors." seeking quashing of two EC dated 25/07/2022 granted by the then Respondent no.4 i.e. State Level Environment Impact Assessment Authority (SEIAA), Maharashtra to M/s Arihant Superstructures Ltd., for construction of two building projects on the Survey No. 35/1A, 35/1B, 35/1C & 36/0 and Survey No. 43/3/2, 59/2, 60/1/2B, 35/1+2/1(2), 35/1+2/1(3) and 35/1+2/1(4) at Village – Ghot, Taluka – Panvel, District – Raigad, which falls within 500 m i.e. within the `no development buffer zone' of the CHWTSDF, which is in violation of the guidelines published by CPCB "Criteria for Hazardous Waste Landfills, 2001".

12. That, it is humbly submitted that in compliance to the Hon'ble NGT order, this Answering Respondent had filed separate reply affidavits to the Hon'ble NGT (WZ) in Appeal no. 39 of 2022 (WZ) and Appeal no. 40 of 2022 (WZ) in January, 2023.

13. That, it is humbly submitted that the Hon'ble NGT vide order dated 21/08/2023 deliberated and disposed the aforesaid Appeals by referring to judgment of the Hon'ble High Court of Gujarat dated 17/02/2014, delivered in Writ Petition (PIL) No.47 of 2012, Parth Mahila Utkarsh Mandal (N.G.O.) through Mahamantri Vs. Sraddha Developers & 10 Ors.), wherein it was noted that "Guideline to the effect that the distance of 500 mtrs is required to be maintained as buffer zone from the landfill site, which should not be treated only as Guideline, rather it should be treated to have a statutory restriction imposed by law or Rule and that no permission to develop the

land within 500 mtrs of landfill site can be permitted at the cost of health of the people at large" and accordingly set aside the EC of the projects, dated 25/07/2022 issued in favor of M/s Arihant Superstructures Ltd., Copy of the Hon'ble NGT order dated 21/08/2023 in Appeal no. 39 of 2022 (WZ) and Appeal no. 40 of 2022 (WZ) is annexed and marked as "**Annexure-R5-II**."

PARA-WISE REPLY

14. That, the averments made in Para nos. 1 & 2 of the Appeal is introductory in nature. Hence, needs no comments from this Answering Respondent.

15. That, the averments made in Para no. 3 of the Appeal refers to the details of the EC granted to M/s Arihant Superstructures by SEIAA which is matter of records. Hence, do not calls for any comments from this Answering Respondent.

16. That, the averments made in Para no. 4 of the Appeal refers to the contention of the Appellant that EC has been granted to M/s Arihant Superstructures by SEIAA in violation of CPCB's Guidelines "Criteria for Hazardous Waste Landfills, 2001"; "Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities, 2017 & Amended guidelines 2019"; and "Protocol for Assessing Proposals of Development Projects in Buffer Zone of Closed CHWTSDF, 2021".

In this regard, it is humbly submitted that submissions made at Para no.7 to 10 of this reply affidavit are re-iterated and not repeated herein for the sake of brevity.

Further, with regard to Protocol for Assessing Proposal for Development of Projects in Buffer zone of CHWTSDF, 2021, it is humbly submitted that the said protocol is applicable only in case of development of projects in the no development buffer zone of Closed CHWTSDF, and the CHWTSDF under reference is in operation.

17. That, the averments made in Para nos. 5 & 6 of the Appeal refers to the contention of the Appellant that the information submitted by the Respondent No. 9 &10 is false and details of the petitioner. The said averments relate to Respondent No. 9 and 10 and hence, this Answering Respondent has no comment to offer.

18. That, the averments made in Para nos. 7 to 14 refers to the details of the Appellant, which is matter of records. Hence, calls for no comments from this Answering Respondent.

19. That, the averments made in Para no. 15 of the Appeal refers to the submission of the Appellant that Building permission is granted to Respondent No. 09 whereas EC is granted to Respondent No. 10. The same is matter of records and need no comments from this Answering Respondent.

20. That, the averments made in Para nos. 16 to 18 of the Appeal under the heading 'Facts of the Case' refers to the declaration of MIDC as nodal agency for selecting & developing sites for CHWTSDF, notification of land for establishment of CHWTSDF and grant of consent to establish/operate to the said CHWTSDF by the MPCB, hence need no comments from this Answering Respondent.

21. That, the averments made in Para no. 19 of the Appeal under the heading 'Facts of the Case' refers to the provision of "No development buffer zone" stipulated in CPCB guidelines "Criteria for Hazardous Waste Landfills". In this regard, it is humbly submitted that submissions made at Para nos. 7 to 10 of this reply affidavit are re-iterated and not repeated herein for the sake of brevity.

22. That, the averments made in Para nos. 20 to 32 of the Appeal under the heading 'Facts of the Case' refers to the actions taken by the Appellant to obtain information regarding "No development buffer zone" from multiple stage government agencies and responses obtain from the agencies, hence need no comments from this Answering Respondent.

23. That, the averments made in Para no. 33 of the Appeal under the heading 'Facts of the Case', are matter of Hon'ble Court records.

It is humbly submitted that this Answering Respondent has been arrayed as Respondent no. 2 and no specific directions were issued by the Hon'ble High Court to this Answering Respondent for compliance of various orders including the recent order, dated 06/01/2025.

24. That, the averments made in Para nos. 34 to 36 of the Appeal under the heading 'Facts of the Case' refers to the submission of application by the Project Proponent for grant of impugned Environment Clearance, decision taken in the SEAC 223rd meeting, activities undertaken by the project proponent regarding accepting bookings, advertisements etc. The same are matter of records and, hence need no comments from this Answering Respondent.

25. That, the averments made in Para no. 37 of the Appeal under the heading 'Facts of the Case', it is humbly submitted that submissions made at Para nos. 7 to 10 of this reply affidavit are re-iterated and not repeated herein for the sake of brevity.

26. That, the averments made in Para nos.38 of the Appeal under the heading 'Facts of the Case' refers to the submission of the Appellant regarding project layout plan indicating RG facilities within 500 meter buffer zone. In this regard, the submissions made by this Answering Respondent at Para nos. 7 to 10 of this reply affidavit are re-iterated and not repeated herein for the sake of brevity.

27. That, the averments made in Para nos. 39 to 41 of the Appeal under the heading 'Facts of the Case' refers to the affidavit submitted by Maharashtra Pollution Control Board (hereafter referred as MPCB) in the Appeal No. 39/2022, inspection of the facility by MPCB and reply of MPCB on the RTI application regarding "No development buffer zone". Hence, calls for no comments from this Answering Respondent.

28. That, the averments made in Para no. 42 & 43 of the Appeal under the heading 'Facts of the Case', refers to the provisions related to "No development buffer zone" in CPCB guidelines "Criteria for Hazardous Waste Landfills"; "protocol regarding development projects in Buffer Zone of Closed CHWTSDF" and "Provision of Buffer Zone around Waste Processing and Disposal Facilities"

    It is humbly submitted that submissions made at Para nos. 7 to 10 and 16 of this reply affidavit are re-iterated and not repeated herein for the sake of brevity.

29. That, the averments made in Para nos. 44 to 46 of the Appeal under the heading 'Facts of the Case' refers to the rights of the Appellant to amend, alter, add pleadings; submission that the present appeal is within limitations, hence need no comments from this Answering Respondent.

30. That, the averments made under heading "Grounds" (Para nos. A to R and U & V) are about the various Grounds for filing the present Appeal by the Appellant. It is humbly submitted that submissions made above of this reply are re-iterated and are not repeated herein for the sake of brevity.

31. That, the averments made under heading "Grounds" (Para nos. S, T & W) are about the various Grounds for filing the present Appeal by the Appellant. It is humbly submitted that the same are matter of records and needs no comments from this Answering Respondent.

32. That, no comments are offered over the averments made under the heading "Cause of Action and Limitation" and "Prayers" (Para nos. a to e).

33. That, in light of the above submissions, this Answering Respondent No. 5 i.e. CPCB shall abide by any order(s) or direction(s) passed by this Hon'ble Tribunal in the present Appeal.

Pratik D. Bharne
(Scientist 'E' & Regional Director)
Central Pollution Control Board

केंद्रीय प्रदूषण नियंत्रण बोर्ड
Central Pollution Control Board
क्षेत्रीय निदेशालय, पुणे/Regional Directorate, Pune
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
M/o Envt. Forest & Climate Change, Govt. of India
सर्वे नं. ११०, हीराबाई धनकुडे हॉल, बाणेर रोड, बाणेर, पुणे – 411045

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
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APPEAL NO. 12/2025 (WZ)

IN THE MATTER OF: -

SAMITE RAJENDRA PATIL **APPELLANT**

VERSUS

UNION OF INDIA & ORS. **RESPONDENT(S)**

AFFIDAVIT

I, Pratik D. Bharne, working as Scientist 'E' & Regional Director in Central Pollution Control Board, Regional Directorate, Survey No. 110, Hirabai Dhankude Multipurpose Hall, Baner Road, Baner, Pune, do hereby solemnly affirm, declare on oath and state as under:

1. That, the deponent is authorized representative to represent the Respondent CPCB in the present case, and as such, I am well conversant with the facts and circumstances of the present case on the basis of the information derived from the official records, and hence, I am competent and authorized to verify, sign and swear this affidavit on behalf of the Respondent CPCB.

2. That, the accompanying reply may be read part and parcel of the present affidavit as I am competent to swear this affidavit.

3. That, the contents there of are true and correct on the basis of the record maintained during ordinary course of business of CPCB and available records and documents and the contents of the same are read over and explained to me and are not repeated herein for the sake of brevity.

DEPONENT

क्षेत्रीय निदेशक / Regional Director
केंद्रीय प्रदूषण नियंत्रण बोर्ड
Central Pollution Control Board
क्षेत्रीय निदेशालय, पुणे/Regional Directorate, Pune
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
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VERIFICATION

Verified at Pune on this day 05th of March, 2025 that the contents of the above reply are correct and true on the basis of the record of the cases as mentioned in the day to day affairs of the CPCB. Nothing has been concealed therefrom or mis-stated.

DEPONENT – Respondent No. 05

क्षेत्रीय निदेशक / Regional Director
केंद्रीय प्रदूषण नियंत्रण बोर्ड
Central Pollution Control Board
क्षेत्रीय निदेशालय, पुणे/Regional Directorate, Pune
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
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Sr. No. 110, Hirabai Dhankude Hall, Baner Road, Baner, Pune-411045

COUNSEL for Respondent No. 05

NOTARY
MANISHA
SAMEER CHITNIS
PUNE (MAHARASHTRA)
REGD. NO. 7703
EXP. DATE
07/03/2025
GOVERNMENT OF INDIA

BEFORE ME

MANISHA SAMEER CHITNIS
NOTARY
GOVERNMENT OF INDIA

Noted & Registered
At.Sr.No. 135/2025

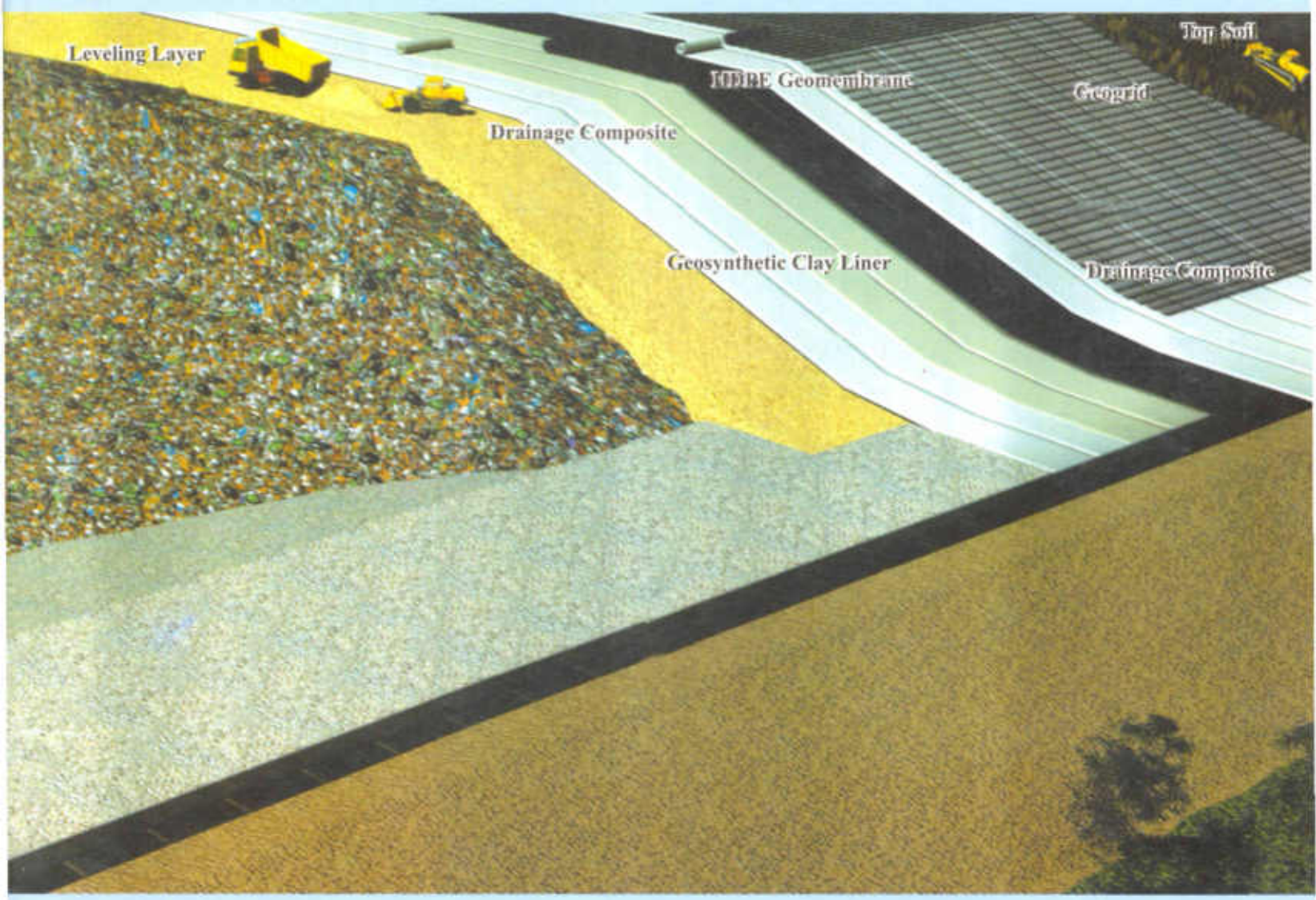
05 MAR 2025

NOTARIAL NOTARIAL NOTARIAL NOTARIAL NOTARIAL

Annexure-R5-I

Hazardous Waste Management
Series : HAZWAMS/17/2000-01

CRITERIA FOR HAZARDOUS WASTE LANDFILLS



CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT & FORESTS
e-mail : cpcb@alpha.nic.in
Website : http//envfor.nic.in/cpcb

February, 2001

Hazardous Waste Management
Series : HAZWAMS/17/2000-01

CRITERIA FOR HAZARDOUS WASTE LANDFILLS

CENTRAL POLLUTION CONTROL BOARD
(Ministry of Environment & Forests, Govt. of India)
Parivesh Bhawan, East Arjun Nager
Delhi – 110 032

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Composing & Laser Typesetting : Mohd. Javed
Printed at : M/s. Gayatri Offset Press, Noida

दिलीप विश्वास
अध्यक्ष

DILIP BISWAS
Chairman

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
(भारत सरकार का संगठन)
पर्यावरण और वन मंत्रालय
Central Pollution Control Board
(A Govt. of India Organisation)
Ministry of Environment & Forests
Phone : 2204948

FOREWORD

The Ministry of Environment & Forests, Government of India, has notified the Hazardous Waste (Management & Handling) Rules, in July 1989 under the Environment (Protection) Act, 1986. On 6th of January, 2000, major amendments to these rules with re-defined categories of hazardous wastes and harmonising them with the international laws, were notified. In order to facilitate implementation it is felt necessary to provide a set of guidelines on the Criteria for Hazardous Waste Landfills for the use of industries, implementing agencies and the general public.

The task of preparation of the guidelines was entrusted to a group comprising Prof. Manoj Datta, Indian Institute of Technology, New Delhi, Dr. D.B. Boralkar, Assistant Secretary, Central Pollution Control Board, Delhi and Ms. Sanchita Jindal, Joint Director (HSMD), Ministry of Environment & Forests, New Delhi. Useful criticism and suggestions were provided by National Productivity Council, New Delhi. The draft document was discussed and finalised by an Expert Committee under the Chairmanship of the Chairman, CPCB. The Expert Committee opined that secured disposal facilities need to be properly designed, constructed, commissioned and operated and that such facilities may not serve for the disposal of high-volume low-toxic waste. The present document provides guidance in respect of criteria for location, site selection and investigation, planning and design, waste acceptance, landfill liner system and cover, construction and operation, inspection, monitoring & record keeping, post-closure, financial assurance and contingency plan for emergencies.

This document on criteria for hazardous waste landfills has been brought out for use by implementing agencies, operators of landfills and others concerned.

(Dilip Biswas)

February, 2001

'Parivesh Bhawan', C.B.D. - cum - Office Complex, East Arjun Nagar, Delhi-110 032
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CRITERIA FOR HAZARDOUS WASTE LANDFILLS

CONTENTS

CRITERIA FOR HAZARDOUS WASTE LANDFILLS

1.0. APPLICABILITY

The criteria stated hereafter apply to owners and operators of facilities that dispose hazardous waste in landfills. The term 'hazardous waste landfill' (HW Landfill) is used to designate a waste disposal unit designed and constructed with the objective of minimum impact to the environment. This term encompasses other terms such as "secured landfill", "engineered landfill", "waste mounds", "waste piles" etc.

