USEPA Alternative Cover Assessment Program (ACAP)

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Introduction

Traditional designs for final landfill covers have utilized components such as geomembranes and low-permeability soil layers to minimize infiltration into waste. Federal regulations allow for alternative earthen designs that emphasize water storage and transpiration by plants, but require demonstration of performance equivalent to that of the low-permeability conventional designs. Few field data sets exist that provide direct measurement of conventional or alternative cover performance. In 1999, the U.S. Environmental Protection Agency's Alternative Cover Assessment Project (ACAP) began construction of a nationwide network of field-scale facilities designed to evaluate the performance of both prescriptive and alternative covers.

Materials and Methods

Cover designs are being tested in large (10 m x 20 m) pan lysimeters(Benson et al. 1999). Field data include direct measurement of drainage, surface runoff, soil moisture content, soil moisture potential, precipitation, and several additional meteorological parameters. At several locations, conventional designs are being tested alongside alternative designs. Prescriptive covers include both composite (which include a geomembrane) and compacted clay designs. Tested alternative designs typically emphasize relatively thick soil layers with high water holding capacity combined with a selection of plants designed to maximize transpiration throughout the soil depth and throughout the growing season. Modeling of the covers was performed using the HELP and UNSAT-H codes and used meteorological data collected from the field effort as well as soil parameters developed from in-situ samples collected during construction of the test sections.

Results and Discussion

The data collected to date indicate that AEFCs designed with adequate storage capacity can be effective in limiting percolation to low (<1.5 mm/yr) levels in arid and semi-arid areas provided the vegetation removes the available water during the growing season (Roesler et al. 2002). However, much higher percolation rates can be realized if the storage capacity is inadequate or the vegetation is ineffective. Less satisfactory performance has been observed for the AEFCs in humid climates where there is more water to manage. The vegetation has not yet matured at the humid sites, however, and the data from the second year of observation suggest that the performance of these AEFCs is improving as the vegetation matures.

The data from the conventional covers indicate that conventional covers with composite barriers are effective in limiting percolation in all climates (<1 mm/yr in dry climates; <7 mm/yr in humid climates) provided they are constructed in a manner that protects the geomembrane from damage. In contrast, the data from conventional covers relying only on clay barriers indicate that the compacted clay barriers can become ineffective even after a short service life. Even in humid climates, cracking of clay barriers can occur within several months of placement.

In some cases an AEFC can perform equally as well as a conventional cover, at least over the relatively short period of monitoring to date. More definitive conclusions in this regard will be possible after longer data records are collected from the ACAP test sections. These data will also be valuable for defining typical percolation rates for conventional and alternative covers, as well as equivalency criteria for alternative cover evaluations.

Precipitation and Percolation for ACAP Test Sections in Humid Climates. Data Reported Through 9/25/02.

Site	Start Date	Cover Type	Total Precipitation (mm)	Total Percolation Rate (mm)	2001-02 Precipitation (mm)	2001-02 Percolation Rate (mm/yr)
Albany, GA	4/19/00	Conventional Compacted Clay	2243	697.7	998	255.0
		Alternative Monolithic	2568	263.4	1007	84.7
Monterey, CA	05/27/00	Conventional Composite	626	35.2	333	26.6
		Alternative Monolithic				67.1
Omaha, NE	10/05/00	Conventional Composite	1140*	5.5	1041*	0.0
		Alternative Cap. Barrier (Thin)		98.7		4.8
		Alternative Cap. Barrier (Thick)		55.7		0.0

Precipitation and Percolation for ACAP Test Sections in Semi-Arid and Arid Climates. Data Reported Through 9/25/02

Site	Start Date	Cover Type	Total Precipitation (mm)	Total Percolation Rate (mm)	2001-02 Precipitation (mm)	2001-02 Percolation Rate (mm/yr)
Albany, GA	4/19/00	Conventional Compacted Clay	2243	697.7	998	255.0
		Alternative Monolithic	2568	263.4	1007	84.7
Monterey, CA	05/27/00	Conventional Composite	626	35.2	333	26.6
		Alternative Monolithic				67.1
Omaha, NE	10/05/00	Conventional Composite	1140*	5.5	1041*	0.0
		Alternative Cap. Barrier (Thin)		98.7		4.8
		Alternative Cap. Barrier (Thick)		55.7		0.0

References

Benson, C., Abichou, T., Wang, X., Gee, G., and Albright, W. (1999). Test Section Installation Instructions– Alternative Cover Assessment Program, Environmental Geotechnics Report 99-3, Dept. of Civil and Environmental Engineering, University of Wisconsin-Madison.

Roesler, A.C., C.H. Benson, W.H. Albright, 2002. Field Hydrology and Model Predictions for Final Covers in the Alternative Assessment Program – 2002. Geo Engineering Report No. 02-08, Geo Engineering Program, University of Wisconsin-Madison, Madison WI.