

Disposal Criteria of Bhanpur Solid Waste Landfill Site: Investigation and Suggestions

Tapas Dasgpta

Research Scholar, AISECT University,

E-mail : dasgpta16@gmail.com

responsibility. Implementation of these modules will reduce

Abstract : *The solid waste management and design assist waste management officials in developing and encouraging environmentally sound methods for the disposal of "nonhazardous" solid waste. Promulgated under the authority of municipal act, the Municipal Solid Waste Landfill (MSWLF) regulation act establish a framework for planning and implementing municipal solid waste landfill programs at the state and local levels. This framework sets minimum standards for protecting human health and the environment, while allowing states to develop more flexible MSWLF criteria. Intension to mitigate or expeditiously remediate potential adverse environmental impacts resulting from municipal landfills. However, other regulations existed prior to the revised MSWLF standards discussed in this module. The promulgation Criteria for Classification of Solid Waste Disposal Facilities and Practices. The established regulatory standards to satisfy the minimum national performance criteria for sanitary landfills governs only those solid waste disposal facilities and practices that do not meet the definition of a MSWLF. Such facilities include waste piles, industrial nonhazardous waste landfills, surface impoundments, and land application units. Environmental Protect Authority (EPA) modified address the fact that these non-municipal non-hazardous wastes landfills may receive Conditionally Exempt Small Quantity Generator (CESQG) hazardous waste, further clarify that construction and demolition landfills may receive residential lead-based paint waste as Solid Waste Disposal Facilities without for MSWLFs as long as all conditions are met.*

KEY WORD : Location restrictions, operation criteria, design criteria, ground water monitoring, closure and post closure care & financial assurance criteria.

Introduction : This module provides a summary of the regulatory criteria for municipal solid waste landfills (MSWLFs). In general, a MSWLF is a landfill that accepts garbage, or solid waste, from households. Wastes that are typically landfilled include bottles, cans, disposable diapers, uneaten food, scraps of wood and metal, newspapers, paper and plastic packaging, and old appliances, as well as some industrial and commercial nonhazardous wastes and construction and demolition (C&D) wastes. MSWLFs may also accept household hazardous wastes and conditionally exempt small quantity generator wastes that are not regulated as hazardous wastes.

The MSWLF location restrictions, facility design and operation standards, groundwater monitoring and corrective action measures, closure and post-closure care, and financial

the environmental impact of existing and future MSWLFs.

General Requirements : A MSWLF unit is a discrete area of land or an excavation that receives household waste and may not be defined as a land application unit, surface impoundment, injection well, or waste pile.

Research, Development, And Emonstration Permits : To promote innovative technologies, EPA published rule to revise the criteria for MSWLFs to allow states to issue research, development, and demonstration (RD&D) permits to new and existing MSWLF units lateral expansions. The Director of an approved state may provide owners and operations variances from certain MSWLF criteria provided that compliance with the RD&D permit will not increase risk to human health and the environment. The specific criteria that are eligible for the variances are the run-on control systems, the liquid restrictions and the final cover requirement. No other variances from the criteria, unless already provided in the existing regulations, are allowed under the RD&D permit.

Location Restrictions : The regulations establish special siting restrictions and performance standards for six types of MSWLF site locations: airports, 100-year floodplains, wetlands, fault areas, seismic impact zones, and unstable areas. These six types of locations are sensitive areas that warrant additional regulatory controls. While all six location restrictions apply to new and laterally expanding MSWLF units, existing units are subject only to airport safety, floodplain, and unstable area controls. Unless the owner and operator of an existing MSWLF unit can make all applicable demonstrations required for airport controls, floodplains, and unstable areas. The owner and operator must also conduct post-closure activities, because these landfill siting regulations involve substantial geological investigation, certain terms used in the regulations are unusually technical.