2.0. LOCATIONAL CRITERIA

HW Landfills shall not be located within a certain distance of the following : lakes, ponds, rivers, wetlands, flood plains, highways, habitation, critical habitat area, water supply wells, Airports, coastal zone. If it is absolutely essential to site a landfill within the restricted zone, then appropriate design measures are to be taken and prior permission from the SPCB/PCC should be obtained :

(a) Lake or Pond : No landfill shall normally be constructed within 200 m of any lake or pond. Because of concerns regarding runoff of waste contaminated water, a surface water monitoring network with approval of SPCB/PCC shall be established.

(b) River : No landfill shall be constructed within 100 m of a navigable river or stream.

(c) Flood Plain : No landfill shall be constructed within a 100 year flood plain. A landfill may be built within the flood plains of secondary streams if an embankment is built along the stream side to avoid flooding of the area. However, landfills must not be built within the flood plains of major rivers unless properly designed protection embankments are constructed around the landfills.

(d) Highway : No landfill shall be constructed within 500 m of the right of way of any state or national highway.

(e) Habitation : A landfill site shall be atleast 500 m from a notified habitated area. A zone of 500 m around a landfill boundary should be declared a no-development buffer zone after the landfill location is finalised.

(f) Public parks : No landfill shall be constructed within 500 m of a public park.

(g) Critical Habitat Area : No landfill shall be constructed within critical habitat areas including reserved forest areas. A critical habitat area is defined as the area in which one or more endangered species live. It is sometimes difficult to identify a critical habitat area. If there is any doubt then the SPCB/PCC shall be consulted for clarification.

(h) Wetlands : No landfill shall be constructed within wetlands. It is often difficult to identify a wetland area. Maps may be available for some wetlands, but in many cases such maps are absent or are incorrect. If there is any doubt, then the SPCB/PCC shall be consulted for clarification.

(i) Airports : No landfill shall be constructed within a zone around Airports as notified by the regulatory authority or the aviation authority.

(j) Water Supply Well : No landfill shall be constructed within 500 m of any water supply well.

(k) Coastal Regulation Zone : No landfill shall be sited in a coastal regulation zone.

(l) Ground water table level : No landfill shall be located in areas where the ground water table will be less than 2 m below the base of the landfill.

(m) Other criteria may be decided by the planners in consultation with SPCB/PCC commensurate with specific local requirements such as presence of monuments, religious structures etc.

3.0. SITE SELECTION

Hazardous waste landfills should preferably be located in areas of low population density, low alternative land use value, low ground water contamination potential and at sites having high clay content in the subsoil.

A HW landfill will be selected following the guidelines published by MoEF The step by step procedure will be as follows :

(i) Earmarking a 'search area' taking into account the location of the waste generation units and a 'search radius' (typically 5 to 250 km). The search area will be so chosen that it minimises the number of HW landfills in any region or state.

(ii) Identification of a list of potential sites on the basis of:
(a) availability of land
(b) collection of preliminary data
(c) restrictions listed in the locational criteria (section 2.0).

(iii) Collection of preliminary data as follows :

(a) Topographic Maps : A topographic map will help find sites that are not on natural surface water drains or flood plains. Topographical maps may be procured from Survey of India.

(b) Soil Maps : These maps, primarily meant for agricultural use, will show the types of soil near the surface. They are of limited use as they do not show types of soil a few metre below the surface. They may be procured from Indian Agricultural Research Institute.

(c) Land Use Plans : These plans are useful in delineating areas with definite zoning restrictions. There may be restrictions on the use of agricultural land or on the use of forest land for landfill purposes. Such maps are available with the Town Planning Authority or the Municipality.

(d) Transportation Maps : These maps, which indicate roads and railways and locations of airports, are used to determine the transportation needs in developing a site.

(e) Water Use Plans : Such maps are usually not readily available. A plan indicating the following items should be developed : private and public tubewells indicating the capacity of each well, major and minor drinking water supply line(s), water intake wells located on surface water bodies, and open wells.

(f) Flood Plain Maps : These maps are used to delineate areas that are within a 100 year flood plain. Landfill siting must be avoided within the flood plains of major rivers.

(g) Geologic Maps : These maps will indicate geologic features and bedrock levels. A general idea about soil type can be developed from a geological map. Such maps can be procured from Geological Survey of India.

(h) Aerial Photographs / Satellite Imagery : Aerial photographs or satellite imageries may not exist for the entire search area. However such information may prove to be extremely helpful. Surface features such as small lakes, intermittent stream beds and current land use, which may not have been identified in earlier map searches, can be easily identified using aerial photographs.

(i) Ground Water Maps : Ground water contour maps are available in various regions which indicate the depth to ground water below the land surface as well as regional

ground water flow patterns. Such maps should be collected from Ground water Boards or Minor Irrigation Tubewell Corporations.

(j) Rainfall Data : The monthly rainfall data for the region should be collected from the Indian Meteorological Department.

(k) Wind Map : The predominant wind direction and velocities should be collected from the Indian Meteorological Department.

(l) Seismic Data : The seismic activity of a region is an important input in the design of landfills. Seismic coefficients are earmarked for various seismic zones and these can be obtained from the relevant BIS code or from the Indian Meteorological Department.

(m) Site Walk Over and Establishment of Ground Truths : A site reconnaissance will be conducted by a site walk-over as a part of the preliminary data collection. All features observed in various maps will be confirmed. Additional information pertaining to the following will be ascertained from nearby inhabitants : (a) flooding during monsoons; (b) soil type; (c) depth to G.W. table (as observed in open wells or tube wells); (d) quality of groundwater and (e) depth to bedrock.

(n) Preliminary Boreholes and Geophysical Investigation : At each site, as a part of preliminary data collection, one to two boreholes will be drilled and samples collected at every 1.5m interval to a depth of 20m below the ground surface. The following information will be obtained : (i) soil type and stratification; (ii) permeability of each strata; (iii) strength and compressibility parameters (optional); (iv) ground water level and quality and (v) depth to bedrock. In addition to preliminary boreholes, geophysical investigations (electrical resistivity/seismic refraction/others) may be undertaken to assess the quality of bedrock at different sites.

(iv) Selection of two best ranked sites from amongst the list of potential sites on the basis of the ranking system stipulated by MoEF (1991).

(v) Environmental Impact Assessment for the two sites for the following parameters :

(a) ground water quality; (b) surface water quality; (c) air quality - gases, dust, litter, odour; (d) land use alteration; (e) drainage alteration; (f) soil erosion; (g) ecological

impacts (h) noise; (i) aesthetics - visual, vermin, flies; (j) traffic alteration; and (k) others.

(vi) Assessment of public perception for the two sites.

(vii) Selection of final site.

(viii) The above site selection procedure shall not be applicable for location of facility within industrial areas of State Industrial Development Agencies. However EIA requirement will apply.

4.0. SITE INVESTIGATION CRITERIA

The data collected during site selection is not sufficient for landfill design. To be able to undertake detailed design of a landfill at a selected site, it is essential to characterise the landfill site and evaluate the parameters required for design. It is necessary that all data listed in Section 3.0 (iii) on "preliminary data" be collected for site characterisation. If some data has not be collected, the same should be obtained before site investigations are undertaken for site characterisation. The following additional data will be collected through a detailed site investigation programme at the chosen site.

A detailed site investigation programme will comprise of subsoil investigation, ground water/hydrogeological investigation, hydrological investigation, topographical investigation and geological investigation. The output expected from each investigation is listed below :

(a) Subsoil Investigation : A detailed investigation plan may be drawn up in consultation with a geotechnical engineer. The output from such an investigation should yield the following :

(i) Stratification of subsoil - type of soil and depth

(ii) Depth to ground water table and bedrock (if located within 15m of base of landfill)

(iii) Permeability of various strata beneath the landfill.

(iv) Strength and compressibility properties of subsoil

(v) Extent of availability of liner material, drainage material, top soil and protective soil in adjacent borrow areas.

(vi) Subsoil properties along approach road.

A minimum of 3 boreholes per hectare of landfill area upto 15m beneath the base of the landfill shall be drilled and insitu tests as well as laboratory tests shall be performed for permeability, strength, compressibility and classification of soils. In addition, test pits and boreholes should be drilled at borrow area for liner and cover materials as well as along approach road.

(b) Ground Water / Hydrogeological Investigation : A detailed investigation plan may be drawn up in consultation with a ground water specialist or a hydrogeologist. The output from such an investigation should yield the following :

(i) Depth to groundwater table and its seasonal variations.

(ii) Ground water flow direction

(iii) Baseline ground water quality parameters - all drinking water quality parameters.

(c) Topographical Investigation : Construction of a landfill involves a large quantity of earthwork. It is essential to have an accurate topographical map of the landfill site to compute earthwork qauntities precisely. A map of 0.3m contour interval is considered desirable.

(d) Hydrological Investigation : The objective of a hydrological investigation is to estimate the quantity of surface runoff that may be generated within the landfill to enable appropriate design of drainage facilities. If additional run off from areas external to the landfill is likely to enter the landfill, this quantity should also be estimated to design interception ditches and diversion channels. Such an investigation shall yield estimates of peak flows. If seasonal rivers or streams run close to the site, hydrological investigation should indicate the possibility of flooding of the site under one in 100 year flood flows. Surface water samples for water quality analysis may be collected from during hydrological studies.

(e) Geological Investigation and Seismic Investigation : Geological investigations shall delineate the bedrock profile beneath the landfill base, if not confirmed by subsoil investigations. Geophysical surveys may be designed in consultation with a geologist. In hilly areas or in quarried rocks, geological investigations should indicate the quality of surficial rock, depth to sound rock and the possibility of interconnected aquifers beneath the landfill base in the rock mass. Detailed seismic data may be obtained as a part of geological investigations (if required) in seismically active areas.

5.0. PLANNING AND DESIGN CRITERIA

5.1. Essential Components :

A HW landfill shall have the following seven essential components :

(a) A liner system at the base and sides of the landfill which prevents migration of leachate or gas to the surrounding soil.

(b) A leachate collection and treatment facility, which collects and extracts leachate from within and from the base of the landfill and then treats the leachate to meet standards, notified under E(P)Act 1986.

(c) A gas collection and treatment facility (optional) which collects and extracts gas from within and from the top of the landfill and then treats it or uses it for energy recovery.

(d) A final cover system at the top of the landfill, which enhances surface drainage, prevents infiltration of water and supports surface vegetation.

(e) A surface water drainage system, which collects and removes all surface runoff from the landfill site.

(f) An environmental monitoring system which periodically collects and analyses air, surface water, soil-gas (optional) and ground water samples around the landfill site.

(g) A closure and post-closure plan which lists the steps that must be taken to close and secure a landfill site once the filling operation has been completed and the activities for long-term monitoring, operation and maintenance of the completed landfill.

5.2. Design life

A landfill design life will comprise of an 'active' period and an 'closure and post-closure' period. The 'active' period shall comprise of the period for which waste filing is in progress at the landfill and typically range from 10 to 25 years depending on the availability of land area. The 'closure and post-closure' period for which a landfill will be monitored and maintained shall be 30 years after the 'active period' is completed.

5.3. Waste Volume, Waste Compatibility and Landfill Capacity

The volume of waste to be placed in a landfill will be computed for the active' period of the landfill taking into account (a) the current generation of waste per annum and (b) the anticipated increase in rate of waste generation on the basis of past records.

A landfill will comprise of separate 'units'. In each unit, only compatible wastes will be disposed. Table 1 gives guidelines regarding compatibility of wastes. Incompatible wastes will be stored in separate units.

The actual capacity of each landfill unit will be computed taking into account the volume occupied by the liner system and the cover material [daily/weekily (optional) intermediate and final cover] as well as the compacted density of the waste. In addition, the amount of settlement a

waste will undergo due to overburden stress and due to bio-degradation (if any) shall also be taken into account.

The total landfill area should be computed on the basis of the designed height of the landfill (usually between 5 to 20m). Approximately 15 to 20% area more than the area required for landfilling should be adopted to accommodate all infrastructure and support facilities as well as to allow the formation of a green belt around the landfill. This additional area shall be computed separately and may be as high as 30% of the total area in case of small to medium landfills. The total landfill area is computed on trial and error basis.

There is no standard method for classifying landfills by their capacity. However the following nomenclature is often observed in literature :

Small size landfill	:	less than 5 hectare area
Medium size landfill	:	5 to 20 hectare areas
Large size landfill	:	greater than 20 hectare area.

5.4. Landfill Layout

A landfill site will comprise of the area in which the waste will be filled as well as additional area for support facilities. The area in which waste is to be filled may comprise of separate landfill units with each unit, accommodating a group of compatible wastes. Within each unit work may proceed in phases with only a part of the area under active operation. A typical site layout is shown in Fig.1. Such a layout must be prepared for all landfills. The following facilities must be located in the layout: (a) access roads; (b) equipment shelters; (c) weighing scales; (d) office space; (e) location of waste inspection facility (if used); (f) temporary waste storage and/or disposal sites for special wastes; (g) demarcation of the landfill areas and areas for stockpiling cover material and liner material; (h) location of surface water drainage facilities; (i) location of landfill leachate management facilities; (j) location of gas management facilities (optional); (k) location of monitoring wells/environmental monitoring facilities, (l) fencing and green belt along the peripheral boundary and (m) emergency exit.

It is essential that for each landfill site, a layout be designed incorporating the above mentioned facilities.

5.5. Landfill Section

Landfills may have different types of sections depending on the topography of the area. The landfills may take the following forms : (a) above ground landfills; (b) below ground landfill; (c) slope landfills; (d) valley landfills (canyon landfills); and (e) a combination of the above. Fig.2 shows some typical landfill sections.

It is recommended that the landfill section be arrived at keeping in view the topography, depth to water table and availability of liner and cover material. Above ground landfills shall be preferred to below ground landfills, as leachate collection in the former is by gravity flow and does not require the use of pumps.

Slope landfills and valley landfills are normally adopted in hilly areas; above-ground landfills in flat undulating ground and below-ground landfills in low-lying areas, depressions or pits.

5.6. Phased Operation

Before the main design of a landfill can be undertaken it is important to develop the operating methodology. A landfill is operated in phases because it allows the progressive use of the landfill area, such that at any given time a part of the site may have a final cover, a part being actively filled, a part being prepared to receive waste, and a part undisturbed.

For each landfill unit, a phased operation plan will be drawn up.

The term 'phase' describes a sub-area of the landfill. A 'phase' consists of cells, lifts, daily/weekly (optional) or intermediate cover, liner and leachate collection facility, gas control facility (optional) and final cover over the sub-area (Fig.3).

Each phase is typically designed for a period of 12 months. Phases are generally filled from the base to the final/intermediate cover and capped within this period leaving a temporary unrestored sloping face. Fig.4 shows a simplified sequence of phased operation.

A 'phase plan' shall be drawn up for the active life of the landfill as soon as the landfill layout and section are finalised. It must be ensured that each phase reaches the final cover/intermediate cover level at the end of its construction period and that it is capped before the onset of monsoons.

During the monsoon months the waste may stockpiled in a temporary holding areas (covered with roof). During this period and the landfill may be kept capped with the final cover/intermediate cover and landfilling operations suspended to reduce infiltration of rain water into the landfill. However, if the incoming waste quantity is too large for temporary stockpiling or the monsoon period lasts for a long period, special phases may have to be designed with high leachate handling capacity and special operating procedures adopted.

5.7. Estimation of Leachate Quantity

Leachate is generated on account of the infiltration of water into landfills and its percolation through waste as well as by the squeezing of the waste due to self weight. The quantity of leachate generated in a landfill

is strongly dependent on the quantity of infiltrating water. This, in turn, is dependent on weather and operational practices. The amount of rain falling on a landfill, to a large extent, controls the leachate quantity generated. Precipitation depends on geographical location.

Significant quantity of leachate is produced from the 'active' phases of a landfill under operation. The leachate quantity from those portions of a landfill which have received a final cover is minimal. Fig. 5 shows the components of a water balance approach for estimating leachate quantity.

For design, computer simulated models (e.g. HELP) have to be used for estimation of leachate quantity generation. It is recommended that such studies be conducted to estimate the quantity of leachate and design the leachate drainage, collection and removal facility.

5.8. Liner System

Leachate control within a landfill involves the following steps : (a) prevention of migration of leachate from landfill sides and landfill base to the subsoil by a suitable liner system; and (b) drainage of leachate collected at the base of a landfill to the side of the landfill and removal of the leachate from within the landfill.

On a basis of review of liner systems adopted in different countries and in consideration with Indian conditions, it is recommended that for all HW landfills the liner system criteria listed in Section 7.0 be adopted in consultation with SPCB/PCC and commensurate with local area specified needs.

5.9. Leachate Drainage, Collection and Removal

A leachate collection system shall be designed at the base of all landfills. It shall comprise of a drainage layer, a perforated pipe collection system, sump collection area, and a removal system.

The leachate collection layer (drainage layer) will usually be a 30 cm thick sand-gravel layer with a slope of 2% or higher and a permeability of greater than 10^{-2} cm/sec (10^{-4} m/sec). A system of perforated pipes and sumps is provided within the drainage layer. The pipe spacing will be governed by the requirement that the leachate head shall not be greater than the drainage layer thickness. Fig. 6 shows a typical layout of pipes and sumps.

Leachate will be removed from the landfill (Fig. 7) by (a) pumping in vertical wells or chimneys (b) pumping in side slope risers, or (c) by gravity drains through the base of a landfill in above-ground and sloped landfills. Side slope risers may be preferred to vertical wells to avoid any down drag problems. Submersible pumps have been used for pumping for several years; educator pumps are also being increasingly used. The

leachate may be stored in a holding tank (for a few days) before being sent for treatment.

