

# NEW REGULATIONS FOR MUNICIPAL-SOLID-WASTE LANDFILLS TO PROTECT OUR GROUNDWATER

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## INTRODUCTION

Over the past two decades, landfill-disposal practices have changed, and the concepts of modern landfill design and operation have been developed. Robert K. Ham has described these developments.<sup>1</sup>

In the late 1960s, the use of daily-, intermediate-, and final-cover soil to seal and control the waste was well established. Also, in reaction to surface-water contamination, there was a tendency to site landfills away from surface water, including wetlands. By the early 1970s, groundwater contamination problems had led to siting landfills in areas with the greatest depth to groundwater, to siting landfills in tight soils such as fine silts and clays, and to the use of clay liners to compensate for sites which did not meet these hydrogeological criteria. By the mid-1970s, the so-called "bath-tub" effect of having leachate accumulate and oftentimes seep out the sides of the landfills had led to the use of drainage media and pipe networks within landfills to withdraw leachate. (Leachate is defined in federal regulations as "a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.")<sup>2</sup> By the late 1970s, the cost of handling leachate, plus the desire to limit the buildup of leachate within landfills, led to the use of final cover systems composed of clay or plastic caps. The resulting obstruction of the venting of landfill gases promoted gas migration into surrounding soils and channeled gas flow through cracks and fissures in the liner or cover, creating odors and potentially dangerous sources for gas migration. By the mid-1980s, at least in large landfills, gas was collected and either flared or used for some purpose. Historically, as Ham has indicated, changes in landfill design and in landfilling practices have resulted from the need to solve problems created by past actions.

From these developments there has emerged the concept of designing a landfill so that the waste is enveloped by a barrier system which, ideally, would isolate it from the local environment. Some of these developments have occurred, to some degree, in all states. However, the designs of and operating practices for municipal-solid-waste landfills (MSWLFs) vary greatly among the states and within each state. Although variations will remain, new federal regulations will require all landfills that dispose of municipal solid waste (MSW) to meet minimum nationwide standards if they operate on or after 9 October 1993.

## LEGISLATIVE BACKGROUND FOR THE NEW RULE

The new regulations were promulgated by the U.S. Environmental Protection Agency (EPA) under the authority of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, and under section 405 of the Clean Water Act. Since subtitle D of RCRA is the part of the act that establishes the framework for controlling the management of non-hazardous solid waste (hazardous waste management is controlled under subtitle C of RCRA), the new regulations commonly are called "subtitle D." The subtitle-D rule was proposed on 30 August 1988<sup>3</sup> and promulgated on 9 October 1991<sup>4</sup>. Major parts of it will take effect on 9 October 1993. The rule is published in Title 40 of the Code of Federal Regulations, part 258 (40 CFR 258).

## APPLICABILITY

The rule applies to existing MSWLF units, which are defined as those which are receiving waste as of 9 October 1993; to lateral expansions of existing

MSWLF units, defined as horizontal expansions of the waste boundaries of an existing unit; and to new MSWLF units which have not received waste prior to this date. MSWLFs which received waste after 9 October 1991 but which stopped receiving waste before the 1993 deadline are exempt from all the rule's standards except for the final cover requirements.

## PURPOSE AND STRUCTURE OF THE RULE

The purpose of the rule is to establish minimum national criteria for the location, design, operation, cleanup, and closure of MSWLFs, including MSWLFs used for sludge disposal and disposal of non-hazardous ash from MSW combustion. RCRA specifies that "the criteria shall be those necessary to protect human health and the environment and may take into account the practicable capability of owners and operators of solid waste disposal facilities."<sup>4</sup> RCRA also states that the basis for classifying a facility as a sanitary landfill and not an open dump is "if there is no reasonable probability of adverse effects on health and the environment."<sup>4</sup> EPA has interpreted the phrases "practicable capability" and "no reasonable probability of adverse effects" to allow for the consideration of costs of the criteria. Therefore, EPA has established criteria that allow to the states some flexibility in administering their individual MSW programs.

EPA intends that the individual states will implement and enforce the MSWLF criteria through their permit programs. In order for a state to do this, it must have its program approved by EPA, thus becoming, in the regulatory language, an "approved state." A state may be an "unapproved state" because its program has been judged to be inadequate or because it did not seek approval at all. Many states currently are seeking program approval but resource limitations may prevent them from meeting the deadline. Alabama (AL), Florida (FL), Georgia (GA), Kentucky (KY), Mississippi (MS), North Carolina (NC), South Carolina (SC), Tennessee (TN), Virginia (VA), and West Virginia (WV), ten states which will be referenced as "10 SE states" throughout this paper, all have administered their MSW programs under the previous criteria and each plans to administer its program under the revised criteria of the new rule. As recently as 24 March 1993, these 10 SE states were in various stages of the approval process: VA has acquired approval, pending some minor changes; KY submitted plans over a year ago and is close to acquiring approval; NC, GA, and FL have submitted drafts of plans to EPA; AL, MS, SC, TN, and WV are working

but have not submitted plans to EPA yet. The approval process requires the state regulatory agency to write its regulations, consistent with the subtitle D regulations, and have them adopted by the state. Given the complexity of the subtitle D rule, the flexibilities which require each state to decide how it will regulate where flexibilities are allowed, and the individual situations in a state which might cause its regulatory agency to want to enact some criteria which are more stringent than the federal criteria, this is not a simple process. Meanwhile, as the 9 October 1993 deadline approaches, state agencies have been busy specifying closure plans for those MSWLFs which are to be closed before the deadline, rewriting or modifying permits for some MSWLFs, and evaluating plans leading to the permitting of new MSWLF units.