Airport Safety Controls : Landfills can attract birds seeking food or nesting sites; therefore, landfills that are located near an airport may pose a risk of collisions between birds and aircraft. The airport safety restrictions is define a danger zone in which special care must be taken to ensure that the likelihood of collisions between birds and aircraft is reduced. These provisions apply to new MSWLFs, existing MSWLFs and lateral expansions located within 10,000 feet of any airport runway used by turbojet aircraft, or within 5,000 feet of any runway end used by piston-type aircraft only. The owner and operator of any unit located within these areas must demonstrate that the management practices of the landfill will minimize the incidents of bird hazards for aircraft.

Provided the owner and operator can make this demonstration, the airport safety criteria do not prohibit the disposal of solid waste within the specified distances. Likewise, the airport safety restrictions do not impact the location of airports or airport runways. However, municipal landfills and lateral expansions proposed within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport which includes provisions that amend the MSWLF location criteria. The amendments come after committee found that collisions between aircraft and birds have resulted in fatal accidents and pose special dangers to smaller aircraft. Since landfills have an inherent nature to attract birds, the law prohibits the location of new MSWLFs within six miles of airports served by general aviation aircraft and regularly scheduled flights of aircraft designed for 60 passengers or less. This restriction does not apply to existing landfills or expansions of existing landfills.

Floodplain Controls : Floodplain regulations establish guidelines that must be followed when a new or existing MSWLF or a lateral expansion is located in a 100-year floodplain. A unit subject to these provisions must be designed and operated to minimize its effect on both the 100-year flood flow and the temporary water storage capacity of the floodplain. The unit's owner and operator must provide evidence that the landfill will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste.

Wetlands Controls : Swamps, bogs, marshes, and other wetlands are unique, critical ecosystems that serve an important role in flood control, help filter wastes from water, provide an important breeding ground for fish and wildlife, and constitute an important recreational resource. EPA has placed a high priority on wetlands protection, but believes an outright ban of new MSWLFs or lateral expansions in wetlands could severely restrict the sites available for new or expanding landfills.

Fault Area Controls : Fault area restrictions ban the siting of new MSWLFs and lateral expansions within 200 feet of a fault that has experienced displacement in Holocene time (i.e., the past 11,000 years). This restriction reflects the Agency's belief that, in general, a 200-foot buffer zone is adequate to protect engineered structures, such as a new MSWLF, from seismic damage. In a state with an approved permitting program, however, the owner and operator may demonstrate that a setback distance less than 200 feet will prevent damage to the structural integrity of the unit and will be protective of human health and the environment.

Seismic Impact Zones : In unapproved states, new MSWLFs and lateral expansions cannot be sited in a seismic impact zone, In a state with an approved permitting program, however, a MSWLF may be located in a seismic impact zone if the owner and operator can prove that all containment structures, liners, leachate collection systems, and surface water control systems are designed to resist the anticipated movement in geologic features at the site.

Unstable Area Controls : Any location susceptible to events or forces capable of impairing a landfill's structural integrity is classified as an unstable area. Owners and operators must assess on-site and local factors, including soil conditions and geologic features, to determine whether an area is unstable. Unstable areas can include poor foundation conditions, areas susceptible to mass movement, and karst topography. New and existing MSWLFs and lateral expansions must not be located in an unstable area unless the owner and operator can demonstrate that engineering measures in the unit's design are sufficient to ensure that the integrity of structural components (e.g., composite liner and final cover) will not be disrupted.

Operating Criteria : Operating criteria are controls for the day-to-day management of a MSWLF. For example, owners and operators must have a program in place to exclude regulated quantities of hazardous waste and polychlorinated biphenyl (PCB) wastes. Additional requirements include daily cover material, controlling disease vector populations (such as rodents and mosquitoes), restricting public access, and maintaining appropriate records.

Cover Material Requirements : Exposed waste at landfills contributes to a range of health, safety, and aesthetic problems, such as disease vectors, fires, odors, blowing litter, and waste scavenging. To control these problems, requires that at the end of each operating day, a cover of at least six inches of soil be placed over exposed waste in a MSWLF.