The design of following components should be undertaken :

(a) leachate pipe and leachate trench network

(b) leachate sumps and pumps

(c) leachate wells/side slope riser

(d) leachate holding tank

(e) backwashing/backflushing arrangement to prevent clogging/ choking/headloss.

The material used for pipes etc., should be such that it is not affected by the leachate quality.

5.10. Leachate Management

The following alternatives shall be considered for leachate management :

(a) Offsite treatment of leachate : This involves storage, pretreatment and transportation of leachate to off-site facilities not associated with the landfill e.g. industrial effluent treatment facility etc. This will be feasible where offsite facilities are available at a reasonable distance and where pretreatment requirements for the leachate (such as adjustment of pH, reduction in concentration etc.) are not very stringent. Transportation of leachate to offsite facility will be undertaken through a manifest system in accordance with HWM rules of MoEF.

(b) Onsite treatment of leachate : This involves complete treatment of the leachate at the landfill site to meet discharge standards for lined drains. Treatment processes may be biological, chemical or physical processes. Processes, which have been judged as having been "demonstrated", should be adopted.

(c) Recirculation : One of the methods for treatment of leachate is to recirculate it through the landfill. This has two beneficial effects : (i) the process of landfill stabilisation is accelerated and (ii) the constituents of the leachate are attenuated by the biological, chemical and physical changes occurring with the landfill. Recirculation of a leachate requires the design of a distribution system to ensure that the leachate passes uniformly throughout the entire waste. Leachate recirculation has been used in some municipal wasie landfills. Information on its efficacy in HW landfills is scanty.

5.11. Gaseous Emissions Management

Landfill gas is generated as a product of waste biodegration or on account of presence of VOCs in the waste. Gas generation can be reduced or eliminated by avoiding disposal of biodegradable/organic wastes. For HW landfills where gaseous emissions are anticipated (as in the case of mixed waste having biodegradable components), the gas management strategy shall be (a) controlled passive venting or (b) controlled collection and treatment/reuse.

5.12. Final Cover System

A final landfill cover, comprising of several layers, each with a specific function shall be installed after each landfill phase reaches the full height. The final cover system shall enhance surface drainage, minimise infiltration, support vegetation to prevent erosion and control the release of landfill gases. On the basis of a review of HW landfill covers adopted in different countries [#] and in consideration with Indian Conditions the cover system criteria listed in Section 7.0 be adopted in consultation with SPCB/PCC and commensurate with local area specified needs.

5.13. Surface Water Drainage System

Surface water management is required to ensure that rainwater run-off does not drain into the waste from surrounding areas and that there is no waterlogging/ponding on covers of landfills. A surface water drainage system comprising of channels, drains, culverts and basins (Fig.8) shall be designed to ensure the following :

(a) Rainwater running off slopes above and outside the landfill area shall be intercepted and channelled to water courses without entering the operational area of the site. This diversion channel may require a low permeability lining to prevent leakage into the landfill.

(b) Rain falling on active tipping areas shall be collected separately and managed as leachate, via the leachate collection drain and leachate collection sumps to the leachate treatment and disposal system.

(c) Rainfall on areas within the landfill site, but on final covers of phases which have been completed and are not actively being used for waste disposal shall be diverted in drainage channels away from active tipping areas, and directed through a settling pond to remove suspended silt, prior to discharge.

(d) Any drainage channels or drains constructed on the restored landfill surface shall be able to accommodate settlement, resist erosion and cope with localised storm conditions.

(e) The horizontal surface of the final cover shall be provided a slope of 3 to 5% for proper surface water drainage. The slope of the cover on the sides will be higher and governed by slope stability considerations.

(f) All interceptor channels, drainage channels and settling ponds (storm water basins) shall be designed by a hydrologist using hydrometerological data.

(g) It shall be ensured that water collected by surface water drainage system and leachate collected by the leachate collection system do not get intermixed at any stage of collection or storage. This shall apply to the 'active' and 'post closure' periods of the landfill.

The design of following components shall be undertaken :

(a) stormwater drains, diversion channel
(b) stormwater basin
(c) culverts

5.14. Base stability, Slope stability and Seismic Aspects

For landfills constructed on loose/soft soil, the base will be checked for stability against bearing failure or excessive settlements.

The stability of side slopes of a landfill shall be checked for the following cases (Fig. 9).

(a) stability of excavated slopes
(b) stability of liner system along excavated slopes
(c) stability of temporary waste slopes constructed to their full height (usually at the end of a phase)
(d) stability of slopes of above-ground portion of completed landfills
(e) stability of cover systems in above ground landfills.

The stability analysis shall be conducted using the following soil mechanics methods depending upon the shape of the failure surface : (a) failure surface parallel to slope; (b) wedge method of analysis; (c) method of slices for circular failure surface and (d) special methods for stability of anchored geomembranes along slopes.

In preliminary design of a landfill section, the following slopes may be adopted.

(a) Excavated soil slopes	(2.5 horizontal : 1 vertical)
(b) Temporary waste slopes	(3.0 horizontal : 1 vertical)
(c) Final cover slopes	(4.0 horizontal : 1 vertical)

Slopes can be made steeper, if found stable by stability analysis results. Acceptable factors of safety may be taken as 1.3 for temporary slopes and 1.5 for permanent slopes. In earthquake prone areas, the stability of all landfill slopes shall be conducted taking into account seismic coefficients as recommended by BIS codes.

5.15. Materials Balance

A materials balance shall be prepared for each material required for construction of a landfill, phase-by-phase, indicating materials required, materials available and deficient material to be imprоted or surplus material to be exported. If a borrow area is located within the landfill site it shall not become a part of an early phase to avoid stockpiling and double handling.

5.16. Site Infranstructure

The following site infrastructure shall be provided at each HW landfill :

(a) Site Entrance and Fencing
(b) Administrative and Site Control Offices
(c) Access Roads
(d) Waste Inspection and Sampling Facility
(e) Equipment Workshops and Garages
(f) Signs and Directions
(g) Water Supply
(h) Lighting
(i) Vehicle Cleaning Facility
(j) Fire Fighting Equipment.

Site entrance infrastructure should include :

(a) A permanent, wide, entrance road with separate entry and exit lanes and gates
(b) Sufficient length/parking space inside the entrance gate till the weighbridge to prevent queuing of vehicles outside the entrance gate and on to the highway.
(c) A properly landscaped entrance area with a green belt of 20m containing tree plantation for good visual impact.
(d) Proper direction signs and lighting at the entrance gate
(e) A perimeter fencing of atleast 2m height all around the landfill site with lockable gates to prevent unauthorised access.
(f) Full time security guard at the site.

An accurate record of waste inputs is essential, hence good quality weighbridges shall be used. For sites receiving more than 400 tons per day of waste, twin weighbridges to weigh both entry and exit weights may be located on either side of an island on which a weighbridge office room

is located. The weighbridge office should be elevated and the weighbridge operator should be able to see entering vehicles as well as speak to drivers.

Administrative and site control offices should include : administrative office building (permanent); site control office (portable) near the active landfill area; stores (permanent) within or near administrative office; welfare facilities - toilets, shower room, first aid room, mess room, small temporary accommodation; infrastructural services - electricity, drinking water supply, telephone, sewerage and drainage system and communication services (telephone etc.) between site control office and administrative office and weighbridge office.

5.17. Environmental Monitoring System

Monitoring at a landfill site (Fig. 10) shall be carried out in four zones (a) on and within the landfill; (b) in the unsaturated subsurface zone (vadose zone) beneath and around the landfill; (c) in the groundwater (saturated) zone beneath and around the landfill and (d) in the atmosphere/local air above and around the landfill.

The parameters to be monitored regularly are :

(a) long-term movements of the landfill cover;
(b) leachate head within the landfill;
(c) leachate quality within the landfill;
(d) gas quality (optional) within the landfill;
(e) quality of pore fluid in the vadose zone;
(f) quality of pore gas (optional) in the vadose zone;
(g) quality of groundwater in the saturated zones and
(h) air quality above the landfill, at the gas control facilities, at buildings on or near the landfill and along any preferential migration paths.

The indicators of leachate quality and landfill gas quality must be decided after conducting a study relating to the type of the waste, the probable composition of leachate and gas likely to be generated and the geotechnical as well as hydro-geological features of the area.

A monitoring programme must specify (i) a properly selected offsite testing laboratory capable of measuring the constituents at current detection levels (ii) a methodology for acquiring and storing data; and (iii) a statistical procedure for analyses of the data.

The following instruments/equipment shall be used for monitoring :

(a) Groundwater samplers for groundwater monitoring wells.
(b) Leachate samplers for leachate monitoring within the landfill and at the leachate tank.

(c) Vacuum lysimeters, filter tip samplers, free drainage samplers for leakage detection beneath landfill liners.
(d) Surface water samplers for collection of sample from sedimentation basin.
(e) Downhole water quality sensors for measuring conductivity, pH, DO, temperature in leachate wells, groundwater wells and sedimentation basins.
(f) Landfill gas monitors (portable) for onsite monitoring of landfill gases.
(g) Active and passive air samplers for monitoring ambient air quality.

It is recomemended that the location of each type of instrument/equipment be finaised in conjunction with an expert on the basis of the topography of the area and the layout of the landfill. A minimum of 4 sets of ground water monitoring wells (one up-gradient and three down gradient) for sampling in each acquifer are considered desirable at each landfill site (Fig.11).

5.18. Closure and Post-Closure Maintenance Plan

A statement on the end-use of landfill site is an essential part of the plan for landfill closure and post-closure maintenance. Some possible uses of closed landfill sites near urban centres include parking area, recreational area etc. A closed landfill should be aesthetically landscaped.

A closure and post-closure plan for HW landfills must be evolved and should indicate the following components :

- Plan for vegetative stabilization of the final landfill cover and side slopes
- Plan for management of surface water run-off with an effective drainage system.
- Plan for periodical inspection and maintenance of landfill cover and facilities.
- Plan for post-closure management of leachate and gas
- Plan for post-closure environment monitoring.

6.0. WASTE ACCEPTANCE CRITERIA

A waste acceptance criterion shall be formulated for each landfill site. The following guidelines for waste acceptance are suggested :

(a) All waste shall be routinely accepted if the truck/tipper carries authorised documents indicating the source and type of waste. Such waste shall be routinely inspected visually at the tipping area in the landfill site.

(b) Bulk or non-containerised liquid hazardous waste or slurry-type hazardous waste containing free liquid or waste sludge, which has not been dewatered, shall not be placed in landfills. Such waste, (usually transported in pipelines) shall be placed in Hazardous Waste Impoundments designed specifically for liquid hazardous waste.

(c) Incinerable/compostable waste or any other type of waste from which energy/material recovery is feasible, shall not be placed in HW landfills.

(d) Incompatible wastes shall not be placed in the same landfill unit. Compatible wastes will be grouped together and placed in the same landfill unit (each such unit shall have its own phase, cells etc). Incompatible waste group shall be accommodated in separate landfill units (each such unit shall have its own phases, cells etc).

(e) Wastes which are incompatible with the liner material shall either be containerised and placed in the landfill (ensuring adequate container safety, or placed in a separate landfill unit made of alternate compatible liner material).

(f) Extremely hazardous waste (e.g. radioactive waste) shall not be disposed off in HW landfills but in specially designed waste disposal units.

(g) Non-hazardous waste (e.g. municipal solid waste) shall not be deposited in HW landfills. However such waste can be deposited in a MSW landfill units in the vicinity of HW landfills.

(h) Residue of treated biomedical waste (e.g. incinerator ash etc) can be deposited in HW landfills.

7.0. LANDFILL LINER AND COVER CRITERIA

7.1 Liner Criteria

The liner system shall be designed, constructed and installed to satisfy the following:

(a) Prevent migration of waste, leachate or gas to the adjacent subsurface soil or ground water or surface water.
(b) Constructed of materials that have adequate chemical properties, physical properties and engineering properties to prevent failure on account of loads, climatic conditions, and contact with waste or leachate.
(c) Placed in a stable manner on the base and side slopes.
(d) Installed to cover all surrounding soils likely to come in contact with the waste or leachate.

The base of the liner system (at the lowest point in a landfill) shall be atleast 2.0 meter above the highest anticipated ground water table level.

7.1.1. Minimum Specifications

The liner system shall be designed specifically for each site to meet the criteria stated in Section 7.1.

The liner system must include the following components. However, depending on the design requirements, the number of components as well as the specifications of the components can exceed the minimum specifications listed below. The components listed below are waste downwards (Fig. 12).

(a) A leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec.).

(b) A single composite liner comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and

(ii) A compacted clay (or compacted amended soil) layer of thickness 150 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permability.

In regions where rainfall is high and/or subsoil is highly permeable (e.g. gravel, sand, silty sand) and/or the water table is within 2.0 m to 6.0 m beneath the base of the landfill, the liner system shall be a double composite liner and shall include the following components, waste downwards (Fig. 13) :

(a) A primary leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).

(b) A primary composite liner comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and

(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 (10^{-9} m/sec) or less.

(c) A secondary leachate collection layer (also called leak detection layer) of thickness 30 cm or more and coefficient of permeability in excess of 10^{-3} cm/sec (10^{-5} m/sec).

(d) A secondary composite liner comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and
(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 (10^{-9} m/sec) or less.

**Specification : [The geomembrane must have (a) Tensile Strength at yield > 18 kN/m, (b) Tensile Strength at break > 30 kN/m, (c) Tear Resistance > 150 N and (d) Puncture Resistance > 250 N].*

The liner materials listed above can be substituted by equivalent materials only if the following is satisfied :

(a) the liner system components continue to function as 'composite' liners; and
(b) the use of such components has been demonstrated over a 10 year period in different HW landfill and approved by a regulatory agency
(c) the design, construction and quality control specifications of such materials have been approved by a regulatory agency and are available for implementation.

For extremely hazardous waste, the number of composite liner layers shall, if necessary, exceed two and these will be finalised by the design engineer in consultation with SPCB/PCC as per site specific conditions.

7.1.2. Design Requirements

The liner system shall meet the following design requirements :

(a) Requirement of adequate stability at the base of the landfill (in soft soil)
(b) Requirement of adequate stability along the sides of the landfill
(c) Requirement of adequate strength to withstand construction loads/vehicle loads
(d) Requirement of permeability and material properties as specified in Section 7.1.1.
(e) Requirement of compatibility with leachate and waste
(f) Requirement of transition filters between waste and leachate collection layer to prevent clogging of the leachate collection layer.

(g) Requirement of protection layer/transition layer between each component of the liner system (A protection layer between a leachate collection layer and the HDPE geomembrane may sometimes be required if coarse/angular sand or gravel is used in the leachate collection layer. The protection layer may comprise of silt/local earth (15cm thick or a geotextile).

(h) Requirement of adequacy of clay additive in amended soils.

Guidelines for design are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.1.3. Construction Requirements

The liner system shall be constructed to ensure that :

(a) the compacted clay (or compacted amended soil) layer has a co-efficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less, is devoid of clods and shrinkage cracks; and achieves the desired strength.

(b) the geomembranes is laid in intimate contact with the compacted clay/compacted amended soil layer; is properly joined/welded at the seams; and is not punctured by construction vehicles/tools

(c) the leachate collection layer has a coefficient of permeability of 10^{-2} cm/sec (10^{-4} m/sec) or more and does not become clogged by intermixing or migration of fine particles.

On side slopes, the horizontal width of the 150 cm thick clay liner will normally exceed 300 cm and the clay can be compacted in horizontal layers using standard compaction equipment or in inclined layers using slope compactors.

Guidelines for construction are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.1.4. Quality Control

A quality assurance programme shall be drawn up by the owner/operator during construction of the liner system. Such a programme will include :

(a) Regular performance of quality assurance test in the field for each component of the liner system – one set of field and laboratory tests for each soil component per 500 to 1000 cubic meters of earthwork and one set of field and laboratory tests for the geomembrane per 200 sq.m. of installed area.

(b) Approval by the regulatory authority of the lists of tests, their frequency and the acceptance criteria.

(c) Periodical visits by representatives of the regulatory authority (or their nominee) during construction of the liner.

(d) Complete documentation of all quality control records and their submission to the SPCB/PCC alongwith statistical analysis showing satisfactory achievement of acceptance criteria.

The quality control tests for compacted clay layer (or amended soils) as well as the leachate collection/drainage layer shall include (i) in-situ density tests, (ii) in-situ moisture content tests, (iii) compaction tests, (iv) permeability tests, (iv) grain size distribution tests and (v) Atterberg's limits tests (vi) others.

The quality control tests for geomembrane liners shall include (i) thickness tests, (ii) density tests, (iii) strength tests, (iv) toughness tests, (v) durability tests, (vi) chemical resistance tests, (vii) field seam strength tests, (viii) overlap check tests, (ix) others.

Guidelines for quality control are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2. Cover Criteria

The cover system shall be designed, constructed and installed to satisfy the following :

(a) Prevent infiltration of precipitation into the closed landfill.
(b) Promote drainage of surface water accumulated on the cover.
(c) Minimise erosion of the cover.
(d) Withstand or accommodate settlement of the cover to maintain its integrity
(e) Have a permeability less than or equal to the liner system
(f) Function with minimum maintenance for the post-closure period of 30 years.

7.2.1. Minimum Specifications

The cover system shall be designed specifically for each site to meet the criteria stated in Section 7.2.

The cover system must include the following components. However, depending on design requirements, the number of components as well as the specification of the components shall exceed the minimum specifications listed below. The components listed below are from top surface downwards to the waste (Fig. 14).

(a) A surface soil layer of local top soil which supports self-sustaining vegetation and which has a thickness not less than 60 cm.

(b) A drainage layer of thickness 30 cm or more having a coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).

(c) A single composite barrier comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more and
(ii) A compacted clay (or compacted amended soil) layer of thickness 60 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permeability.