Since the standards differ in approved and unapproved states, a logical question is, "What is expected of an owner/operator whose facility is sited in a state that is not an approved state?" In states without approved programs, EPA will require compliance with the specific federal standards in the rule, which it has written to be self-implementing wherever possible. However, certain provisions, such as the number, spacing, and location of groundwater-monitoring wells depend on site-specific conditions. In these cases, EPA has established performance standards and requires third-party certification to document compliance with them. Flexibilities are not available except in approved states.

Because a given state's regulations will affect the economic impact of the subtitle-D regulations on that state, the authors have gathered information about the differences in regulations among the 10 SE states. However, until the states have received EPA approval for their plans, regulations in those states are subject to being changed. Therefore the authors will not publish their summary of these differences until after such approval is granted.

In the narrative that follows, as the contents of the subtitle-D rule are presented, some of the specific, self-implementing standards will be noted along with the flexibilities available to states with approved programs. Only an overview of the regulations will be given. For details, dates for compliance, and guidelines for demonstrating compliance, the full body of the regulations must be studied.

## MAJOR PROVISIONS OF 40 CFR 258

The rule sets forth minimum federal criteria for MSWLFs, including:

- location restrictions
- operating criteria
- design criteria
- groundwater-monitoring and corrective-action requirements
- closure and post-closure care requirements
- financial assurance criteria

### LOCATION RESTRICTIONS

Location restrictions address the potential effects that a MSWLF may have on the surrounding environment, as well as the effects natural and man-made conditions may have on the performance of the landfill. Six topics are addressed by the location criteria: airport safety, flood plains, wetlands, fault areas, seismic impact zones, and unstable areas. All restrictions apply to new MSWLF units and to lateral expansions of existing units. Only the airport safety, flood plain, and unstable area restrictions apply to existing units, which either must meet these requirements or close by 9 October 1996. The criteria do not prohibit the location of a landfill in these areas, but specify the conditions under which this is allowed. Usually, what is required is that the owner/operator demonstrate to the director of an approved state program compliance with the criteria according to guidelines established by EPA and the state. For example, in unstable areas, which can include poor foundation conditions, areas susceptible to mass movement, and Karst terrains, the demonstration must show that engineering measures have been incorporated into the design of the unit to ensure that the integrity of the structural components of the unit will not be compromised.

### OPERATING CRITERIA

The operating requirements, developed to ensure the safe daily operation and management at MSWLFs, will take effect on 9 October 1993 and will apply to all facilities in operation on or after that date. These requirements include: the exclusion of hazardous waste, the use of daily cover, control of disease vectors and explosive gases, air monitoring, facility access, run-on/run-off-control systems, restrictions on liquids disposed of, and recordkeeping requirements.

## DESIGN CRITERIA

New MSWLF units and lateral expansions of existing MSWLF units must comply with either a design standard or a performance standard. The design criteria are not applicable to existing units, which may expand vertically to address short-term capacity needs.

The design standard, set to be protective in all locations, must be used in states without EPA-approved permit programs. It is a composite liner system comprising at least two feet of soil with a hydraulic conductivity of  $10^{-7}$  centimeters per second (cm/sec), overlain by a flexible membrane liner (FML) and a leachate-collection system that is designed and constructed to maintain less than a 30-centimeter depth of leachate over the liner. The thickness of the FML must be at least 30 mils. If the FML is made of high density polyethylene (HDPE), its thickness must be 60 mils. The FML component must be installed in direct and uniform contact with the compacted soil component.

The performance standard is available only to MSWLFs located in approved states. A performance-based alternative design must demonstrate the capability of maintaining contaminant concentrations of 24 specified analytes; including metals, solvents, pesticides, and herbicides; below maximum contaminant levels (MCLs) in the uppermost aquifer at the facility's relevant point of compliance (RPOC), which will be determined by the state. The MCLs, based on health considerations as guided by the Safe Drinking Water Act, are maximum concentrations of contaminants allowed in water used for drinking. The relevant point of compliance can be located a maximum of 150 meters from the waste management unit boundary, defined as the vertical surface which is located at the hydraulically downgradient limit of the unit and which extends down into and through the entire thickness of the uppermost aquifer. In unapproved states, this waste management unit boundary is the RPOC. Most of the 10 SE states plan to set this RPOC at the unit boundary or within 100 feet of the boundary.

The performance-based design has been established, according to EPA, to allow design innovation and to allow states to consider site-specific conditions in their approval of alternative designs.<sup>5</sup> It is predictable that many states will incorporate the specified design standard into their regulations as the minimum design requirement, with their regulations written so that the state can require designs which are even more



protective in some circumstances. Some states may require a more protective design as their minimum requirement.