Disease Vector Control : Disease vectors are rodents, flies, mosquitoes, or other animals and insects capable of transmitting disease to humans. As stated above, one purpose for the daily cover requirement is to prevent the facility from becoming a breeding ground, habitat, or feeding area for disease vector populations. If compliance with the daily cover material requirement is insufficient to ensure disease vector control, the facility owner and operator must employ additional methods (e.g., shredding the waste) to protect human health and the environment.

Explosive Gases Control : The decomposition of organic waste produces methane gas. High concentrations of methane in MSWLF structures or the facility area create an explosion hazard for employees, facility users, and occupants of nearby structures. To mitigate potential hazards, a routine methane monitoring program, conducted at least quarterly. It must be implemented in accordance with ensure that the following conditions are mentioned :

- In facility structures, the concentration of methane gas must not exceed 25 percent of the lower explosive limit for methane.
- At the facility property boundary, the concentration of methane gas must not exceed the lower explosive limit.

While the owner and operator must follow if these methane levels are exceeded, states with approved programs may establish alternative response procedures.

Access Requirements : Access to MSWLF facilities must be controlled to prevent unauthorized people from entering the MSWLF. Owners and operators of all MSWLFs may use artificial or natural barriers, as necessary, to control public access to the facility and prevent unauthorized vehicular traffic and illegal dumping of wastes.

Runoff Control Systems : To prevent the flow of surface water onto or from a landfill unit, requires all MSWLF units to have run-on and runoff control systems. The intent of the design, construction, and maintenance of a run-on control system is to prevent the flow of surface water onto the active portion of a unit during the period of greatest precipitation in a 25-year storm. These system controls are intended to mitigate erosion, reduce surface discharge of wastes in solution or suspension, and minimize run-on available to percolate down through waste that creates leachate. A runoff control system, likewise, must be designed and operated to collect and control the water volume resulting from a 24-hour, 25-year storm

Surface Water Requirements : The runoff control measures would be largely undermined if collected waters were improperly managed. Runoff collected from the active portion of a landfill unit must be managed in accordance with, which requires that all MSWLFs be operated in compliance with the Clean Water Act.

Noncontainerized Liquids : Restricting the introduction of liquids into a landfill reduces the unit's potential to generate leachate. According to the household waste (excluding septic waste), properly recirculated leachate, or gas condensate derived from the MSWLF may be disposed of in bulk or noncontainerized liquid form. Furthermore, the re-circulation of leachate or gas condensate in MSWLFs is limited to units equipped with composite liners and leachate collection systems. EPA is researching bioreactor landfills, which re-circulate leachate to accelerate the decomposition and stabilization of the waste, in order to identify and prioritize future regulatory needs. Containers holding liquids may be disposed of in a MSWLF only if the waste is a household waste, the container is similar in size to one typically found in household waste, or the container is designed to hold liquids for use other than storage.

Recordkeeping Requirements :MSWLF owners and operators must retain certain records and documents near the facility in an operating record. In unapproved states, the following materials must be kept in the operating record :

- Location restriction demonstrations required.
- Inspection records, training procedures, and notification procedures required.
- Gas monitoring results and any remediation plans required. MSWLF unit design documentation for placement of leachate or gas condensate in a unit as required.
- Demonstrations, certifications, findings, monitoring, testing, or analytical data required by groundwater

monitoring and corrective action.

- Closure and post-closure care plans and any monitoring, testing, or analytical data as required.
- Cost estimates and financial assurance documentation required.
- Information demonstrating compliance with the small landfill exemption required.

Design Criteria :To prevent unit failures, the regulations establish a uniform design standard for new units and lateral expansions, allowing for site-specific MSWLF designs in approved states. In states without approved permitting programs, the MSWLF design criteria require construction with a composite liner and leachate collection system.