(d) A regulatory layer (optional) of thickness 30 cm having coefficient of permeability greater than 10^{-2} cm/sec (10^{-4} m/sec). Such a layer shall be provided whenever there is requirement of (i) gas collection or (ii) transition filter between waste and soil.

The drainage layer shall be replaced by the local top soil, if the coefficient of permeability of the local top soil is greater than 10^{-4} cm/sec. In such a case the total thickness of the surface soil layer (of top soil) will be 90 cm.

In dry arid regions, where self sustaining vegetation is not possible, special erosion control measures shall be adopted for the stability for the cover soil layer.

The cover materials listed above can be substituted by equivalent materials if the following is satisfied :

(a) the use of such components has been demonstrated over a 10 year period in different HW landfills and approved by aregulatory agency or SPCB/PCC.
(b) the design, construction and quality control specifications of such materials have been approved by a regulatory agency or SPCB/PCC and are available for implementation.

7.2.2. Design Requirements

The cover system shall meet the following design requirements:

(a) Requirement of stability/integrity of cover under settlement through design/maintenance/repair.
(b) Requirement of stability of steep side slopes of cover
(c) Requirement of establishment of self-sustaining vegetative cover for long-term stabilisation/or special measures in dry arid regions.
(d) Requirement of adequate strength to withstand construction loads/vehicle loads.
(e) Requirement of permeability and material properties as specified in Section 7.2.1.

(f) Requirement of surface water drainage as specified in Section 5.13.
(g) Requirement of transition filter between waste and the layer immediately above it.
(h) Requirement of protection layer/transition layer between each component of the liner system.

Guidelines for design are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2.3. Construction Requirements

The cover system shall be constructed to ensure that

(a) the surface soil layer is adequately compacted and prepared to allow vegetative growth.
(b) the compacted clay/compacted amended soil layer has a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less; is devoid of clods and shrinkage cracks; and achieves the desired strength.
(c) the geomembranes is laid in intimate contact with the compacted clay/compacted amended soil layer; is properly joined/welded at the seams; and is not punctured by construction vehicles/tools.
(d) the drainage layer has a coefficient of permeability of 10^{-2} cm/sec (10^{-4} m/sec) or more and does not become clogged by intermixing or migration of fine particles.
(e) the final cover slopes are as specified in section 5.13.

Guidelines for construction are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2.4. Quality Control

A quality assurance programme shall be drawn up by the owner/operator during construction of the cover system. Such a programme shall include :

(a) Regular performance of quality assurance tests in the field for each component of the cover system – one set of field and laboratory tests for each soil component per 500 to 1000 cubic meters of earthwork and one set of field and laboratory tests for the geomembrane per 200 sq.m. of installed area.
(b) Approval by the regulatory authority of the lists of tests, their frequency and the acceptance criteria.
(c) Periodical visits by representative of SPCB/PCC (or their nominee) during construction of the cover
(d) Complete documentation of all quality control records and their submission to the SPCB/PCC alongwith statistical analysis showing satisfactory achievement of acceptance criteria.

The type of quality control tests for the drainage layers, compacted clay layer and geomembrane shall be the same as those indicated in Section 7.1.4. for the liner system.

Guidelines for quality control are indicated in "Manual for Design, Construction & Quality of Liners & Covers" (to be prepared).

8.0. Construction and operational criteria

The construction and operation of a landfill shall consist of the following steps :

(a) Site Development
(b) Phase Development
(c) Phase Operation
(d) Phase Closure
(e) Landfill Closure
(f) Post-closure vegetative stabilisation

8.1. Site Development

The following construction activities shall be undertaken during site development :

(a) Construction of perimeter fence, entrance gate, and green belt
(b) Construction of main access road near the entrance gate with parking area
(c) Construction of road along the perimeter of the site and well as construction of arterial load to tipping area of the first phase.
(d) Acquisition and installation of weighbridges
(e) Construction of weighbridge room/office; administrative office and site control office
(f) Construction of waste inspection facility, equipment workshop and garage, vehicle cleaning area
(g) Installation of direction signs, site lighting, fire fighting facilities, communication facilities
(h) Construction of water supply and waste water/sewage disposal system
(i) Construction of surface water drainage system
(j) Construction of main leachate pipe, tank and treatment facility
(k) Installation of environmental monitoring facilities
(l) Construction of gas collection pipe and treatment facility (if needed)
(m) Construction of waste recovery/incineration/waste processing facility (if so planned)
(n) Construction of emergency exit gate.

8.2. Site Procedures : Record Keeping & Waste Inspection

Record keeping procedures as well as waste acceptance procedures to be followed at the landfill site shall be formulated.

Records shall be kept on a daily, weekly and monthly basis. In addition a site Manual shall be kept at the site office giving all site investigation, design and construction details – these are necessary as landfill design may get modified during the operational phase.

(i) Site Manual : The site manual shall contain the following information :

(a) Data collected during site selection
(b) Environmental impact assessment report
(c) Site investigation and characterisation data
(d) Detailed topographical map
(e) Design of all landfill components
(f) Landfill layout and its phases
(g) Construction plans
(h) Details of leachate management plan
(i) Details of gas management plan (optional)
(j) Environmental monitoring program
(k) Closure and post-closure plan
(l) All permissions/licences from concerned authorities.

(ii) **Site Reports :** The daily, weekly and monthly reports shall comprise of the following :

(a) Weighbridge data (daily inflow and outflow for each vehicle)
(b) Waste inspection data (daily)
(c) Materials, stores etc. (daily)
(d) Bills/accounts (daily)
(e) Visitor record (daily)
(f) Complaints record from nearby areas (daily)
(g) Topographic survey at operating phase (daily/weekly)
(h) Photographic record at operating phase (daily/weekly)
(i) Environmental monitoring data (weekly/monthly)
(j) Wastefilling plan and actual progress i.e. cell construction (daily/weekly) and review (monthly)
(k) Leachate generation and gas generation (weekly/ monthly/extreme events).
(l) Weather/climatic data (extreme events)
(m) Accidents etc. (adhoc)
(n) Others.

(iii) Vehicle Inspection :

Each vehicle carrying the waste shall be checked for :

(a) Incoming weight (full)
(b) Outgoing weight (empty)
(c) Availability of relevant docuemnts
(d) Visual check at weigh-in (if feasible)
(e) Visual inspection after discharge at tipping area (inspection report to be filed for each vehicle). A visual inspection checklist must be framed which should list visual features for identification of unacceptable material. This checklist shall be filled for every unloading by a vehicle in tipping area at the working phase in the landfill.

If there is reason to doubt the presence of unacceptable waste, the vehicle shall be taken to the waste inspection facility, the waste down-loaded, inspected visually and sampled (if necessary). Vehicles having non-conforming waste shall be held-up and matter reported to engineer or manger at site.

8.3. Phase Development

Development of each phase shall be done in stages. These stages are:

(a) Clearing the area of all shrubs and vegetation
(b) Excavation (if required),
(c) Stockpiling of excavated material and material imported from borrow area,
(d) Levelling of base and side slopes of landfill and achieving desirable grades at the base of the landfill,
(e) Construction of embankment and temporary berms along the perimeter of the phase,
(f) Construction of temporary surface water drains,
(g) Installation of monitoring instruments,
(h) Liner Construction
(i) Leachate collection and removal system

8.4. Phase operation

At the design stage, the phases of a landfill are clearly demarcated. Operation of a phase requires planning and execution of daily activities – daily waste filling plan and demarcation, waste discharge and inspection, waste placement, waste compaction, daily covering of waste, prevention of pollution and fires.

(a) **Daily waste filling plan and demarcation at site :** On the completion of a phase and before the start of a new phase, a waste filling plan for daily cells shall be evolved. A study of the landfill base contour maps

and the final cover levels of the phase allows such a plan to be devloped. If a phase is to be operational for 365 days, all 365 cells must be marked in plan and in sectional drawings. These may require revision as a landfill is constructed because waste quantities may vary in an unforeseen manner. The area and height proposed to be filled every day should be demarcated at the site on a daily or weekly basis using temporary markers or bunds.

(b) **Waste discharge and inspection :** Waste shall be discharged by tipping at the working area of a landfill, within the area demarcated for the cell. Every discharged load shall be visually inspected by a designated operator. Working area personnel shall be trained and competent at waste identification in order that they can recognise waste which may be non-conforming. In the event of reasonable doubt as to the waste acceptability, the operator shall inform the waste reception facility and/or the site manager immediately and the consignment shall be isolated pending further inspection.

(c) **Waste placement (spreading) and compaction :** Once waste has been discharged it shall be spread in layers and compacted in a well defined manner to ensure that the completed slopes of a daily cell are at the designed gradients. Waste placement (spreading) can be done by the following methods :

(i) Face tipping method : Waste is deposited on top of existing surface and spread horizontally by tipping over an advancing face.

(ii) Inclined layering method (onion skin tipping) : Similar to (a) but inclined layering (gentle slope) done instead of advancing of face.

(iii) Working upwards : Waste is deposited on the lower surface and pushed upwards.

It is necessary to level and compact the waste as soon as it is discharged at the working area. Steel wheeled mobile landfill compactors (smooth / cleated / spiked / special wheels) are generally accepted as the best equipment for this purpose. They have largely replaced the small crawler-tracked machines which were previously in general use.

(d) **Daily / Weekly Cover :** Daily / Weekly cover (optional) is primarily used for prevention windblown dust, litter and odours, deterrence to scavengers, birds, reduction of infiltration (during unseasonal rian) and in improving the site's visual appearance. Soil used as daily / weekly cover shall give a pleasing uniform appearance from the site boundary. To achieve this a thickness of about 150 mm is usually adequate and shall be adopted.

(e) **Operation in Monsoons :** During the monsoon month, high rainfall results in excessive generation of leachate. Hence, before the onset of monsoons, the phase must be capped with a cover. Waste received

during monsoon months shall be stockpiled in temporary holding area (covered). Alternatively special "monsoon phases" may be designed with high leachate holding capacity and operated using daily covers / temporary covers.

8.5. Pollution Prevention and Safety During Operation

The following measures are needed to ensure that the landfill operation shall not adversely affect local environment within and outside the landfill.

(i) **Traffic :** Heavy lorry traffic shall give rise to nuisance, damage to road surface and verges and routing problems. The following measures are helpful :

(a) routing to avoid residential area
(b) using one-way routes to avoid traffic conflict in narrow roads
(c) carrying out road improvements, for example strengthening or widening roads, improved provision of footpaths, improvement of sight lines, provision of passing places, provision of new roads,
(d) Limiting the number of vehicle movements
(e) Restrictions on traffic movement hours which are staggered with respect to peak traffic hours.

(ii) **Noise :** Adverse impacts on the local community from noise may arise from a number of sources including : throughput of vehicles and fixed and mobile plant, for example compactors, generators at the site. Peripheral noise abatement site measures shall be adopted.

(iii) **Odour :** Offensive odours at landfill sites may emanate from a number of sources, including waste material, which have decomposed significantly prior to landfilling, leachates and leachate treatment systems, and landfill gas. Good landfill practices shall greatly reduce general site smell and reduce impact from odours which could lead to complaints from the local community, site users and site staff. Good practice includes : (a) adequate compaction; (b) speedy disposal and burial of malodorous wastes; (c) effective use of appropriate types of daily cover; (d) progressive capping and restoration; (e) effective landfill gas management; (f) effective leachate management and (g) consideration of prevailing wind direction when planning leachate treatment plants, gas flares, and direction of tipping.

(iv) **Litter :** Poor litter control both on and off site is particularly offensive to neighbours. Good operational practice shall be adhered to in terms of temporary fencing, waste discharge, placement, compaction and covering to minimise the occurrence of windblown litter.

(v) **Bird Control :** Birds are attracted to landfill sites in large numbers where sites receive appreciable amounts of bio wastes. Measures which can be used to mitigate birds nuisance include the employment

of good landfill practice, working in small active areas and progressive prompt covering of waste, together with the use of bird scaring techniques.

(vi) **Vermin and Other Pests :** Landfills have potential to harbour flies, rodents and vermin, particularly where the waste contains bio materials. Modern landfilling techniques including prompt emplacement, compaction and covering of wastes in well defined cells are effective in the prevention of infestation by rodents and insects.

(vii) **Dust :** Dust from landfill operations is mainly a problem during periods of dry weather but can also arise from dusty waste as it is tipped. Dust is generally associated with (a) site preparation and restoration activities; (b) the disposal of waste comprising of fine particles, for example powders; and (c) traffic dust. Dust suppression can be effected by (a) limiting vehicle speed; (b) spraying roads with water; and (c) spraying site and powder type waste with water; (d) covering powder type waste with daily soil cover.

(viii) **Mud on the Road :** Mud on the public highway is one of the most common causes of public complaint. It is therefore, in the interest of the landfill operator to provide adequate wheel cleaning facilities to ensure that mud is not carried off site by vehicles.

(ix) **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 shall be treated as a potential emergency and dealt with accordingly.

(x) **Landfill Safety Aspects :** Training of employees shall include site safety, first aid and the handling of dangerous materials where appropriate. Since landfill sites can pose dangers to both site operator and users, emergency plans shall be laid down. Landfill sites shall be regarded as potentially hazardous locations and the operator shall have a written safety plan for the site. Safety hazards present at landfill sites may include : (a) moving plant and vehicle; (b) steep slopes; (c) bodies of standing water; (d) contaminated, putrescible, toxic, flammable or infective material and (e) noxious, flammable, toxic or hazardous gas. All employees and visitors to the site shall be made aware of the potential hazards and the safety procedures to be implemented including fire safety.

8.6. Phase Closure

After the last set of cells of a phase are placed (on the highest lift), an intermediate or final cover shall be constructed. If another phase is to be placed over the just completed phase, an intermediate cover is provided. However if the just completed phase has reached the final

height of the landfill, the final cover system and surface water drainage system is provided.

An intermediate cover shall be made of locally available soil (preferably low permeability) and is 45 to 60 cm thick. It is compacted with smooth steel drum rollers and provided a suitable gradient (3 to 5%) to encourage surface water to run-off from the cover and thus minimise infiltration. The side slopes of the intermediate cover are compacted by the crawler tracked dozer moving up and down the slope.

Final cover construction and quality control all criteria are discussed in Section 7.0.

8.7. Landfill Closure

As each phase is completed and as the final cover level is reached in successive phases, the following interconnectivities are established :

(a) the leachate collection system of each phase is sequentially connected (if so designed)
(b) the surface water drainage system at the cover of each phase is sequentially connected (if so designed)
(c) the temporary surface water drainage system constructed at the base of each completed phase is dismantled
(d) the gas collection system (if provided) of each phase is sequentially connected.

Upon completion of all phases a final check is made of the proper functioning of all inter connected systems.

An access road is provided on the landfill cover to enable easy approach for routine inspection of the landfill cover.

8.8. Post Closure Vegetative Stabilisation (Long Term)

If a landfill cover is intended to be used for a specific purpose e.g. park or vehicle parking area, then the cover shall be stabilised in such a manner that the end-use is achieved. However, if no specific end-use is envisaged, then long-term vegetative stabilisation will be undertaken to return the land to its original and natural vegetative landform.

Vegetation is by far the most common and usually the preferred stabilisation option after closure of landfills. If a self-perpetuating vegetative cover can be established, not only can wind and water erosion be minimized, but also the landfill can be returned to some semblance of its original appearance and land use. In favourable climates, revegetation may require only modest effort or may occur by natural process during a reasonably short period of time. However, in arid climates or a harsh environment, establishment of vegetation may

be a difficult and costly process and alternative techniques may be examined for vegetative stabilisation.

While the specific procedures are unique to each landfill and climatic regime, the following representative elements of the process shall be adopted in all procedures.

(a) Seedbed Preparation : Seedbed preparation is necessary to set the stage for establishment of the short-term community. Initial operations shall include grading, furrowing, or grouping to enhance microclimate and addition of nutrients and soil amendments, if required.

(b) Short-Term Vegetation : It is common practice, in both humid and dry environments, to rely largely on grasses for the primary initial source of short-term land cover. Usually several species are included in the initial seeding mixture to increase diversity and reduce the chance of total community failure. Short term vegetation is usually assisted by irrigation.

(c) Long Term Vegetation : To achieve the ultimate goal of attaining a self sustaining and stable community, a transition between short term and long term vegetation must occur. In some cases, this may be left to invasion by native species after short term vegetation is assured and soil development is well under way. In other cases – for example, when irrigation has been used temporarily to establish the short term community – it may be necessary or desirable to enhance the natural succession process by replanting with a more diverse mix of species suited to the next stage of community succession, such as shrubs. The need for artificial enhancement of the successional process shall depend on the success of previous short term efforts and on the ultimate intended land use of the reclaimed area. All vegetation efforts, however, shall work toward self generation and minimum management in the long term. Fig. 15. illustrates the sequential steps in vegetation growth after landfill closure.

9.0. INSPECTION, MONITORING & RECORD KEEPING CRITERIA

9.1. During Construction of Liners and Covers

(a) During the construction of liners and covers, inspection shall be carried by the SPCB/PCC (or its nominee) atleast twice during each phase to ensure that construction procedures and quality control procedures isted in section 7.0 are being followed.

(b) Immediately upon the completion of construction of a liner in each phase, the complete set of construction records and quality control test results as listed in Section 7.0 will be provided by the

owner/operator to the SPCB/PCC for verification and record keeping. The same will also be done upon the completion of cover system in each phase.

9.2. During Operation

(a) The owner/operator shall monitor and keep a record of the following in the operation period :

(i) Functioning of the leachate management system (including levels in leachate holding tank) (weekly)

(ii) Functioning of the surface water run-off system (weekly)

(iii) Functioning of the gas management system (if any) (weekly)

(iv) Waste filling records shall be kept on daily basis as specified in Section 8.2 on site procedure

(v) Environmental monitoring shall be done, 1 to 2 times a month, and all parameters listed in Section 5.17 shall be recorded and compared with the permissible limits provided by the SPCB/PCC

(vi) After a major storm, the occurence of the storm and functioning of various systems shall be recorded.

