

# Landfill Capping Research

Current Federal Regulations – Minimum technical requirements for closure of Municipal Solid Waste Landfills (MSWLFs) regulated under Resource Conservation and Recovery Act (RCRA) Subtitle D are contained in Title 40 of the Code of Federal Regulations, Section 258.60 (40 CFR 258.6).

The regulation allows either a minimum criteria cover system or a performance-based cover system design. The specific requirements of that regulation are as follows.

- (a) Owners or operators of all MSWLF units must install a final cover system that is designed to minimize infiltration and erosion. The final cover system must be designed and constructed to:
  - (1) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than  $1 \times 10^{-5}$  cm/sec, whichever is less and
  - (2) Minimize infiltration through the closed MSWLF by the use of an infiltration layer that contains a minimum 18-inches of earthen material, and
  - (3) Minimize erosion of the final cover by the use of an erosion layer that contains a minimum 6-inches of earthen material that is capable of sustaining native plant growth
- (b) The director of an approved state may approve an alternative final cover design that includes
  - (1) An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (a) (1) and (a) (2) of this section, and
  - (2) An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in paragraph (a) (3) of this section

More on Title 40 of the Code of Federal Regulations, Section 258.60 (40 CFR 258.6) at <http://www.ecfr.gov/cgi-bin/text-idx?SID=c988bb17c76932acc2e107a1aa586033&mc=true&node=sp40.27.258.f&rgn=div6>

Current State Regulations – NR 504.07, Minimum Design and Construction Criteria for Final Cover Systems - [https://docs.legis.wisconsin.gov/code/admin\\_code/nr/500/504](https://docs.legis.wisconsin.gov/code/admin_code/nr/500/504)

- All final cover systems shall be designed to minimize leachate generation by limiting the amount of percolation through the cap system, reduce landfill maintenance by stabilizing the final surface through design of compatible slopes and establishment of vegetation, account for differential settlement and other stresses on the capping layer, minimize the climatic effects of freeze-thaw and desiccation on the clay capping layer of the final cover system, and provide removal of leachate and venting of gas from those landfills which accept wastes with a high moisture content or which readily biodegrade
- All new landfills and expansions of existing landfills shall be designed with a final cover system meeting the requirements in subs (2) to (9) unless it is established to the satisfaction of the department that portions of the final cover system are not needed based on the proposed waste types and the proposed design.

Subsections (2) through (9) require the following final cover system layers, from bottom to top:

- Minimum 6-inch-thick grading layer
- Minimum 2-foot-thick clay cap meeting the same specifications as the clay liner system, or a geosynthetic clay liner (GCL) overlaying a 2-foot-thick soil barrier layer
- Geomembrane with nominal thickness of 40 mils or greater
- Minimum 2.5-foot-thick drainage and rooting zone layer

- Minimum 6-inch-thick topsoil layer
- Vegetation

The language included in subsection NR 504.07(1)(B), Wisconsin Administrative Code (WAC), provides some flexibility for WDNR to consider and approve an alternative final cover system design as long as it can meet the design criteria established in subsection NR 504.07(1)(a), WAC.

#### Research Development & Demonstration (RD&D)

(Bareither et al 2014 WDNR OSR Rpt) – An RD&D permit provides owners with the flexibility to reduce run-on surface water control, add supplemental liquids other than leachate, and use alternative final cover designs to enhance waste moisture content. Approved operations under an initial RD&D permit are limited to 3 year trial periods. Three renewals of the RD&D Permit can be obtained under current USEPA regulations, culminating in a maximum period of 12 years for RD&D actions  
 Visit, [http://docs.legis.wisconsin.gov/code/admin\\_code/nr/500/514](http://docs.legis.wisconsin.gov/code/admin_code/nr/500/514) for more information on Wisconsin’s regulation for RD&D under NR 514.1

#### Organic Stability Rule

(Bareither et al 2014 WDNR OSR Rpt. (Pg. 6)) “Wisconsin’s landfill Organic Stability Rule (OSR) requires owners and operators of municipal solid waste landfills to “incorporate landfill organic stability strategies into the plans of operation for their facilities.” Specifically, the rule requires that landfill owners submit a plan to the Wisconsin Department of Natural Resources for “significantly reducing the amount of degradable organic material remaining after site closing in order to materially reduce the amount of time the landfill will take to achieve landfill organic stability.” Organic stability is viewed as a state of near complete decomposition of organic waste constituents such that human health, environmental and financial risks associated with undecomposed waste are reduced.

