Landfill Partial Final Covers

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State of Florida Solid Waste Rules in Chapter 72-701 of the Florida Administrative Code require landfills to receive final cover within 180 days of reaching final grades. This requirement leads to closing landfill slopes in phases, normally referred to as partial closure. Generally, partial closures start from the bottom of the landfill slope up to a certain elevation, with geosynthetics in the final cover temporarily anchored along the partial closure's sides and upper boundaries (Photo 1). Engineers propose different designs for securing the lower boundary of partial closures at the bottom of the landfill slope. Some engineers propose an anchor trench outside the bottom lining system anchor trench to secure the final cover geosynthetics. Others specify welding the cover geomembrane to the bottom lining system geomembrane.

Photo1: Partial closure of landfill slope

Photo 2: LTDS under construction below cover geomembrane

Final Cover Anchor Trench at Perimeter Berm
Experience with anchor trenches for the final cover geosynthetics at the bottom of the landfill slope where the perimeter berm is located has not been positive because of these issues:

- Landfill gas may escape through the opening between the bottom lining system anchor trench and the final cover anchor trench.
- Leachate seeps below the final cover geomembrane that reach the bottom of the landfill slope may penetrate the landfill perimeter berm through the opening between the two anchor trenches.
- High concentrations of landfill gas may be detected along the landfill perimeter berm at the location of the two anchor trenches during surface emissions monitoring.
- If high leachate levels are developing above the bottom lining system, landfill leachate may escape through the opening between the two anchor trenches.
- A suitable landfill gas collection system below the final cover geomembrane, at the lower boundary of the landfill slope, collects gases accumulating in the area. This is an important consideration because the closest gas collection well may be more than 250 ft. away, up on the slope.
- A rainwater toe drain system above the final cover geomembrane, at the bottom of the landfill slope, collects and drains the water in the final cover geocomposite.

Welding of Final Cover Geomembrane to the Bottom Lining System Geomembrane
To eliminate these issues, engineers weld the final cover geomembrane to the bottom lining system geomembrane for cases where there is a bottom lining system below the waste. The welding completely seals the landfill interior space from the outside environment and keeps regulated materials, such as waste, leachate and gas, within the sealed system. Of course, the engineer should design proper means to address these elements behind the sealed system; designs may include:

- A leachate toe drain system below the final cover geomembrane at the bottom of the landfill slope to collect and convey leachate seep liquids to the leachate collection system at the bottom of the landfill.

Leachate Toe Drain System (LTDS)
Leachate toe drain system is a concept originally developed by SCS and incorporated into landfill final cover designs more than 20 years ago. Unfortunately, many solid waste engineers are unaware of the need for LTDS, so their designs lack this important feature. LTDS saves a tremendous amount of repair money in the long run by avoiding complications for landfill operators.

Engineers install an LTDS at the landfill perimeter berm below the final cover geomembrane to collect leachate seep liquids that flow down the slope, below the final cover geomembrane. LTDS allows collected liquids to flow to the leachate collection system at the bottom of the landfill (Photo 2).

Engineers also install vertical pipes on the LTDS pipe at certain intervals to remove excess gas pressure from underneath the final cover geomembrane in the lower part of the slope (photo 3).

Rainwater Toe Drain System (RTDS)
A rainwater toe drain system removes water that moves laterally within the final cover geocomposite toward the slope's bottom. The RTDS includes a perforated HDPE pipe encased in gravel and wrapped in geotextile. Along the landfill slope's bottom, the RTDS is positioned behind a HDPE flap welded to the final cover geomembrane. The RTDS is sloping with high and low points along the alignment (Photo 4). Lateral drain pipes located at low points remove water from the RTDS to the perimeter ditch.

Other designs that involve extending the geocomposite to daylight at the slope surface cause problems such as:

- Excessive vegetation impacts the opening of the geocomposite at the outlet edge
- Soil erosion from higher-up clogs the opening of the geocomposite at the outlet edge
- Algae growth at the opening of the geocomposite at the outlet edge
- Gradual discharge of water from geocomposite softens the perimeter berm soils in the vicinity of the outlet edge
- Water percolates into the landfill perimeter berm and causes stability issues
- A slippery surface develops along the outlet edge on top of the landfill perimeter berm, creating a health and safety issue for landfill personnel

Photo 3: Vacuum pipe connected to LTDS pipe.

Photo4: RTDS completed above Cover Geocomposite

Install the RTDS on terraces along the depression on the interior side of the terrace. Direct discharge from the final cover geocomposite can cause the same issues discussed previously on landfill terraces. There is proven track record of success that makes RTDS a superior design.

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