(b) The SPCB/PCC (or its nominee) shall inspect all facilities atleast twice a year. The owner/operator shall provide a copy of the environmental monitoring record to the SPCB/PCC on a yearly basis.

9.3. During Closure and Post Closure Period

Period inspection and routine maintenance at a closed landfill site shall be carried out for a period of 30 years after closure. The SPCB/PCC shall inspect all facilities during the closure and post closure period atleast once a year. The owner/operator shall provide a copy of the environmental monitoring record to the SPCB/PCC once a year. The following components of a closed landfill shall be inspected visually after landfill closure to confirm that all functional elements are working satisfactorily and inspection report will be recorded. A maintenance schedule with specified reporting formats is drawn up after each inspection.

(a) Cover System : The final cover is inspected 2 to 4 times a year (a) to check that vegetation growth is occurring satisfactorily and that plants are not showing stunted growth, (b) to detect if any erosion gullies have been formed thereby exposing the barrier

layers, (c) to earmark depressions that may have developed with time and (d) to identify ponding of water on the landfill cover. Atleast one inspection shall be carried out during or immediately after the peak of the monsoon season.

Closed landfills show significant settlement. Rectification measures shall not only re-establish the initial slope of the cover (for proper surface water run-off) but shall also ensure that all the components of the landfill cover system continue to perform as originally envisaged. Site managers shall have sufficient equipment and funds to periodically carry out maintenance work in the form of soil filling, re-grading the cover and revegetating the landfill cap.

In areas where extensive erosion gully formation is observed, filling of cover material, regrading of cover slopes and re-vegetation must be routinely undertaken.

(b) Surface Water Drainage System : The surface water drainage system is also inspected 2 to 4 times a year (a) to identify cracks in drains due to settlements, (b) to delineate clogged drains requiring immediate clean-up and (c) to study the level of deposited soil in the storm water basin and initiate excavation measures. Broken pipes and extensively cracked drains may require replacement after filling soil beneath them to establish slopes for gravity flow. In extreme cases where long-term settlement shall be excessive, it shall become necessary to make sumps and operate storm water pumps for removal of accumulated water in the drainage system.

(c) Gas and Leachate Management Systems : A weekly operating record of leachate and gas management systems shall be kept in the post-closure period. Periodic inspection of the leachate and gas collection systems (2 to 4 times a year) is undertaken to identify broken pipes, leaking gas (if any) and damaged or clogged wells/sumps. Repair work requires skilled manpower and shall be carried out by the agencies operating the gas treatment and leachate treatment facilities. One may often have to install new gas extraction wells and leachate collection wells if the damaged/clogged facilities are inaccessible and irrepairable.

9.4. Environmental Monitoring Systems

Ground water monitoring wells, air quality monitoring systems and vadose zone monitoring instruments shall be periodically inspected 2-4 times a year to check that all systems are functioning satisfactorily and that well caps and sampling ports are not subjected to damage due to excessive settlement or vandalism.

Environmental monitoring systems have to be maintained during the entire post-closure period. Wherever possible, monitoring instruments must be periodically re-calibrated. Sampling devices shall be routinely detoxified and also regularly checked for proper functioning of the opening and closing of valves or spring loaded mechanisms.

10.0. Post-Closure Criteria

(a) After closure of the landfill, the owner/operator of the landfill shall maintain the integrity of the final cover systems incldiuing making repair, as necessary, to rectify the settlement, subsidence or erosion of the cover.

(b) After closure of the landfill, the owner/operator shall continue to operate all leachate, gas and surface water management systems as well as continue environmental monitoring of the landfill for a period of 30 years or until such time that harmful leachate is not produced for 5 continuous years.

(c) If after a few years of closure, the leachate is observed to meet all discharge standards, the same shall be discharged directly to lined drains.

(d) The landfill shall be abandoned after 30 years of closure, if concentrations of contaminants in all liquid and gaseous emissions from the landfill are observed to be below prescribed limits. However, if the emissions continue to be hazardous, the landfill management strategy shall have to be evolved for future years.

11.0. FINANCIAL ASSURANCE CRITERIA

The owner/operator shall prepare detailed financial estimates for the following :

(a) the fixed initial cost for setting up the landfill facility

(b) the recurring annual costs for operating the facilities

(c) the cost of hiring a third party to close the landfill

(d) the cost of hiring a third party to conduct post-closure care for 30 years after closure of the landfill

(e) the cost of hiring a third party to undertake corrective action in case of an emergency resulting in loss of ecology due to the failure of the system during the active, closure and post-closure periods.

The owner/operator shall demonstrate the funds needed for (c), (d) and (e) above will be available whenever they are needed in the form of options such as trust funds, surety bonds, letter of credit, insurance etc.

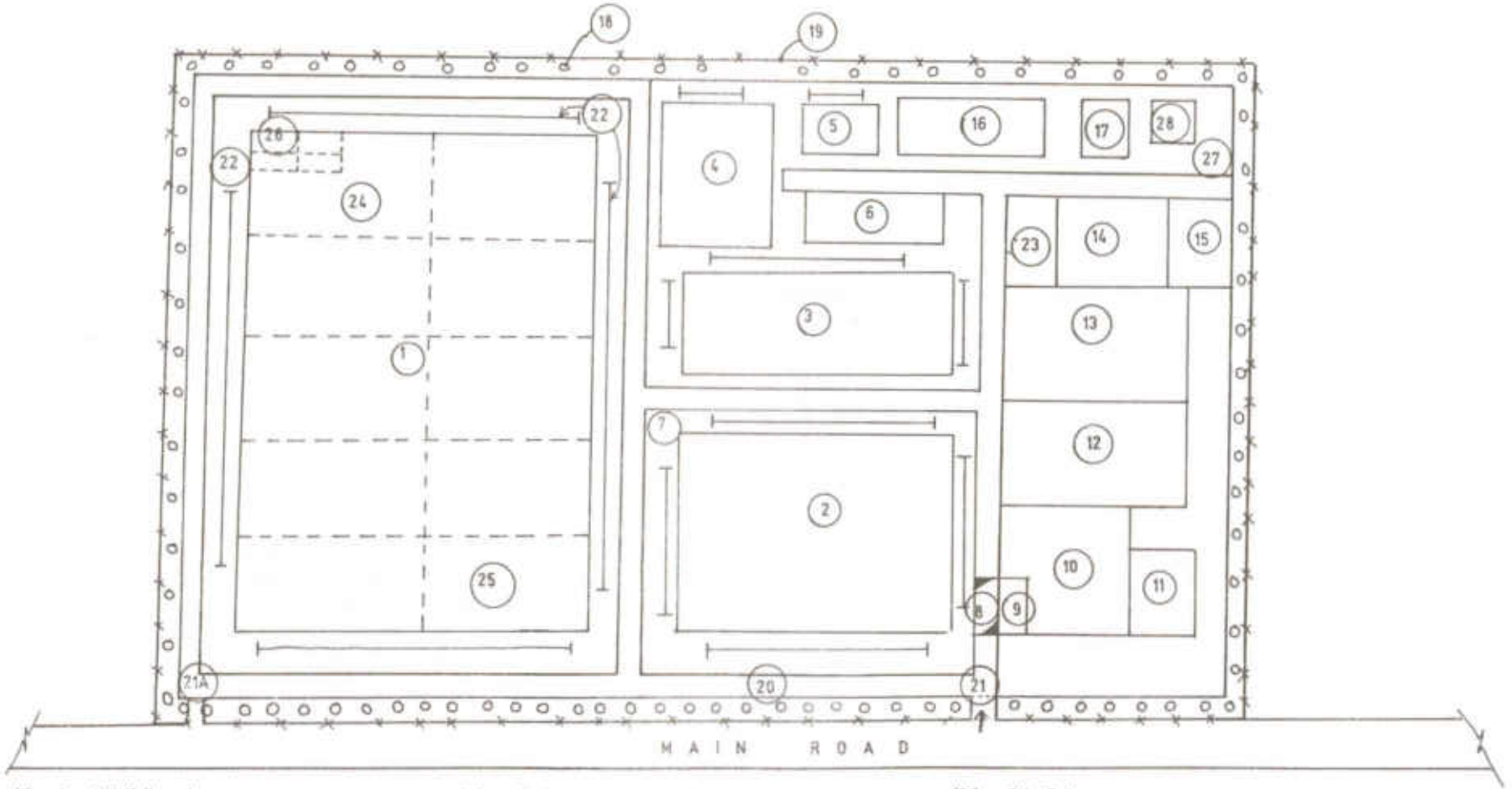
12.0. CONTINGENCY PLAN FOR EMERGENCIES

The owner/operator of a HW landfill shall prepare a contingency plan listing procedures to be executed immediately whenever there is fire, explosion or unexpected release of hazardous waste at the landfill site during the active period as well as during the closure and post-closure periods. Such a contingency plan shall be approved by the SPCB/PCC.

1	Oxidising Mineral Acids	1										
2	Caustics	H	2									
3	Aromatic Hydro-carbons	H_F		3								
4	Halogenated Organics	$H_{F\ GT}$	H_{GF}		4							
5	Metals	$GF_{H\ F}$			H_F	5						
6	Toxic Metals	S	S				6					
7	Sat Aliphatic Hydro-carbons	H_F						7				
8	Phenols and Cresols	H_F							8			
9	Strong Oxidising Agents		H	H_F		H_F		H		9		
10	Strong Reducing Agents	$H_{F\ GT}$			H_{GT}				GF_H	$H_{F\ E}$	10	
11	Water and Mixtures containing water	H			H_E		S				GF_{GT}	11
12	Water Reactive Substances ←			Extremely reactive, do not mix with any chemical or waste material →								12

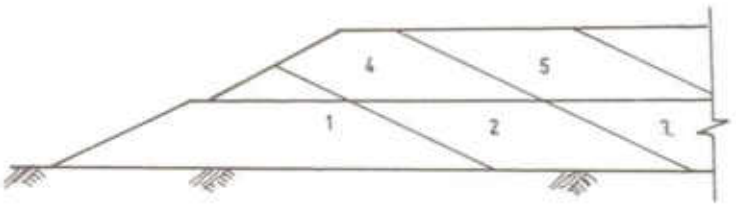
E Explosive
F Fire
GF Flammable Gas
GT Toxic Gas
H Heat Generation
S Solubilisation of Toxins

Table 1 : Compatibility of Selected Hazardous Wastes

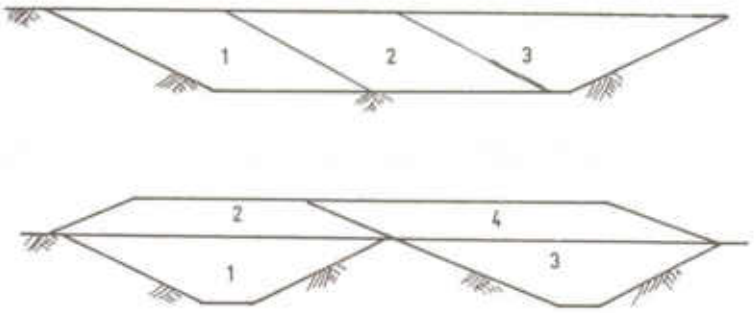


(1) Landfill Unit 1
(2) Landfill Unit 2
(3) Landfill Unit 3
(4) Landfill Unit 4
(5) Landfill for Special Hazardous Waste
(6) Area for Stockpiling Cover and Liner Material
(7) Mobile Site Office
(8) Weigh Bridge
(9) Reception/Security
(10) Administrative Office
(11) Environmental Laboratory
(12) Open Lorry/Tanker Parking Area
(13) Temporary Waste Storage Shed
(14) Equipment Shelter
(15) Workshop
(16) Landfill Leachate Management Facilities
(17) Storm-water Collection/Sedimentation Tank
(18) Green belt
(19) Fencing
(20) Approach Road/Arterial Roads
(21) Site Entrance
(21A) Emergency Exit
(22) Environmental Monitoring Facilities
(23) Vehicle Washing
(24) Phase (1) of Landfill Unit 1
(25) Phase (10) of Landfill Unit 1
(26) Cell (1) of Phase (1) of Landfill Unit 1
(27) Air Quality monitoring Station to be located at 120° from each other
(28) Space for Waste Recovery/Incineration/Waste Processing Facilities

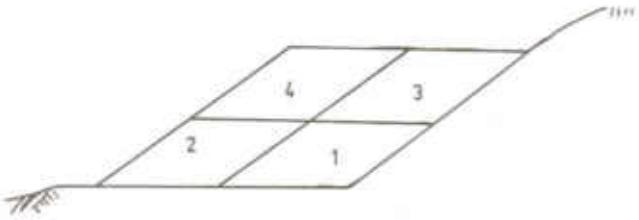
FIG. 1: TYPICAL LAYOUT OF HAZARDOUS WASTES LANDFILL



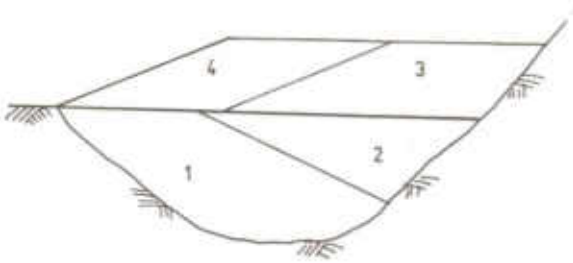
(a) Above ground landfill



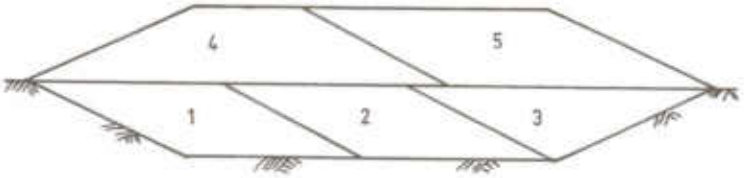
(b) Below ground and trench landfill



(c) Slope landfill



(d) Valley landfill



(e) Above and below ground landfill

FIG. 2: TYPICAL SECTION OF HW LANDFILLS

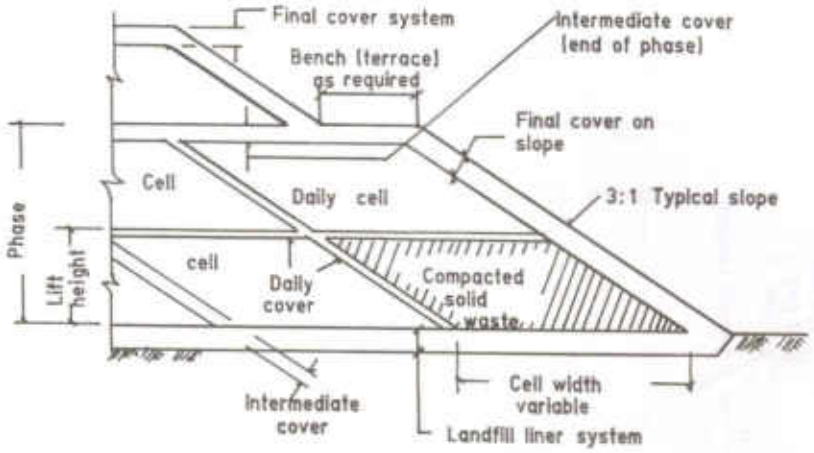
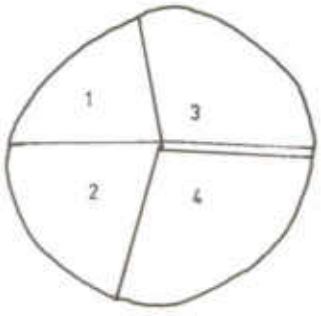
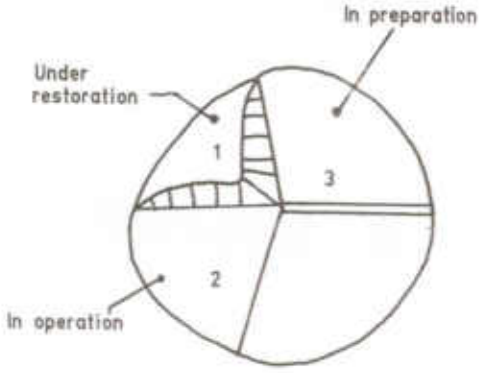


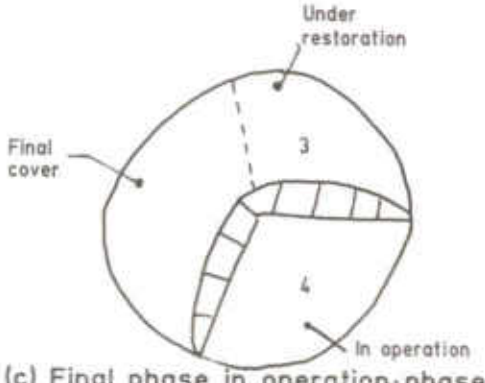
FIG. 3: COMPONENTS OF A LANDFILL PHASE



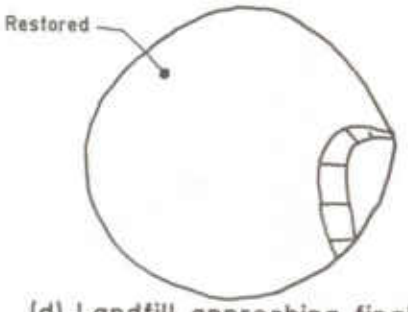
(a) Landfill layout with phases marked



(b) Phase 2 in operation



(c) Final phase in operation; phase 1 & 2 given final cover



(d) Landfill approching final closure

FIG. 4: OPERATION OF A LANDFILL IN PHASES

- Precipitation conditions (P)
- Evaporation transpiration (E_T)
- Surface water runoff (R)
- Infiltration and precipitation over the landfill site (P_1)
- Changes in the water storage in the sealing layer (ΔU_S)
- Overland water flow from surrounding terrain (R_1)
- Ground water flow from surrounding land (I_G)
- Decomposition of waste generating small volumes of water (b)
- The moisture content of the waste when it is deposited(S)
- Leakage of leachate volume (L_1)
- Collected leachate volume (L_R)
- Changes in the moisture content of the waste (ΔU_w)