#### **Description of topic**

The Organic Stability Rule has been in place since 2007 and is required for landfills “(1) new or expanded landfills as of 1 January 2007, (2) landfill plans of operation approved between 1 January 2004 and 1 January 2007, and (3) active landfills where current filling operations have not achieved 50% of design capacity as of 1 January 2012.” (Bareither et al 2014 WDNR OSR Rpt. (Pg. 11)) Some elements of traditional capping methods may be at odds with the goals of the Organic Stability Rule. Alternative capping methods offer an opportunity to improve results within the Organic Stability Rule, and may also provide other advantages. Alternative capping methods should be evaluated, taking into account the Organic Stability Rule as well as current federal regulations and current state regulations.

The follow are a list of alterative capping methods and organic management around Wisconsin and the rest of the country.

1. Organic Diversion
  - a. Organic diversion is the process of diverting organic material such as food waste and yard waste from the landfill to allow for more space and less time to wait for decomposition and organic stability to take place
2. Evapotranspirative or Water Balance Cover
  - a. “The ability to balance storage of water corresponding to an acceptable level of percolation with the ability of plants and the atmosphere to remove stored water and replenish the water storage capacity of the cover profile.”

- b. This method allows for additional water to seep into the landfill to aid in faster decomposition.
  - c. Might emit too much methane
  - d. Gets to balance faster
  - e. Pair this with native vegetation
3. Delayed Final Cover Schedule
  - a. This method can be paired with any capping scenario, it is a delay in final cover capping for up to two years (delay beyond two years requires Plan of Operation Modification)
  - b. Maximize decomposition before being capped.
  - c. This method has been approved in Wisconsin at two landfills
  - d. Benefit is that it allows time for OSR settlement
  - e. Airspace may become available to fill – would need to get a plan mod for this
4. Leachate Recirculation
  - a. [http://www.epa.ohio.gov/portals/34/document/guidance/gd\\_602.pdf](http://www.epa.ohio.gov/portals/34/document/guidance/gd_602.pdf)
  - b. The process of reintroducing collected leachate back into the landfill
  - c. Improves leachate quality, faster stabilization of landfill and enhancement of gas
5. Liquid Waste Addition
  - a. The process of adding liquid sludges to the landfill to initiate a faster process of decomposition
6. Native Vegetation
  - a. The use of native vegetation can be utilized with the clay composite, GLC composite and water balance final cover systems
  - b. Aesthetically pleasing, encourages wildlife
  - c. Improved erosion control, water absorption and reduced maintenance for the landfill
7. Other types of caps
  - a. Exposed geomembrane
  - b. Solar
  - c. Long term or sacrificial intermediate caps
  - d. Other

#### Traditional Capping Includes

1. Clay or GCL Composite Final Cover System

#### List of possible work efforts or solutions

- It is recommended that more research goes into the Delay Final Cover method to find out what happens after the permitted delayed time is up and also what would it take for the WDNR to standardize this method in Wisconsin
- Reach out to the two landfills in Wisconsin that have received approval for Delay Final Cover method to find out what worked for them to have this approved
- Research more into Evapotranspirative final cover system
- Encourage WDNR to standardize landfill capping evaluations

#### Potential subgroup

				
Albright et al 06 clay cover performance.pdf	Albright et al 2013_field hydrology f	Apinwantragoon et al 2015_field hydrology v	Bareither et al 2014_WDNR OSR Rpt.	Benson & Bareither 2012_water balance c