Iowa Department of Natural Resources
Solid Waste Section of Land Quality Bureau

Related to

567 IAC 113.8(2)"b"(4) Freeze/thaw effects to landfill liner

September 26, 2012

The following is applicable to Municipal Solid Waste Landfill (MSWLF) units constructed with a composite liner system, pursuant to Iowa Administrative Code (IAC) 567-113.7(5)"a"(1), and may be placed in the operating record and provided to the department as adequate documentation that freeze/thaw effects had no adverse impact on the compacted clay component of the liner.

Background

Rule 567 IAC 113.8(2)"b"(4) requires:

> *"The owner or operator must place documentation in the operating record and submit a copy to the department that adequate cover material was placed over the top of the leachate collection system in the MSWLF unit or that freeze/thaw effects had no adverse impact on the compacted clay component of the liner."*

This rule is intended to provide a performance based standard that is flexible yet still accomplishes the goal of protecting the compacted clay portion of the liner from freeze/thaw damage.

Demonstrating performance requires monitoring soil temperatures with thermocouples or re-testing the compacted clay liner. Because the onset of freezing temperatures is variable this approach is troublesome for landfill operators and requires adequate cover material or select waste to be stockpiled and readily available. Stockpiling waste is undesirable and cover materials may be costly and potentially damaging to the drainage layer's hydraulic conductivity. If damage to the liner or drainage layer is suspected, the Department may require the landfill operator to investigate and assess the damage and then make repairs. Repair of damage can be very costly. If the compacted clay is not repaired, then the Department cannot concur with the construction certification report, in which case, the landfill operator cannot fill with waste. Landfill operators are reluctant to take this risk and instead, construct smaller MSWLF units to ensure that four feet of waste (an acceptable frost protection measure) can be placed over the entire liner system prior to the ground freezing. Building smaller MSWLF units means more frequent construction and generally higher unit construction costs.

In the case of steep or long side slopes, placing a frost protection layer can be difficult. Placing a thin veneer of cover material lends itself to sliding off of the slope. Damage caused by heavy machinery while installing materials is the most significant cause of damage to geomembranes.

Decision

The Department has considered the factors above and approves of the following approach for demonstrating that freeze/thaw effects had no adverse impact on the compacted clay component of the liner:

> **Except for portions of the sideslope greater than 10 feet above the base liner, a layer of solid waste at least 4 feet thick, or an adequate amount of other frost protection material, shall be placed over the leachate collection system in all portions of the lined area prior to December 31st of the year following the year the clay portion of the liner was constructed. After this date, solid waste may not be placed on any portion of the base liner or lower 10 feet of the sideslope not covered with a 4–foot thick layer of solid waste or other adequate frost protection material. Those portions of the base liner or lower 10 feet of sideslope not covered with a 4–foot thick layer of solid waste or other frost protection material by this date shall be investigated for density and effects from freeze–thaw as specified by the department and shall be repaired and recertified during the next construction season if required, prior to waste placement.**

Justification

The Department believes that this decision addresses the concerns encountered in the implementation of 567-113.8(2)"b"(4) and will continue to provide adequate protection to composite liner systems. This approach allows the liner system to go through the first winter season without frost protection. The benefit of doing so means less frequent construction, and stockpiling of waste or placing of frost protection material. Studies[1] show that frost damage can occur after one freeze/thaw cycle, but these same studies indicate that 12 lb/in^2 of overburden stress (about 25 ft. of overlying soil and waste material) will decrease the hydraulic conductivity to its value before freezing. Because it may take several years for enough waste to be put in place before the original hydraulic conductivity is achieved, it is important that there are no leaks in the geomembrane liner. Most leaks through the geomembrane are a result of construction errors or inappropriate methods for placement of the drainage layer. Having an electrical leak location survey of the geomembrane liner or the QCA officer provide 100% observation of liner and drainage layer installation are recommended methods to minimize leaks in the liner.

This approach also reduces the likelihood of damage to the liner from equipment stress while trying to place a thin layer of frost protection on the sideslopes or the cover layer sliding off of the slope. As with the base liner, the same concerns exist for frost damage to the exposed sideslopes. This further supports the need to ensure that there are no defects in the geomembrane.

In the alternative, the owner or operator may continue to utilize past procedures or other means to document that adequate cover material was placed over the top of the leachate collection system in the MSWLF unit or that freeze/thaw effects had no adverse impact on the compacted clay component of the liner.

The Department intends to revise IAC 567-113.8(2)"b"(4) in the future with language similar to the alternate language above.

Alex Moon

Alex Moon
Supervisor, Solid Waste Section

10/8/2012

Date

[1] Edwin J. Chamberlain, Allan E. Erickson, and Craig H. Benson, "**Frost Resistance of Cover and Liner Materials for Landfills and Hazardous Waste Sites,**" US Army Cold Regions Research and Engineering Laboratory Special Report 97_29, December 1997.

Benson, C.H., Chamberlain, E.J., Erickson, A.E., and Wang, X., "**Assessing Frost Damage in Compacted Clay Liners,**" Geotechnical Testing Journal, GTJODJ, Vol. 18, No.3, September 1995, pp. 324-333.