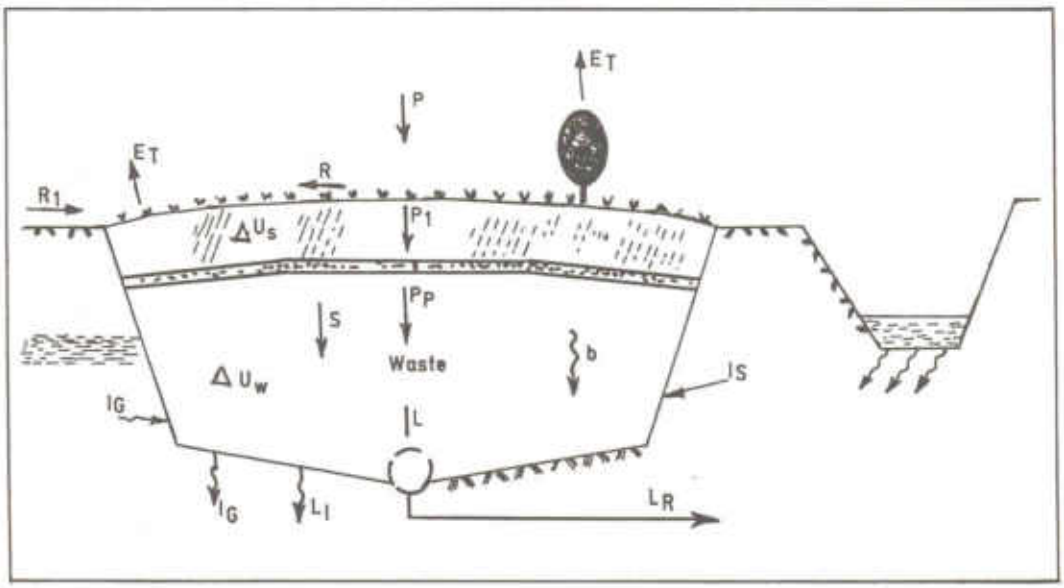
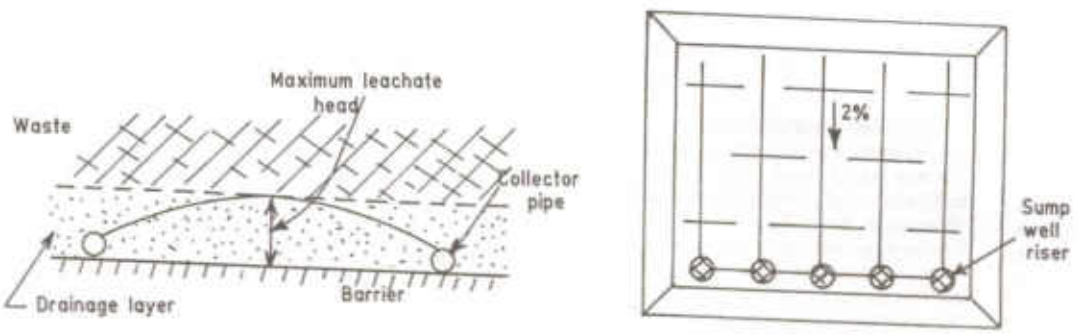


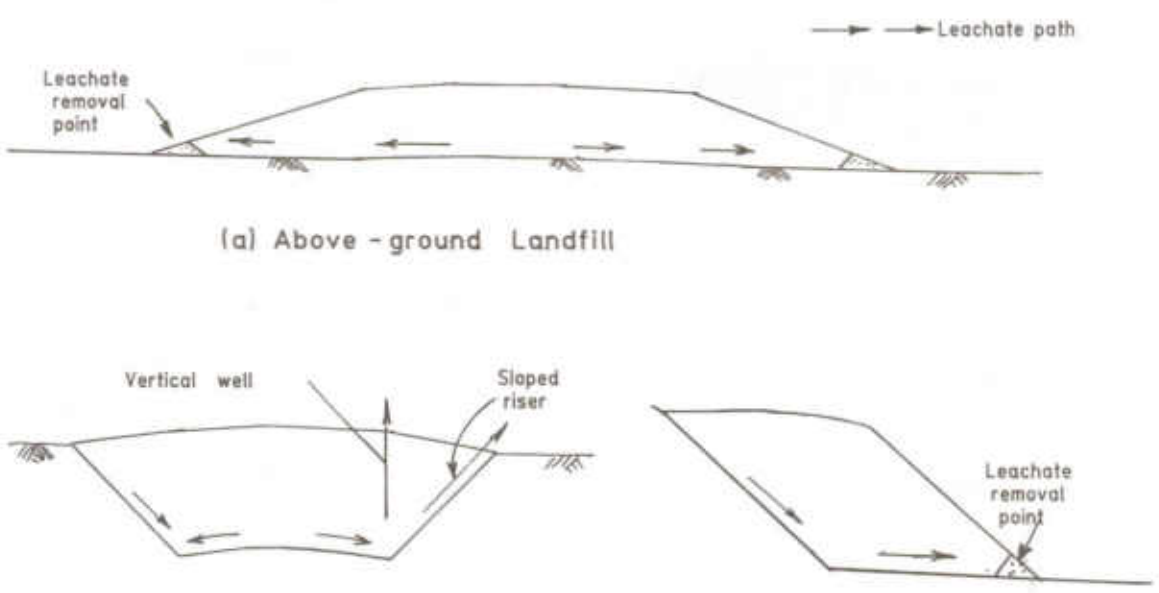
FIG. 5: WATER-BALANCE FOR ESTIMATION OF LEACHATE QUANTITY



(a) Leachate mound

(b) Pipe network (plan) at base of Landfill

FIG. 6: LEACHATE COLLECTION PIPE NETWORK



(a) Above - ground Landfill

(b) Below ground landfill

(c) Sloped landfill

FIG. 7: LEACHATE PATH AND LEACHATE REMOVAL

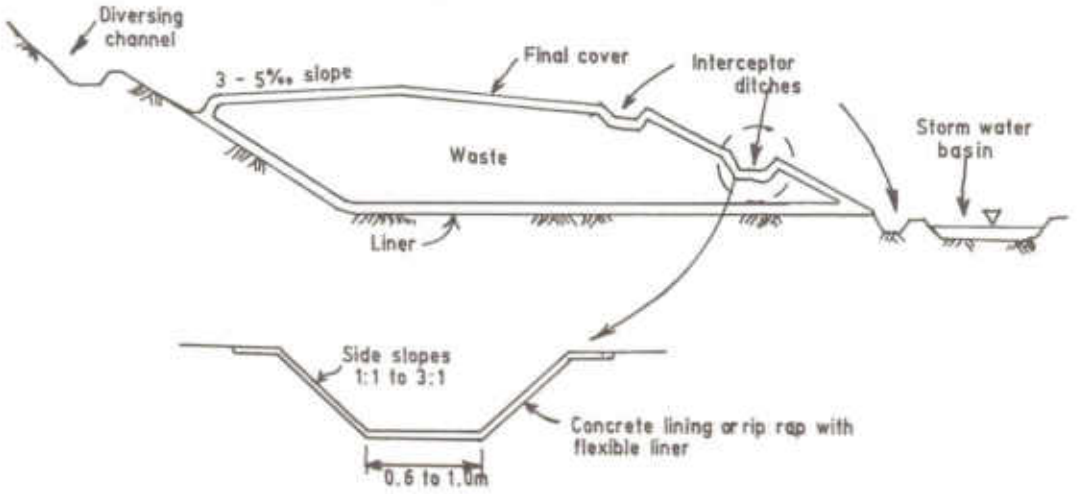


FIG. 8: SURFACE WATER DRAINAGE SYSTEM FOR A COMPLETED LANDFILL

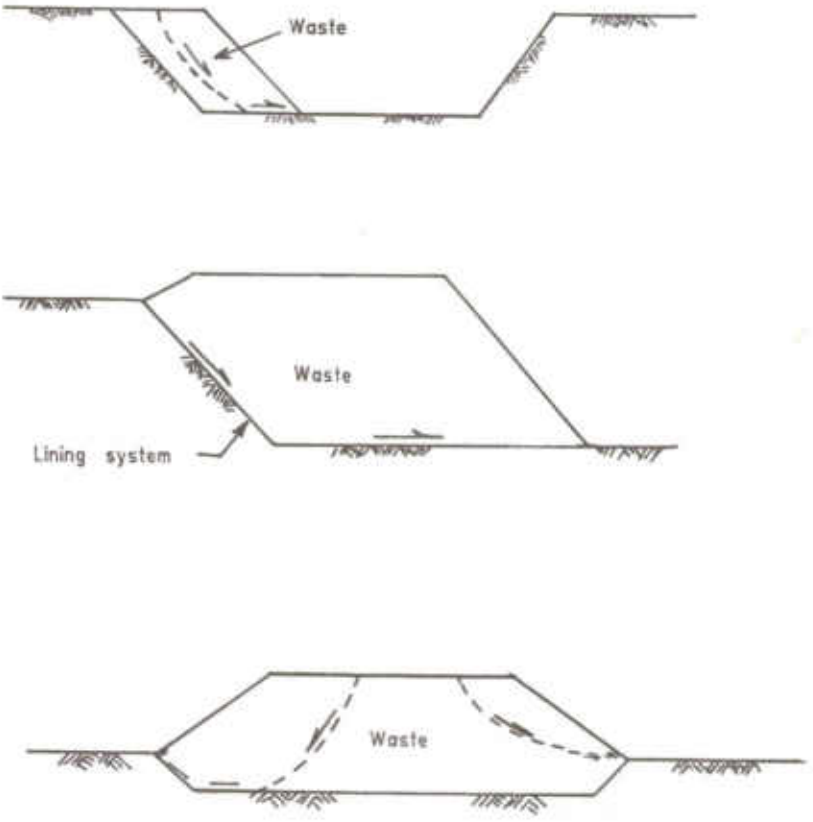


FIG. 9: SOME TYPICAL FAILURE MECHANISMS FOR SLOPES IN LANDFILLS

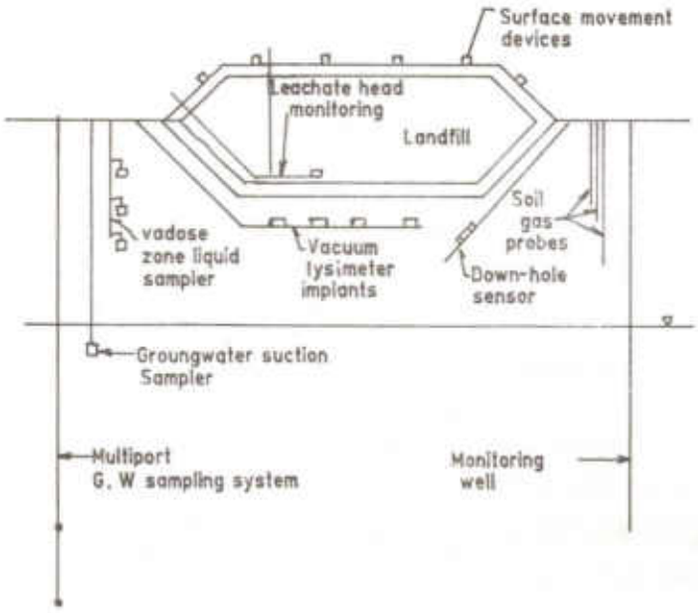


FIG. 10: TYPICAL LANDFILL INSTRUMENTATION

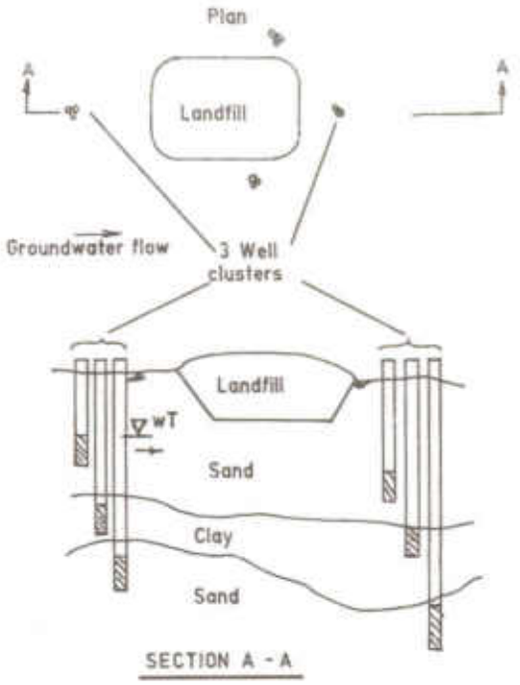


FIG. 11: GROUND WATER MONITORING WELLS AROUND A LANDFILL.

