REEXAMINING ALTERNATIVE EARTHEN COVERS

The US EPA and a group of collaborators are conducting a research program, called the Alternative Cover Assessment Program (ACAP), on how landfill covers that use soil and vegetation only compare with conventional clay and composite covers. The 2003 ASCE *Civil Engineering* article "Examining the Alternatives" reported on ten conventional cover and 14 alternative earthen final cover (AEFC) 10m x 20m field-test sections with lysimeters constructed at 11 landfills across the country to access durability and effectiveness (seepage). Preliminary field data had been collected for at least two years from all but one site. The hydrologic performance was summarized in the following groups: AEFCs in arid and semiarid locations, AEFCs in humid and subhumid locations and conventional covers in both locations.

The AEFCs in semiarid and arid sites had generally allowed little percolation, most rates being less than 1.5 mm/yr. However, an AEFC at Sacramento allowed significant percolation. Here the thin cover allowed percolation of 130 mm/yr and the thicker cover allowed 8.5 mm/yr. The vegetation proved ineffective in removing the stored water during the 2001 growing season. As a result, much of the water stored from the previous winter remained in the cover, leading to inadequate storage capacity the following winter.

AEFC performance at humid and subhumid sites has not been uniform. Two sites that used poplar trees had excessive percolation rates of 177 and 150 mm/yr their first year. The two AEFCs at Omaha and the AEFC at Marina, CA all of which used grasses, also allowed considerable percolation during the first year.

The conventional covers being evaluated included three covers that used compacted clay as the sole barrier layer and seven composite barriers. Percolation rates from compacted clay only barriers have been inconsistent. This has been identified at one site to be due to flow through desiccation cracks in the compacted clay only barrier.

Percolation rates from the composite barriers, including two containing geosynthetic clay liners (GCLs), had been very low. The geomembrane in the composite barrier test plots had been intentionally punctured with an 11 mm hole to supposedly simulate construction defects in a geomembrane. Recently, the leaders of the ACAP study have put on a series of workshops. At these workshops the investigators admitted that this puncture frequency of 1 hole per 200 m^2 was exaggerated. They concede that 1 hole per 2000 m^2 is more realistic. Thus, they have scaled back by a factor of ten the measured leakage that was originally reported in the *Civil Engineering* article. The revised leakage through composite barriers reported at the workshops was:

- GM/GCL: 0.0 mm/yr
- GM/CCL: 0.1-2.3 mm/yr

Given the results so far, the field data indicate that AEFCs can be effective in providing low percolation rates in dry climates provided that the vegetation is mature enough to remove the available water during the growing season. **However, the ACAP investigators recommend AEFC test plots with lysimeters before building a full-scale AEFC. The lysimeter should be designed**

as shown in Figure 1 and include a root barrier, incremental layer and geocomposite layer in order to minimize the potential for a false low percolation flow.

The ACAP investigators chose an allowable percolation rate of 3 mm/yr based upon the expected leakage of a GM/CCL composite barrier and MSW regulations that call for alternative covers to be equivalent to a prescriptive GM/CCL composite barrier. In humid and subhumid climates, ACAP percolation rates have been higher than allowed for some of the AEFCs. **The key climate factors that were determined to result in excessive leakage in an alternative earthen cover are:**

- **Annual precipitation > 300 mm/yr**
- **Maximum daily precipitation > 30 mm/day**
- **Snow and spring rainfall > 250 mm/yr**
- **Precipitation/Potential ET > 0.2**

Thus, designers should consider composite GM/GCL covers in regions that have one of these climate factors noted above.

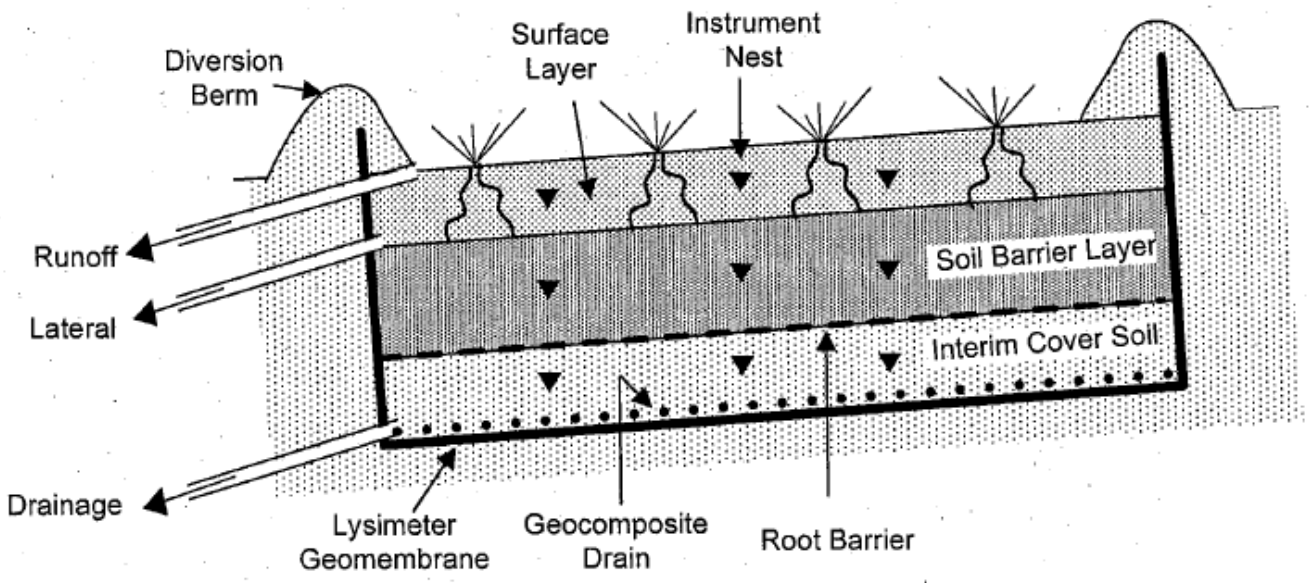

Figure 1. Recommended Lysimeter