

Water Balance Data from the Alternative Landfill Cover Demonstration

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A large-scale field demonstration comparing final landfill cover designs was constructed and is currently being monitored at Sandia National Laboratories in Albuquerque, New Mexico. Two prescriptive cover designs were constructed side-by-side with four alternative landfill covers designed for dry environments (Figure 1). The demonstration is intended to evaluate the different landfill cover designs based on their respective water balance performance, ease and reliability of construction, and cost.

The Alternative Landfill Cover Demonstration (ALCD) test covers include a prescriptive RCRA Subtitle 'D' Soil Cover, a prescriptive RCRA Subtitle 'C' Compacted Clay Cover, and four alternative covers: a Geosynthetic Clay Liner (GCL) Cover, a Capillary Barrier, an Anisotropic Barrier, and Evapotranspiration (ET) Cover. The RCRA Soil and Compacted Clay Covers were constructed to serve as baselines for comparison against the alternative cover designs

The test covers are each 13 m wide by 100 m long. The 100 m dimension was chosen because it is representative of many hazardous and mixed waste landfills found throughout the DOE complex (approximately 2 acres in surface area). All covers were constructed with a 5% slope in all layers. The slope lengths are 50 m each (100 m length crowned at the middle with half of the length, 50 m, sloping to the east and the other 50 m sloping toward the west). The western slope component of the covers are monitored under ambient conditions. A sprinkler system was installed in each of the eastern slope components to facilitate stress testing of the covers.

Continuous data collected from the test covers include: soil moisture status, percolation, lateral drainage, and surface runoff. An on-site weather station obtains precipitation, solar radiation, temperature, wind speed and direction, and humidity. All measurements are made with automated monitoring systems to provide continuous data (Dwyer et al. 1998). Manual backup systems are available for use in case of failure in one or more of the automated measurements systems and/or to verify accuracy of the automated systems. Periodic measurements on vegetation cover, biomass, leaf area index, and species composition are also obtained (Wolters et al. 2000).

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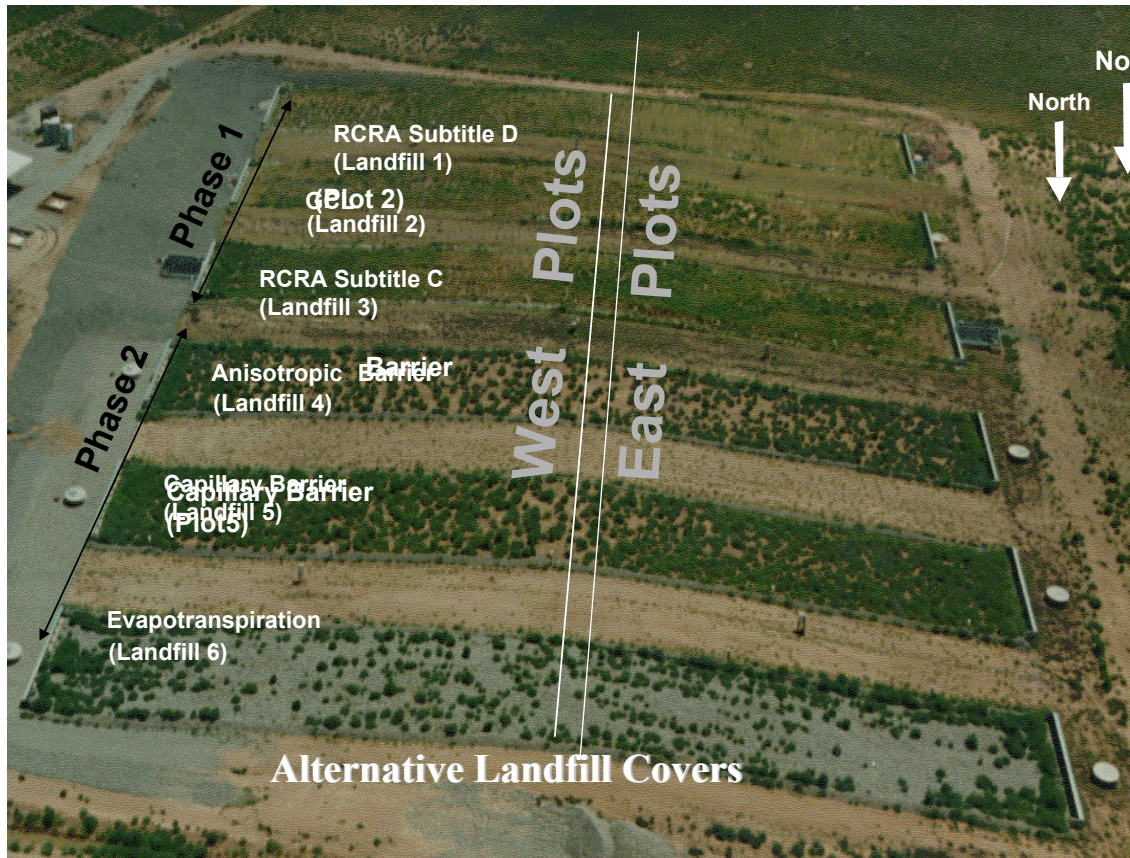