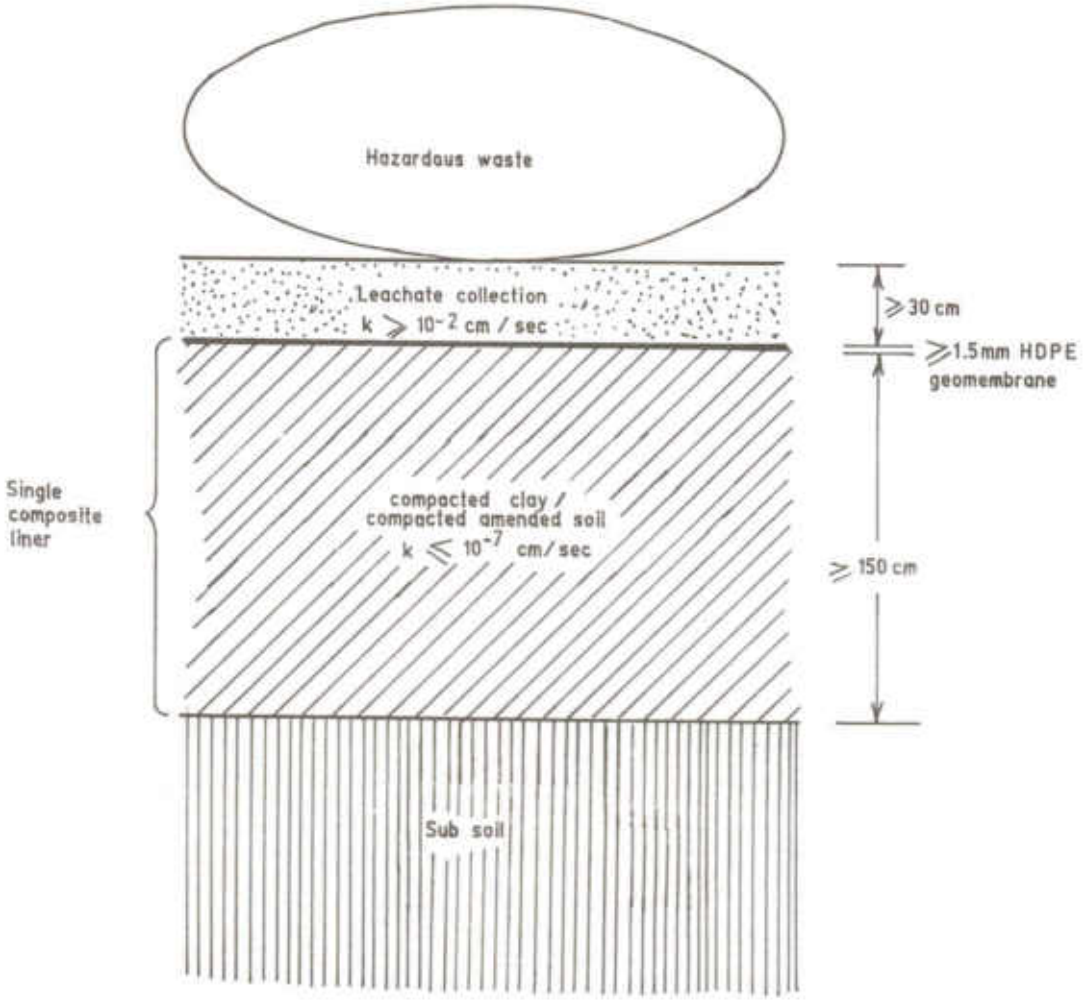


FIG. 12 : SINGLE COMPOSITE LINER SYSTEM

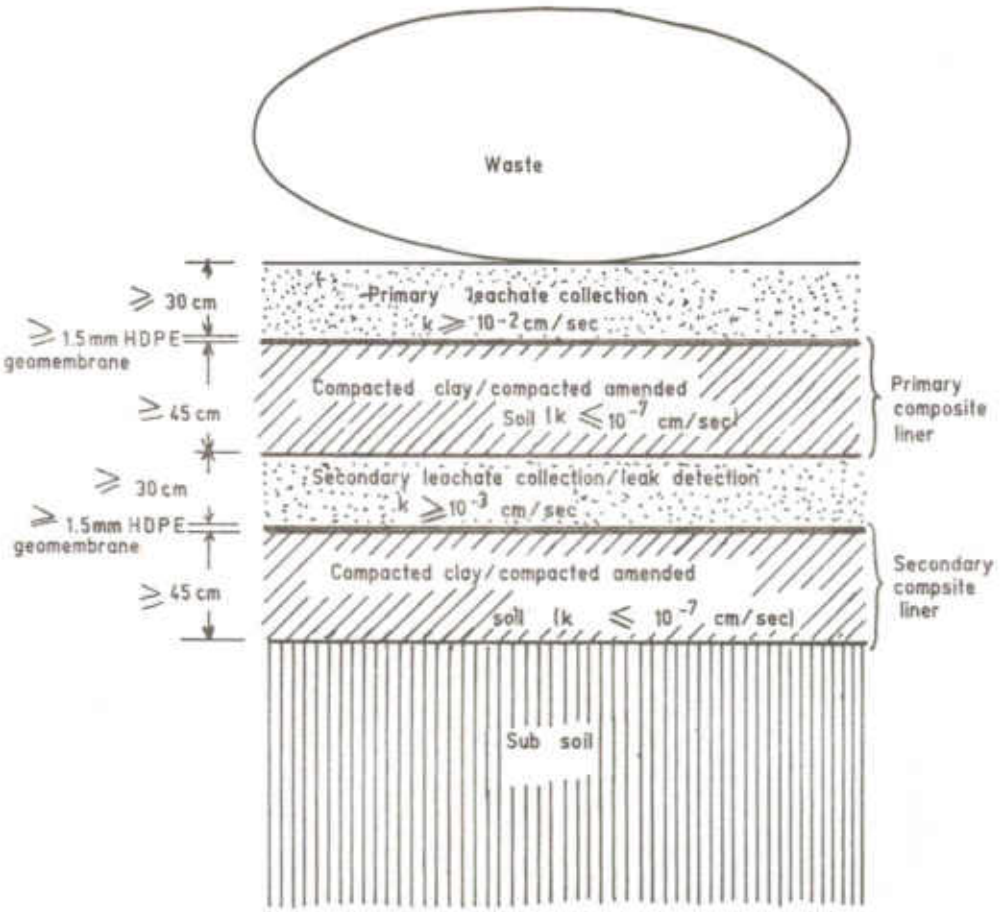


FIG. 13 : DOUBLE COMPOSITE LINER SYSTEM

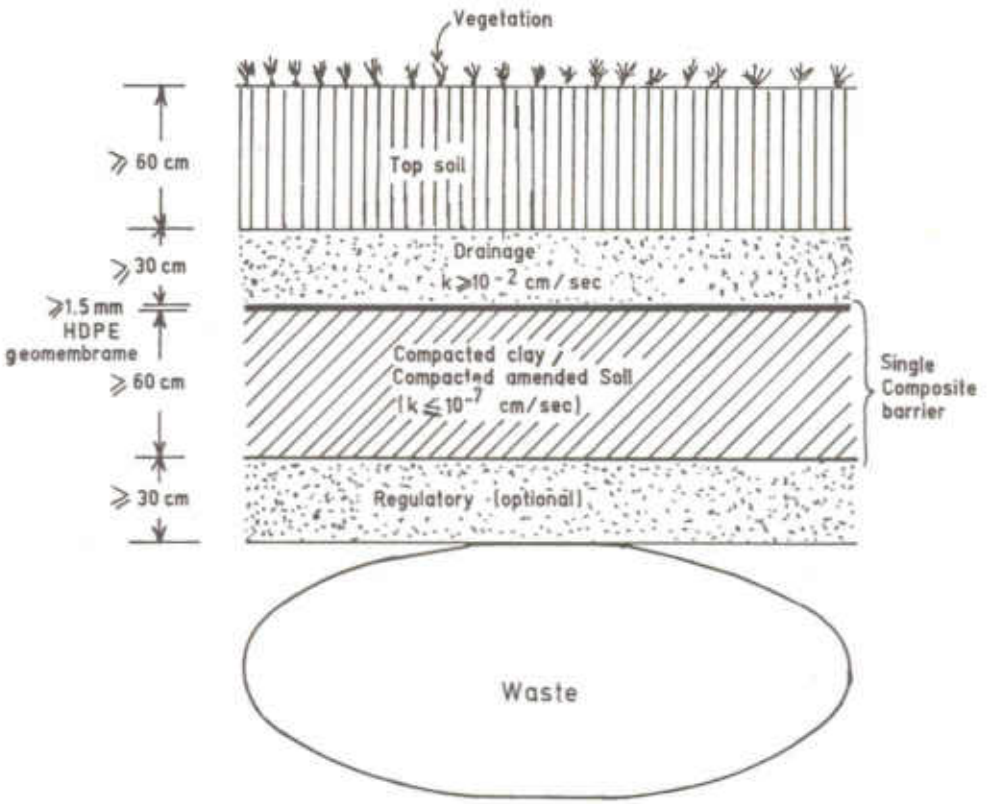
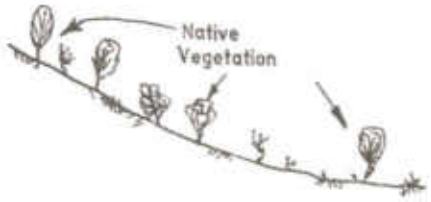
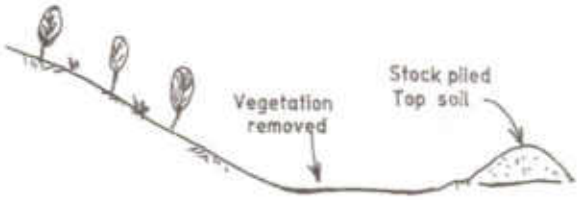


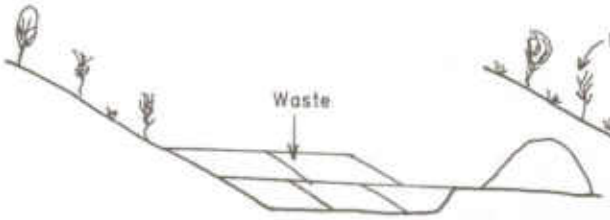
FIG. 14 : COVER SYSTEM



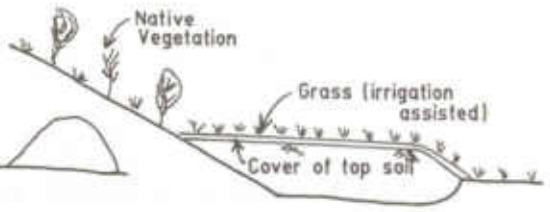
(a) Original Landform



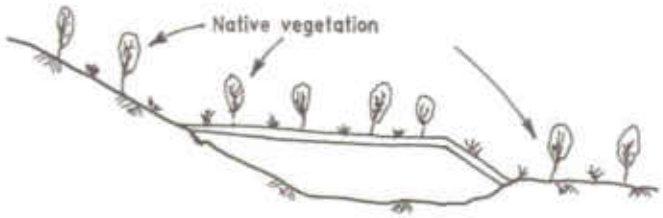
(b) Excavation for Landfill



(c) Landfilling in Progress

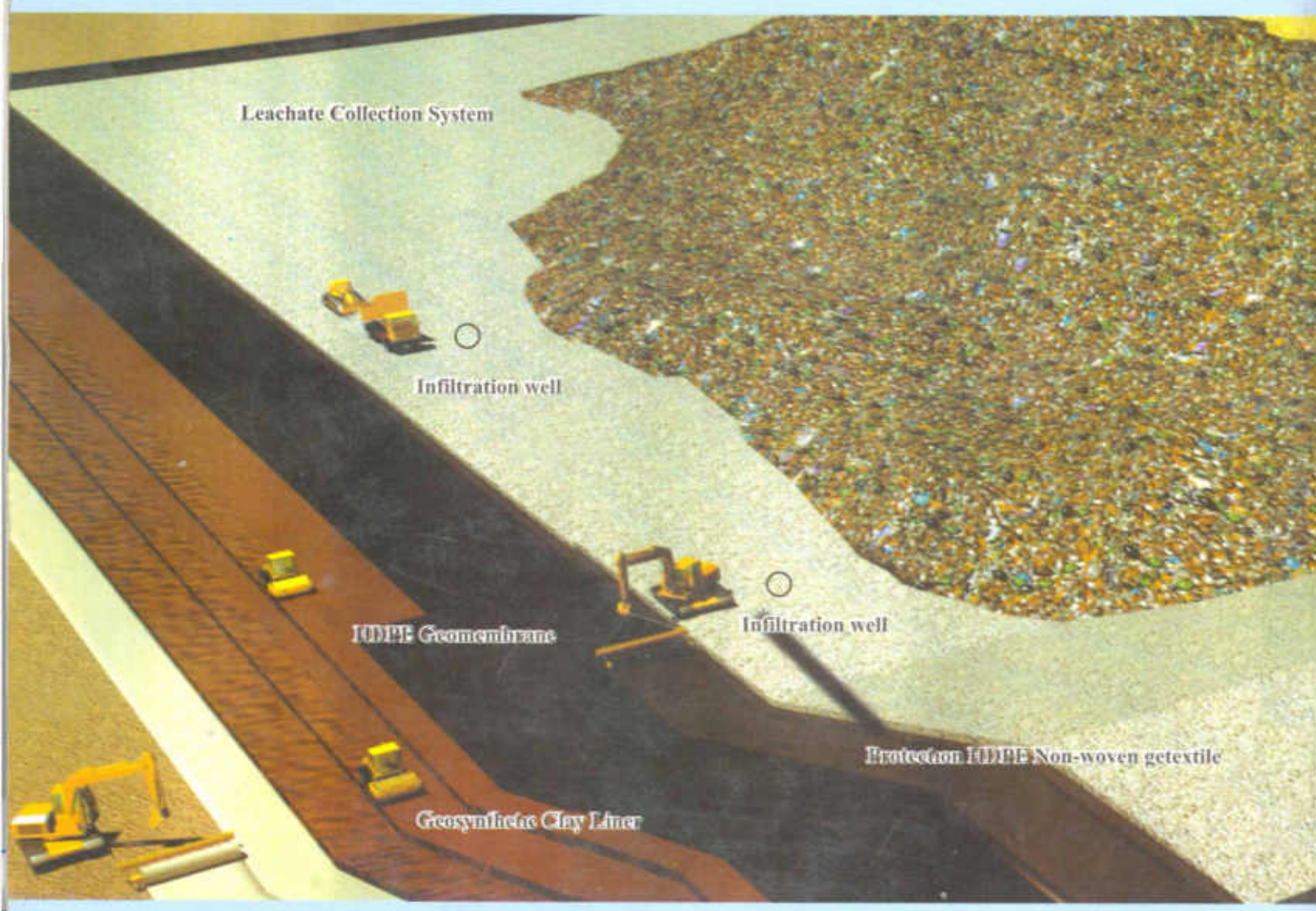


(d) Short-Term Vegetation on Landfill Cover



(e) Long-Term Vegetation on Landfill Cover

FIG. 15 : LONG-TERM VEGETATIVE STABILISATION OF CLOSED LANDFILL


Leachate Collection System
Infiltration well
Infiltration well
HDPE Geomembrane
Protection HDPE Non-woven getextile
Geosynthetic Clay Liner

Annexure-R5-II

Item No.2&3 (Pune Bench)

BEFORE THE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

[THROUGH PHYSICAL HEARING (WITH HYBRID OPTION)]

APPEAL NO.39 OF 2022 (WZ)

Taloja Manufacturers Association .... Appellant

Versus

Union of India & Ors. .... Respondents

AND

APPEAL NO.40 OF 2022 (WZ)

Taloja Manufacturers Association .... Appellant

Versus

Union of India & Ors. .... Respondents

Date of Hearing : 21.08.2023

CORAM: HON'BLE MR. JUSTICE DINESH KUMAR SINGH, JUDICIAL MEMBER
HON'BLE DR. VIJAY KULKARNI, EXPERT MEMBER

Appellant : Mr. Ronak Arora, Advocate

Respondents : Mr. Rahul Garg, Advocate for R1
Mr. Aniruddha Kulkarni, Advocate for R2 and R4 with Ms. Dipti Kapil, Senior Environmental Engineer (H.W.M. Division, CPCB, HO)
Ms. Manasi Joshi, Advocate for R3
Mr. R.B. Mahabal, Advocate for R5
Mr. Anil Anturkar, Senior Advocate i/b and With Mr. Yatin Malvankar, Advocate for R6

ORDER

1. Since in both these appeals, the facts (except the survey numbers), prayers and legal position are identical, these are being decided by this common order.

2. These appeals have been filed seeking quashing of Environmental Clearance (EC) dated 25.07.2022 granted by respondent No.4 – SEIAA

Maharashtra to respondent No. 5 - Arihant Superstructures Ltd for building and construction project of residential nature upon land situated in Survey numbers, stated hereunder and respondent No.5 be restrained from raising construction in pursuance of the said EC within 500 mtrs of outer boundary of existing Central Hazardous Waste Treatment Storage and Disposal Facility (for short, "CHWTSDF") of Taloja Industrial Area, within the `no development buffer zone'.

3. The brief facts of these appeals are as follows:

As regards **Appeal No.39 of 2022 (WZ)**, it is submitted by the appellant that the above mentioned EC has been granted for construction of the above project of residential nature upon the land bearing Survey No.43/3/2, 59/2, 60/1/2B, 35/1+2/1(2), 35/1+2/1(3) and 35/1+2/1(4) of village Ghot, Taluka Panvel, District Raigad, within `no development buffer zone' of TSDF, which is in violation of CPCB Criteria for Hazardous Waste Landfills, 2001 ("Guidelines of 2001", for short), the Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities, 2017 (hereinafter referred to as "Guidelines of 2017"), amended Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities, 2019 (hereinafter referred to as "Amended Guidelines of 2019") as well as Protocol for Assessing Proposals of Development Projects in Buffer Zone of Closed CHWTSDF, 2021 (hereinafter referred to as "PBZC CHWTSDF, 2021"). The said EC has been granted upon a parcel of land within the periphery of 500 mtrs of the `no development buffer zone' ("NDBZ", for short) around the existing operational CHWTSDF. A bare perusal of Form-1 and other supportive documents submitted by respondent No.5 would show that Project Proponenthas concealed the facts of the existence of the CHWTSDF near the project in question. False disclosures have been made in the application for EC and material facts have been concealed.

Besides that, the EC has been granted in violation of CPCB Guidelines. The impact upon human health of existing operational CHWTSDF has not been taken into account while granting the EC. Most of the member industries of Taloja Manufacturers' Association (for short, "TMA") are of red category, being manufacturers of chemical and engineering cutters. The hazardous and other waste generated in the member industries of TMA are being treated, stored and disposed at the existing CHWTSDF of Taloja MIDC. The existence of a residential township project adjacent to the NDBZ is going to create obstructions/day to day problems in the smooth operations of industries as well as the industrial waste management of Taloja MIDC. The MIDC, after completing necessary legal formalities of Environmental Impact Assessment, vide notification dated 10.09.2001, has notified land Survey No.61 (part) to 66 and survey Nos.68 to 74 and survey nos.77 to 85 of village Ghot, Tehsil Panvel, District Raigad, to be reserved for development of CHWTSDF. The CPCB has issued the criteria for hazardous waste landfills, 2001, providing that habitation should be 500 mtrs from the hazardous waste TSDF and a zone of 500 mtrs from TSDF should be declared as NDBZ.

4. Further it is submitted that respondent No.5 – Project Proponent while submitting the PFR as per Appendix-II, Form-1A has concealed the facts relating to surrounding features of the proposed site within 500 mtrs despite the fact that there was an operational CHWTSDF existing within 500 mtrs of the project in question. Therefore, it is intentional concealment on its part before obtaining the EC by misleading the SEIAA.

5. It is further mentioned that the minutes of the SEAC's 174th meeting held on 24.05.2022 to 26.05.2022 would indicate that no question regarding the environmental sensitivity was put forward by the SEAC following which the project in question was recommended to SEIAA for granting EC. The Criteria for Hazardous Waste Landfills, 2001 clearly

provides that habitation shall be at 500 mtrs distance from the hazardous waste TSDF and a zone of 500 mtrs from TSDF facility shall be declared as NDBZ. The said provision is made at paragraph 2.0(e) of the Guidelines. The said TSDF can potentially discharge landfills gas, leachate, contaminated surface water, offensive odours, noise, litter, dust and pose risk of fires during operation.

6. As far as **Appeal No.40 of 2022 (WZ)** is concerned, it has been filed praying for quashing of EC dated 25.07.2022 granted by respondent No.4 – SEIAA to respondent No.5 – Project Proponent for construction of the above project of residential nature upon the land situated at Survey Nos. 35/1A, 35/1B, 35/1C and 36/0 of village Ghot, Taluka Panvel, District Raigad, within `no development buffer zone' of TSDF, on the same grounds and facts, which are common, which have already been stated by us in the facts of Appeal No.39 of 2022, narrated above.

7. These appeals were considered by this Tribunal on 29.09.2022 and were admitted. The Registry was directed to issue notice to all the respondents. As per service affidavit, all the respondents have been served.

8. **Respondent No.3 – MPCB**, as per affidavit dated 24.11.2022, has taken the stand that in respect of Appeal No.39 of 2022, the SEIAA had granted EC to respondent No.5 on 25.07.2022. It is submitted that respondent No.5 has applied for Consent to Establish to the MPCB and the Consent to Establish is yet to be granted, while in Appeal No.40 of 2022, the SEIAA had granted EC to respondent No.5 on 25.07.2022 and the Consent to Establish has been granted by the MPCB to respondent No.5 – Project Proponent on 27.09.2022 for the aforesaid project.

9. From the side of **respondent No. 2 – CPCB,** affidavit dated 16.01.2023 has been filed in both the appeals, stating the position of relevant Rules and annexed therewith the Criteria for Hazardous Waste

Landfills. In paragraph No.2.0 under the head "Locational Criteria", at sub-clause (e), under "Habitation", it is stated that "a landfill site shall be atleast 500 m from a notified habituated area. A zone of 500 m around a landfill boundary should be declared a no development buffer zone after the landfill location is finalized". In respect of the above criterion, we made a query to Mr. Aniruddha Kulkarni, learned counsel for respondent No.2 – CPCB as to who would be declaring the `no development buffer zone', he responded that it falls in the domain of the State Government and when enquired as to which Department of the State Government, he stated that it is the job of Urban Development Department of the State Government. He admitted that it has not been notified as `no development buffer zone', so far.

