GUIDANCE DOCUMENT #692

Division of Materials & Waste Management
October 2014 (originally published on November 3, 2004)[1]

Constructing Recompacted Soil Liners and Soil Barrier Layers

Applicable Rules

MSW: OAC 3745-27-08(D)(8) and (21)
OAC 3745-27-08(E)
ISW: OAC 3745-29-08(D)(8) and (21)
OAC 3745-29-08(E)
RSW: OAC 3745-30-07(C)(1)
OAC 3745-30-07(F)(1) to (3)
OAC 3745-30-09(F)(3)(a)
Tires: OAC 3745-27-72(C)(1) and (9)(b)

DMWM Cross Referenced guidance document

#665 *Use of the Best Fit Line of Optimums (BFLO) for Test Pad and Recompacted Soil Liner/Barrier Layer Construction*

Purpose

This document provides suggestions regarding construction of the recompacted soil liners (RSL) in the composite liner system and the soil barrier layer (SBL) in the composite cap system.

Applicability

This document is applicable to municipal (MSW), industrial (ISW), and residual (RSW) solid waste landfill and scrap tire monofills with an RSL and RSW SBLs (a test pad is not required[2] for MSW and ISW SBLs).

Detailed Discussion

The rules establish design and construction standards for RSLs and SBLs. One of the more critical design requirements for RSLs and SBLs is permeability. However, instead of destructively testing the RSL and SBL construction, test pads are used to assure that the material and construction method will attain the required permeability. A number of questions have arisen over the years regarding how RSLs and SBLs are to obtain the required permeability.

THE RELATIONSHIP OF COMPACTION AND MOISTURE CONTENT IN TEST PADS, AND IN THE RSL AND RSW SBL

The construction of the RSL and RSW SBL must meet (1) the minimum standards established in the rules and (2) the construction details established by the test pad. Therefore, although the rule may establish a minimum compacted density of 95% of the standard proctor or 90% of the modified proctor and a moisture content wet of optimum, the construction of the test pad further refines these limits in order to assure that the permeability of the recompacted soil will be $< 1 \times 10^{-7}$ cm/sec.

In order to provide owners and operators with the widest range of moisture content and density values, DMWM recommends that test pads be constructed with compaction and moisture content values close to the minimum specifications desired for the construction of the RSL and the RSW SBL. The results from the test pad will be used to confirm whether or not the specifications are acceptable for obtaining the required permeability during field scale construction.

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[1] Note: This document was originally published on the date noted above. DMWM re-issued the document to make it consistent with current formatting and publication standards after evaluating the content and determining it is still relevant and appropriate. No substantive changes were made to the document.

[2] Although the rules may not require a test pad, if the permit requires a test pad, a test pad must be constructed.

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Although a best fit line of optimums would not replace the test pad, it can be used to establish the minimum moisture content and density for recompacting soils. See DMWM guidance #665 *Use of the Best Fit Line of Optimums (BFLO) for Test Pad and Recompacted Soil Liner/Barrier Layer Construction* for more information.

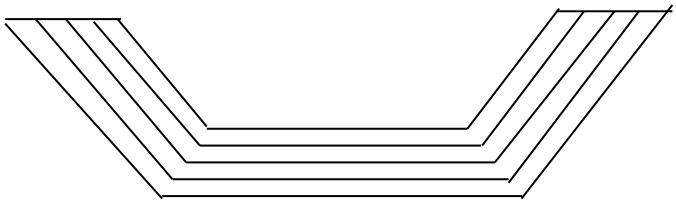
The Relationship of Test Pad K_H and K_V from ASTM D6391 and Construction of the RSL

Flow through recompacted soil can occur through the soil matrix and through lift interfaces. In matrix flow, the horizontal permeability is usually between 2 and 10 times greater than the vertical permeability. For interface flow, dye studies have shown that leachate can follow vertical flaws to the more permeable lift interface (usually a symptom of poor compaction, for example, due to thick loose lifts), and follow the horizontal interface to another vertical flaw, and so on, until the liner is breached.

The most commonly used field permeability test for test pads is ASTM D6391 (two stage borehole). ASTM D6391 provides the ability to measure the hydraulic conductivity in the horizontal (k_h) and vertical (k_v) directions. However, the rules do not distinguish between horizontal and vertical permeability.

Review of literature on this topic favors using the k_v from ASTM D6391 as the controlling component for permeability when RSL construction is parallel to the side slope and k_h when RSL is constructed against the side slope. Recompacted soil is naturally anisotropic, with the horizontal permeability between 2 and 10 times greater than the vertical permeability. A ratio greater than this could indicate poor lift bonding and that the construction methods are probably not adequate.

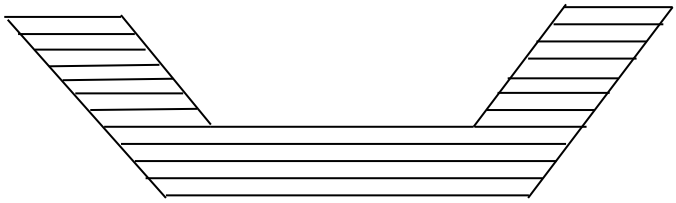
For liners constructed parallel to the slope:



Vertical permeability controls, therefore:

$k_v \leq 1x10^{-7}$ cm/s.

For liners constructed in horizontal lifts against a slope:



Both components of permeability are critical, therefore:

$k_h \leq 1x10^{-7}$ cm/s and $k_v \leq 1x10^{-7}$ cm/s.

Contact

If you have questions regarding this document or would like additional information, please contact:

Central District Office DMWM Supervisor (614) 728-3778

Northeast District Office DMWM Supervisor (330) 963-1200

Northwest District Office DMWM Supervisor (419) 352-8461

Southeast District Office DMWM Supervisor (740) 385-8501

Southwest District Office DMWM Supervisor (937) 285-6357

Central Office Authorizing Actions and Engineering Unit (614) 644-2621

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