## **GROUNDWATER MONITORING AND CORRECTIVE ACTION**

Under the new rule, all landfills (new units and existing units) will be required to install groundwater-monitoring systems except where the director of an approved state program suspends the requirements because there is no potential for migration of leachate constituents from the facility. The criteria include requirements for location, design, and installation of the systems and set standards for ground-water sampling and analysis. Furthermore, specific statistical methods and design criteria are provided for identifying a significant change in groundwater quality. If a significant change in groundwater quality occurs, the regulations require an assessment of the nature and extent of contamination, followed by an evaluation and implementation of remedial measures.

The groundwater-monitoring systems for new units must be installed before new units are operational. For existing units, the compliance schedule depends on their location relative to drinking-water intakes. For distances of one mile or less, between one and two miles, and more than two miles, the compliance dates are 9 October 1994, 9 October 1995, and 9 October 1996, respectively. Approved states may establish alternative schedules but must ensure that 50% of all existing units are in compliance by the 1994 date and that all are in compliance by the 1996 date. Some of the 10 SE states will require all their MSWLFs to be compliant with these regulations on 9 October 1993.

Each monitoring system must be designed to obtain representative samples from the uppermost aquifer. These samples must characterize the background quality of the groundwater and the quality of ground-water passing the relevant point of compliance (in approved states) or at the waste management unit boundary (in unapproved states). The number, spacing, and depths of monitoring wells may be based on site-specific conditions, but a qualified groundwater scientist or the director of an approved state must certify that the system complies with the performance standards in the rule.

The sampling and analysis program is in three stages: detection monitoring, assessment monitoring, and corrective action. This scheme is very similar to the approach currently used at hazardous-waste landfills.<sup>6</sup>

Detection monitoring, which must continue for the active life of the facility and during post-closure, requires semi-annual monitoring for the 62 indicator parameters (15 metals and 47 volatile organic compounds) listed in appendix I to 40 CFR 258. Background concentrations also must be established for these parameters. Detection of any of the indicator parameters at a statistically significant level above established background levels triggers an assessment monitoring program.

The purpose of assessment monitoring is to evaluate whether specific waste constituents, in addition to those identified during detection monitoring, are present at statistically significant levels above background levels. The additional constituents are 213 chemicals which are listed in 40 CFR 258, Appendix II. When a constituent from this list is detected at a statistically significant level, a ground-water protection standard (GWPS) must be set. The GWPS will be the MCL for the constituent if a drinking-water standard (MCL) has been set for it. Since MCLs have not been set for all constituents in Appendix II, the background concentration level is to be the GWPS for constituents lacking MCLs. During assessment monitoring, there must be annual analysis for all 213 constituents in addition to semi-annual resampling for any detected constituent and semi-annual monitoring for the 62 indicator parameters (the detection monitoring program does not end when assessment monitoring begins). If subsequent monitoring indicates an increase over the GWPS, the owner/operator must characterize the nature and the extent of contamination, and the facility moves into the corrective-action phase.

During corrective action, the owner/operator must evaluate alternative corrective measures, select the appropriate remedy, and implement it. Meanwhile, semi-annual monitoring for all Appendix I constituents and for those Appendix II constituents exceeding GWPSs must be performed.

Approved states are allowed to modify the constituents for which monitoring is required, the sampling frequency, the groundwater-protection standards, or the length of a required corrective action if they believe such modifications are appropriate based on site-specific conditions. Additionally, an approved state has the authority to determine that corrective action is not necessary in certain situations.

## CLOSURE AND POST-CLOSURE CARE REQUIREMENTS

Plans for closure and for post-closure care must be prepared by 9 October 1993 for all MSWLFs that receive waste on or after that date. Each MSWLF unit must be closed in accordance with specified standards, which require installation of a final cover designed to minimize infiltration and erosion. Post-closure care is required for 30 years (approved states may increase or decrease this period) and includes, among other requirements, the continuation of groundwater monitoring, gas monitoring, and leachate management.

## FINANCIAL ASSURANCE REQUIREMENTS

Owners or operators of all MSWLFs in operation on or after the 1993 deadline (except for states and the federal government) will be required to demonstrate financial responsibility for the costs of closure, post-closure care, and corrective action for known releases of contaminants. The regulations detail several mechanisms which may be used.

## ESTIMATED COMPLIANCE COSTS

EPA estimates that the total annualized compliance cost of the new standards will be 330 million dollars.<sup>4</sup> This equates to an average disposal-cost increase of \$2 per ton, which is about 4% more than the current average cost nationally (\$46 per ton).<sup>6</sup> The average incremental cost per household is projected to be \$4 per year.

Current disposal costs in some of the 10 SE states are much lower than \$46 per ton. Many unlined landfills are operating in these states without being required to monitor groundwater. Where groundwater monitoring is practiced, the program is less stringent than it will be under subtitle D. The authors believe that the compliance cost in the 10 SE states will cause the disposal-cost increase in these states to exceed EPA's estimates. Also, the authors believe EPA has underestimated the costs to the nation.

## REFERENCES

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