10. A query was made by this Tribunal vide order dated 15.05.2023 to respondent No.2 – CPCB as to whether there is any scientific basis for stipulating 500 mtrs of buffer zone around CHWTSD facility. The response is given through an e-mail dated 20.09.2023 stating in paragraph No.4 thereof that the buffer zones of 100 to 500 mtrs for residential/habitation areas have been prescribed in other countries such as Australia, Malaysia, South Africa, Canada, UK, etc. The said buffer zone is found to be necessary to protect the public health and environment from potential adverse impacts from such hazardous waste landfills. The hazardous waste landfills receive heterogeneous waste, which may react and emit various gaseous pollutants, including Volatile Organic Compounds (VOCs) and odorous gases. The buffer zone will help in achieving dispersion and dilution of pollutants, thereby lower exposure of the habitants in the vicinity. The hazardous waste landfills generate leachate, which is a kind of liquid waste, which contains toxic chemicals, which may contaminate soil and groundwater in case of failure of landfill liners of the secured landfill. The buffer zone can reduce the

concentration of contaminants reaching the habitation areas in the vicinity.

11. The **stand taken by respondent No.5 – Project Proponent**, vide affidavit dated 13.03.2023, is that it had given a public notice dated 02.10.2014 in the newspaper in order to verify the title of the lands in question, which were intended to be purchased for constructing the residential property. The answering respondent also made search of the land records to verify whether there are any reservations, encroachment, charge, buffer zone, notified Ecologically Sensitive Zone restrictions, lien, any other acquisitions pending, attachment, acquisition notice or impediment of any type. The land in question was previously falling under CIDCO as the Local Planning Authority. It was then that the CHWTSDF was sanctioned and became operative. Then this land fell under the jurisdiction of MMRDA and now under PMC. Right from the operation of CHWTSDF, over last 20 years, no unpleasant incident has occurred nor any contamination of groundwater is found. Form-1 and Form-1A are to be filled in by the Project Proponent with conceptual plan. All the information was submitted by the answering respondent to SEAC/SEIAA, Maharashtra. None of the questions framed in those forms required to disclose the presence of CHWTSDF facility. The entire exercise of the appraisal and forms was attuned to bring out the project's impact on the surrounding environment. The forms were not designed to bring out the impact of the surrounding environment on the project. The answering respondent has shown that Taloja river is 1.0 km from the site and schools, hospitals were available at 5.0 kms from the site, but did not give such information to be furnished in the said form. It is admitted that from the existing CHWTSDF, the distance of the proposed site is 200 mtrs and that the CHWTSDF facility was established long back about 20 years ago. The buffer zone area around CHWTSDF is not under the

control of MIDC. Hence, it cannot be notified by MIDC as buffer zone. Therefore, buffer zone has to be within CHWTSDF area that was owned by MIDC (Local Planning Authority). Therefore, the MIDC as Local Planning Authority can notify that area as Buffer Zone or No Development Zone as they have the ownership and planning rights over it. No Local Planning Authority or CPCB Guidelines can declare the No Development Zone or Buffer Zone on the land which is not owned by them or without requiring any right over it. Such declaration on the land of someone else, who has purchased the same would be a violation of the constitutional rights of the owner.

12. According to the answering respondent, in last 22 years, never any Buffer Zone was required to be created, but now it is vehemently stated that the Buffer Zone should be left. Further it is mentioned that these issues need to be left to be decided before SEAC/SEIAA for their technical consideration. It is further stated that cost to be incurred on account of setting up of Buffer Zone needs to be based on the principle of "Extended Producer's Responsibility" (EPR) and principle of "Polluter Pays".

13. From the side of **respondent No. 6 – Panvel Municipal Corporation**, its **stand**, as per their affidavit dated 18.08.2023, is that the building permissions have been granted by the answering respondent within the buffer zone of closed CHWTSDF. Survey Nos.35 and 36 of village Ghot, Taluka Panvel, District Raigad were shown as Green Zone in the approved Development Plan of Ambernath Kulgaon Badlapur and surrounding notified area. Village Ghot was included in the jurisdiction of Panvel Municipal Corporation vide Govt. Notification dated 26.09.2016. The `No Development Zone' as well as `Green Zone' shall be treated as equivalent to Agricultural Zone. But if the owner of the land constructs the housing for EWS/LIG in the form of tenements of size upto 50 sq.mtrs., built up area on his plot, then he shall be allowed FSI of

maximum building potential mentioned in the Table No.6G of Regulation 6.1 or 6.3. The housing scheme mentioned in Regulation No.7.7 shall be permissible in Agricultural Zone with FSI of 1.00 with approach road of minimum 9 mtrs.

14. It is further submitted that area adjacent to the land in question was indicated as Industrial Zone as per approved Development Plan of Navi Mumbai prepared by CIDCO at the relevant time. It is further mentioned that neither CIDCO nor MIDC, who were the erstwhile Planning Authority, have never notified the area in question to be Buffer Zone surrounding the CHWTSDF. The bare perusal of the development permission dated 25.03.2022 would show that only Commencement Certificate is issued subject to strict compliance of terms and conditions as mentioned in Annexure-A and condition No.46 thereof mentions the Commencement Certificate issued subject to the condition that the owner/developer shall submit Environment Clearance Certificate before starting any construction on the said plot. Therefore, it was mandatory upon respondent No.5 to obtain EC from the concerned Authority before commencement of any work. Even before issuance of EC, the concerned Authorities ensured that all norms were complied with and only thereafter the EC was issued. Boundary of 500 mtrs is an assumption; however, none of the authorities has marked a buffer zone till date. If buffer zone is to be kept, then it should be within the plot boundary of the concerned Authority. It is further mentioned by the answering respondent that MIDC has issued a Public Notice dated 27.03.2023, which is annexed at page 981 of the paper-book, which contains resumption and denotification of the land bearing Survey Nos.61 (Part) to 66 of Chal village for CHWTSDF, Taloja, notified under Section 8 of Hazardous Waste (Management and Handling) Rules, 1989 as amended from time to time.

15. Further it is submitted that after issuance of Public Notice dated 27.03.2023, the Municipal Commissioner of the answering respondent has passed an order dated 27.06.2023 to the effect that the Development Permission issued to respondent No.5 – Project Proponent dated 25.03.2022 has been revoked, exercising the powers vested in him under Section 51 of the MRTP Act. The true copy of the said revocation order is annexed as Exhibit-F.

16. The above reply is being stated to be taken as reply in Appeal No.40 of 2022 from their side.

17. From the side of the appellant, rejoinder dated 19.08.2023 has been filed, wherein it has been reiterated the stand taken in the appeals with respect to the concealment of information in Form-1 by the Project Proponent. He has submitted in paragraph No.15 of the rejoinder that the Project Proponent withheld the important information while filling the Form-1 which was required to be filled in at point No.9, which was pertaining to "the factors which should be considered which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality" and sub-head 9.4 pertains to "have cumulative effects due to proximity to other existing or planned projects with similar effects". It is stated that against column at 9.4, "No" is mentioned, which is a concealment because this information ought to have been given by the Project Proponent that there was CHWTSDF situated there in the vicinity.

18. Next the applicant has drawn our attention to the information which was required to be mentioned by the Project Proponent relating to environmental sensitivity at page No.9 of Form-1 and at serial No.1 thereof, it read `areas protected under international conventions, national or local legislations for their ecological, landscape, cultural or other related value'. Much emphasis has been laid in respect of information

asked for in this column, wherein mention is made of "No". The learned counsel for the appellant submits that the Guidelines which provide for buffer zone of 500 mtrs would fall in the category of legislation and this ought to have been mentioned in the information column, which has not been done, which would amount to concealment on the part of the Project Proponent.

19. The applicant has drawn our attention to paragraph No.29 of the rejoinder wherein it is submitted that the averments in para 35 and 36 of the reply-affidavit filed by respondent No.5 – Project Proponent have been rebutted by saying that for maintaining a buffer zone/buffer ring, a big part of the land i.e. 57 hectare in case of buffer zone of 200 mtrs and 191 hectare in case of buffer zone of 500 mtrs would fall within the `no development buffer zone'. It is stated that the said contention of respondent No.5 – Project Proponent is absolutely misconceived because size/extent of land cannot be a ground to do away with the requirement flowing from statutory power for maintaining the buffer zone. It is also stated that the requirement/concept of maintaining no construction zone is also provided in the cases of national parks, wildlife sanctuary, coastal areas, eco-sensitive areas, etc.

20. During arguments, learned counsel for the appellant has drawn our attention to the judgment of the Hon'ble High Court of Gujarat dated 17.02.2014, delivered in ***Writ Petition (PIL) No.47 of 2012 (Parth Mahila Utkarsh Mandal (N.G.O.) through Mahamantri Vs. Sraddha Developers & 10 Ors.***), wherein the petitioner N.G.O. had brought to the notice of the Hon'ble Court that respondent No.4 therein namely Ahmedabad Municipal Corporation and respondent No.6 i.e. Director (Environment) and Additional Secretary, Forest & Environment Department, state of Gujarat had granted permission to respondent Nos.1 and 2 to construct residential flats in the name of Paradise Park

situated at T.P. No.73, Final Plot No.38/2/1 and 38/2/2, Ward Ramol-Hathijan, Tal. Dascroi, Mouje Vinzol, just adjacent to the Hazardous Waste Landfill site, which was, according to the petitioner, against the CPCB Guidelines framed for setting up of the operating facility (Hazardous Waste Management). Our attention was drawn by the learned counsel for the appellant to paragraph Nos.26, 27, 40, 41 and 42 of the said judgment, which read as follows:

> *"26. We are not at all impressed by the submission canvassed by Mr.Soparkar, the learned senior advocate appearing for the respondent no.11 - Ahmedabad Builders' Association, that the distance of 500 meters to be maintained as a buffer zone from a landfill site is more in the nature of a guideline rather than a statutory restriction imposed by any law or rules in that regard. We can appreciate the anxiety on the part of the respondent no.11 to do away with the restriction of maintaining 500 meters of buffer zone from a landfill site but no permission to develop the land within 500 meters of a landfill site can be permitted at the cost of health of the people at large.*
>
> *27. The criteria provided by the Central Pollution Control Board for the hazardous waste landfills make it very clear that a landfill site should be atleast 500 meters from a notified habitated area. It further provides that a zone of 500 meters around a landfill boundary should be declared as a 'nodevelopment buffer land' after the landfill location is finalized. This may be in the nature of a criteria or a guideline but the same should not be ignored on the premise that the law or any rules do not provide for the same.*
>
> *31. The report of Mr.Nansey on which strong reliance has been placed by the respondent no.11 is hardly of any consequence so far as the case at hand is concerned. Let us assume for the moment that the experts are of the opinion that the landfill site will have no hazardous effect on human habitation in the vicinity, then in such circumstances, should we ignore the statutory prohibition imposed by the Legislature and override the same relying on a report of an expert. The answer has to be emphatically 'No'. This Court sitting in*

writjurisdiction cannot say that although there is a restriction imposed by the authority under a statute so far as the distance to be maintained from the landfill site and human habitation, the same should be ignored as the experts are of the opinion that such a landfill site would not pose any potential health hazard to the people residing in the vicinity of the same. It is for the authorities concerned to take into consideration such opinion, if any, and take appropriate decision in that regard. If the authorities concerned are of the opinion, having regard to the ill-effects of a landfill site on the humans, that the distance of 500 meters is not required to be maintained, then they may do away with such a restriction but so long as such restriction remains, we are duty bound to see that the same is complied with in its letter and spirit unless such restriction imposed is found to be ultra vires any statutory provision.

40. We are confronted with a situation where on one hand the health of thousands of people would be at stake if they start residing within the vicinity of the landfill site vis-a-vis the right of the developers to develop their land at the place which is within 500 meters of the landfill site.

41. We are of the opinion that the health of the people at large is of paramount importance rather than the right of the members of the respondent no.11 Association to develop the land by putting up construction on the same. We are also conscious of the fact that all those who are desirous of developing their land are likely to be put in difficulty but, at the same time, we cannot permit the authorities to grant development permission ignoring the statutory restriction and the hard reality existing as on today. To permit development and construction near the landfill site will be nothing short of pushing people to live at such a place where there is a potential health hazard and more particularly when the law itself prohibits a landfill site within a radius of 500 meters from a human habitat.

42. Our final conclusion is as under :

(1) The Ahmedabad Municipal Corporation committed an error in granting permission in favour of the respondent nos.1 and 2 for construction of the Paradise Park on the specious plea that

since the area in question is falling within the residential zone such permission was granted. We are saying so, because even at the time of grant of such permission, the Corporation was aware that there does exist a landfill site adjoining the site where construction was to be made.

(2) The reliance placed by the Ahmedabad Municipal Corporation on the letter dated 21st January 2011 of the Government of Gujarat, Forests and Environment Department, by which the Government asked the Corporation to consider the representation of the respondent nos.1 and 2 permitting them to go ahead with the project is also completely misplaced.

(3) The Government of Gujarat, Forests and Environment Department, vide letter dated 8th December 2010 addressed to the Corporation, had issued specific direction under Section 5 of the Environment (Protection) Act, 1986, to take the permission granted in favour of the Paradise Park in review and necessary action in that regard coupled with instructions to the local officers dealing with the grant of permission to the housing projects not to grant permission nearby the TSDF sites upto the distance of 500 meters and should not have once again asked the Corporation vide letter dated 21st January 2011 to consider the representation of the respondent nos.1 and 2 to go ahead with the construction on the ground that there were many residential projects near the TSDF sites already in existence.

(4) The respondent nos.1 and 2 cannot take advantage of such illegal permission granted by the Corporation dehors the statutory restriction as regards the distance to be maintained from the TSDF sites. If the respondent nos.1 and 2 are aggrieved in any manner or are of the view that they acted and proceeded with the construction on the strength of the permission which was granted by the Corporation, then it would be open for the respondent nos.1 and 2 to seek appropriate relief before the appropriate forum in accordance with law against the Corporation for damages. However, we make it clear that we have not gone into the question of damages and it would be for the appropriate forum to look into the same in accordance with law.

(5) The Ahmedabad Municipal Corporation shall not grant any permission to the housing projects nearby the TSDF sites within the radius of 500 meters in all parts of the city of Ahmedabad where such TSDF sites are located including the Building Use Permission to the respondent nos.1 and 2.

(6) In the report submitted by the experts, it has been stated that the respondent no.10 - Green Environment Service Cooperative Society has not provided vents in Cell No.3 due to which, during the inspection, the technical team was unable to carry out any sampling test/analysis of the emission from vents in Cell No.3.

(7) The respondent no.10 is directed to comply with the shortcomings and the deficiencies pointed out by the Committee in its report within a period of four weeks from today and inform about such compliance to the Committee so that the Committee can once again make an inspection to ensure that their suggestions have been complied with.

(8) The authorities are also directed to chalk out a plan or a project by which all borewells in the area within 500 meters of the landfill site could be closed over a period of time and necessary arrangements are made for adequate supply of potable water through pipelines.

(9) The State Government, the Gujarat Pollution Control Board and the Ahmedabad Municipal Corporation shall, in consultation with each other, proceed to act in accordance with the decision taken in the meeting convened on 5th September 2011 as discussed in para 18 of this judgment."

21. Based on this, it is argued that the point involved in the present appeals before us is fully covered by the decision in the case before the Hon'ble High Court of Gujarat. In the case in hand also, the CHWTSDF was located already since long and within 500 mtrs of buffer zone thereof EC has been granted to respondent No.5 – Project Proponent to raise construction of the residential building. The Hon'ble High Court of Gujarat has clearly interpreted the Guideline to the effect that the distance of 500 mtrs is required to be maintained as buffer zone from

the landfill site, which should not be treated only as Guideline, rather it should be treated to have a statutory restriction imposed by law or Rule and that no permission to develop the land within 500 mtrs of landfill site can be permitted at the cost of health of the people at large. In the case in hand, it is admitted by respondent No.5 - Project Proponent as well as respondent No. 4 SEIAA, Maharashtra and respondent No. 6 - Panvel Municipal Corporation that the site in question is within 500 mtrs of CHWTSDF where the project has been sanctioned and EC has been granted to the project which falls within 500 mtrs of the buffer zone of CHWTSDF. Therefore, the law laid down in the judgment in the case of ***Parth Mahila Utkarsh Mandal (N.G.O.) through Mahamantri*** (supra) is found to be fully applicable in the facts of the present case.

22. It has also been submitted from the side of respondent No.6 that the permission, which had earlier been granted, has been revoked. Therefore, this matter has become infructuous. But we are not in agreement with the said view point because in the order of revocation dated 27.06.2023, it has also been simultaneously mentioned that the Project Proponent is directed to modify and resubmit the proposal according to new notification of MIDC. Therefore, it appears that they still would consider the grant of permission under the same EC.

23. On the basis of argument which we have heard from the side of respondent No.6 and the position having been admitted by the respondent No.5 – Project Proponent that the project in question is falling within 500 mtrs of the CHWTSDF facility, which was already in existence, which cannot be permitted to be constructed in view of the law laid down by the Hon'ble High Court of Gujarat in the case of ***Parth Mahila Utkarsh Mandal (N.G.O.) through Mahamantri*** (supra), on this single count, the Environmental Clearance (EC) dated 25.07.2022

in both these appeals deserves to be set aside and it is accordingly set aside.

24. Both the appeals are accordingly allowed and disposed of. The pending I.As., if any stand disposed of.

25. No order as to costs.

Dinesh Kumar Singh, JM

Dr. Vijay Kulkarni, EM

August 21, 2023
APPEAL NOs.39-40/2022 (WZ)
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