Composite Liner System: The uniform design criteria require a composite liner and a leachate collection system. The composite liner system consists of an upper component, which is a flexible membrane liner (FML) that satisfies specific thickness standards. The lower component must be constructed of at least a 2-foot layer of compacted soil and must exhibit a hydraulic conductivity of no more than 1×10^{-7} cm/sec. EPA believes that the combination of an FML and a compacted soil layer ensures adequate protection by providing both a highly impermeable upper liner to maximize leachate collection and removal and a lower soil layer to serve as a back-up in the event of FML failure. The leachate collection system must be designed and constructed to maintain less than a 30-cm depth of leachate over the liner

Site-Specific Designs :Flexibility in design requirements is allowed for approved states. The performance-based requires that a MSWLF's design be capable of controlling migration of hazardous constituents into the uppermost aquifer. This design performance standard requires that maximum contaminant levels (MCLs) not be exceeded in the uppermost aquifer at the relevant point of compliance. In general, the relevant point of compliance must be located within 150 meters of the waste management boundary on the landfill owner's property.

Groundwater Monitoring And Corrective Action : Similar to the regulations for hazardous waste treatment, storage, and disposal facilities (TSDFs), MSWLF groundwater monitoring and corrective action requirements consist of three sequential phases. Detection monitoring, minimally required for all units, is designed to measure concentrations of certain indicator parameters. Statistically significant increases (SSI) in these indicators trigger groundwater assessment monitoring for hazardous constituents. Finally, a corrective action program is required if remediation of contaminated groundwater is necessary. Once established, groundwater monitoring must be conducted throughout the active life and post-closure care period of the MSWLF unit. While new units must be in compliance with the groundwater monitoring requirements prior to accepting waste, the compliance date in unapproved states for each existing landfill depends on its distance from a drinking water intake.

Groundwater Monitoring System Requirements : A groundwater monitoring system must be installed to yield samples from the uppermost aquifer that represent both the quality of background groundwater (usually from an upgradient well) and the extent of groundwater contamination at the waste management unit boundary (from downgradient wells). Each time groundwater is sampled, the owner and operator must determine the rate and direction of groundwater flow and measure the water elevation in each well.

The number, spacing, and depths of monitoring wells depend on site-specific characteristics such as aquifer thickness and groundwater flow rate and direction. Unless approved by the competent authority specifications must be certified by a qualified groundwater scientist. In addition, all monitoring well bore holes and other measurement, sampling, and analytical devices must be operated to meet design specifications for the duration of the groundwater monitoring program.

The Agency recognizes that local conditions can make installation of a monitoring well system around each landfill unit difficult. In approved states, multiple MSWLF units may share a common groundwater monitoring system, provided that sharing the multiple unit system is as protective of human health and the environment as installing a separate monitoring system for each unit.

Groundwater Sampling And Analysis Program : Consistent sampling and analytical procedures are essential to obtain reliable monitoring results that accurately measure hazardous constituents and other parameters established in either detection monitoring or assessment monitoring programs. Each MSWLF's groundwater monitoring program must be developed to ensure that monitoring results provide an accurate representation of groundwater quality at both background and downgradient wells. For example, sampling and analysis programs must include procedures and techniques for sample collection, sample preservation and shipment, analytical procedures, chain of custody control, and quality assurance and quality control (QA/QC) procedures.

Closure And Post-Closure Care :MSWLFs not adequately closed and maintained after closure may pose a continuing threat to human health and the environment. As with hazardous waste facilities, EPA established requirements for MSWLF closure and post-closure care to address wastes left in place at a facility may pose a threat even after disposal activities have ceased.

Closure Criteria :Closure standards require owners and operators to install a final landfill cover system that is designed to minimize soil erosion and infiltration of liquids through the cover. The cover's infiltration layer, consisting of at least 18 inches of earthen material, must be at least as impermeable as any bottom liner system or natural subsoils, but in no case may the permeability be greater than 1×10^{-5}

cm/sec. While this standard does not explicitly require the use of a synthetic membrane in the final cover, the Agency anticipates that if a MSWLF has a synthetic membrane in the bottom of the unit, then the infiltration layer in the final cover will, in all likelihood given today's technologies, include a synthetic membrane in the final cover. The erosion layer must be a minimum of six inches of earthen material that can sustain native plant growth.