Figure 1. Test Cover Layout

The water balance equation used is:

$$E = P - I - R - D - \Delta S;$$

where: precipitation plus applied water if any (P), surface runoff (R), lateral drainage (D), evapotranspiration (E), soil water storage (S), and percolation or infiltration (I) are the six water balance variables.

The measured percolation and precipitation data collected to date (Dwyer et al 2000) is presented below in tabular format. The first year of monitoring (1997) was a relatively wet year. The precipitation values listed in Table 1 include the periods May through Dec of 1997 and January through June of 2000 as well as all of 1998 and 1999. The last two years (1999 and 2000) have been extremely dry years.

Precipitation Totals	
Year	Volume (liters)
1997 (May 1 - Dec 31)	154,585
1998	169,048
1999	130,400

2000 (Jan 1 - Jun 25)	28,151
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Table 1. Measured Precipitation Values at the ALCD Site

The measured percolation values for each landfill test cover are presented in Table 2. The percolation data was converted into a respective flux rate (mm/year) for each cover (Table 3).

Year	Percolation Totals (l)					
	Subtitle D	GCL	Subtitle C	Capillary Barrier	Anisotropic Barrier	ET
1997 (May 1 - Dec 31)	3974	564	46	607	57	84
1998	2764	210	169	456	77	243
1999	1740	2401	20	472	155	6
2000 (Jan 1 - Jun 25)	0	0	0	0.02	0	0
Total	8478	3175	235	1535	289	333

Table 2. Measured Percolation Values of Test Covers at the ALCD Site

Year	Flux rates (mm/year)					
	Subtitle D	GCL	Subtitle C	Capillary Barrier	Anisotropic Barrier	ET
1997 (May 1 - Dec 31)	10.62	1.51	0.12	1.62	0.15	0.22
1998	4.96	0.38	0.30	0.82	0.14	0.44
1999	3.12	4.31	0.04	0.85	0.28	0.01
2000 (Jan 1 - Jun 25)	0.00	0.00	0.00	0.00	0.00	0.00
Average	4.82	1.81	0.13	0.87	0.16	0.19

Table 3. Flux Rate Values of Test Covers at the ALCD Site

References:

1. Dwyer, SF, B Reavis, G Newman. Alternative Landfill Cover Demonstration, FY2000 Annual Data Report. Sandia Report SAND2000-2427.
2. Dwyer, SF, J Lopez, R Aguilar. 1998. Data Quality Management Plan (DQMP) for the Alternative Landfill Cover Demonstration Project. Sandia Report SAND98-2050.
3. Wolters, G. L, G. C. Newman, S. F. Dwyer. 2000. FY97-99 Vegetation Analysis of ALCD Soil Amended Landfill Cover Plots. Sandia Report *in print*.