Closure Plan :The owner and operator must prepare a written closure plan describing the measures necessary to close each MSWLF unit at a facility at any point during the unit's active life. The closure plan must include at least the following:

- a description of the final cover, and the methods and procedures used to install the cover
- an estimate of the largest area of the MSWLF that may ever require a final cover during the unit's active life
- an estimate of the maximum inventory of wastes maintained on site during the active life of the landfill facility
- a schedule for completing all activities necessary to satisfy the closure criteria specified.

Completion Of Closure Activities : In general, no later than 30 days after a MSWLF unit receives the final volume of waste, the owner and operator must begin closure activities. A unit with remaining capacity may receive additional wastes and is allowed one year following the most recent receipt of wastes to initiate closure activities. After closure begins, all closure activities must be completed within 180 days. Finally, the owner and operator must obtain either an independent registered professional engineer's certification approval verifying that closure has been completed in accordance with the established closure plan. In approved states, deadlines for closure activities may be extended.

Post-Closure Care Requirements : Post-closure care entails a 30-year period after closure during which the owner and operator must conduct monitoring and maintenance activities to preserve the integrity of a MSWLF system. The purpose of post-closure care is to ensure that landfills are closed in a manner that controls, minimizes, or eliminates the escape of waste, leachate, contaminated rainfall, or waste decomposition products to soils, waters, and the atmosphere. Post-closure care requires maintaining the following:

- the integrity and effectiveness of all final covers.
- the leachate collection system.
- the applicable groundwater monitoring system.
- the methane gas monitoring system required.

In addition to the closure plan, the owner and operator must prepare a written post-closure plan that provides a description of monitoring and maintenance activities, information identifying the facility contact for the post-closure period, and a description of the planned uses of the property during the post-closure period. Pursuant to, any planned uses must not disturb either the integrity of the final covers and liners or the function or components of the monitoring and containment

systems.

Following completion of the post-closure care period for each MSWLF unit, the owner and operator must obtain either certification of post-closure by an independent registered professional engineer or verification of completion of post-closure care activities. The certification or approval must indicate that post-closure care has been completed in accordance with the post-closure plan

Financial Assurance Criteria :Financial assurance criteria require demonstration of responsibility for the costs of closure, post-closure care, and known corrective action. EPA believes that compliance with these requirements will help ensure responsible planning for future costs. Adequate funds must be available to hire a third party to carry out all necessary closure, post- closure care, and known corrective action activities in the event that the owner and operator declare bankruptcy or lack the technical expertise to complete the required activities

Cost Estimates :The amount of financial assurance, using acceptable financial mechanisms, must equal the cost of a third party conducting these activities. To determine these costs each MSWLF owner and operator must prepare a written, site-specific estimate of the costs of conducting closure, post- closure care, and known corrective action.

Conclusion : **Closure**

The owner and operator must calculate a detailed cost estimate for closure based on the largest area of a MSWLF unit that may ever require a final cover during its active life. The cost estimate must equal the expense of closing the area when the extent and manner of operation would make closure most expensive.

The owner and operator must increase both the closure cost estimate and the amount of financial assurance maintained if the closure plan is adjusted or if changing unit conditions (e.g., increases in design capacity) raises the maximum cost of closure. The closure cost estimate and the amount of financial assurance maintained may also be reduced if, as a result of changes in facility conditions (e.g., partial closure of a landfill), the existing cost estimate exceeds the maximum cost of closure during the remaining life of the MSWLF unit. The owner and operator must document evidence supporting such a reduction.

Post-Closure Care : The financial assurance requirements for post-closure are similar to the requirements for closure of MSWLF units. The owner and operator must have a detailed, site-specific written estimate of the cost of hiring a third party to conduct post-closure care for the MSWLF unit. This cost estimate must account for the total costs of conducting post-closure care, including annual and periodic costs described in the post-closure plan. Post-closure care cost estimates must be based on the most expensive costs during the post-closure care period. As with closure cost estimates, changes in facility conditions or the post-closure plan may require the owner and operator to modify the post-closure care cost estimate and the amount of financial assurance.

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