

ALTERNATIVE LANDFILL COVER DEMONSTRATION

TECHNOLOGY NEED

An EPA study of contaminant migration at 163 randomly selected landfills concluded that current landfill practices needed improvement. Problems were discovered at 146 of the 163 sites. Another study sponsored by the California Environmental Protection Agency revealed that as high as 86% of existing landfills are failing. All areas of the country have experienced some form of water contamination due to leachates from landfills.

Current cover design criteria emphasizes barrier layers that block infiltration of water through the cover into the waste. The measurement of saturated hydraulic conductivity is the method chosen by the EPA to define the effectiveness of the barrier layer (e.g., The lower the hydraulic conductivity, the more effective the layer.). This is not a practical solution in arid and semi-arid regions because saturation of cover soil layers is rarely, if ever, achieved.

The saturated hydraulic conductivity method can actually be detrimental to covers in arid and semi-arid regions. In order to achieve the low saturated hydraulic conductivity required by the EPA, the barrier soil must be remolded by compacting it 'wet of optimum' which eventually leads to the soil drying, shrinking, and cracking leaving the barrier layer ineffective. These cracks provide pathways for the infiltration of water. This defeats the original purpose of creating a barrier layer to block the infiltration of water into the waste.

The Alternative Landfill Cover Demonstration (ALCD) is developing technologies to improve current landfill cover systems. The project will provide alternatives to the EPA's landfill cover designs that will work more effectively and be easier and less expensive to install in arid and semi-arid climates. It is also working to improve regulatory acceptance of alternative landfill cover designs for use across the DOE complex.

TECHNOLOGY DESCRIPTION

The ALCD is testing innovative landfill covers using currently accepted EPA cover designs as baselines. These covers are installed and instrumented in a side-by-side demonstration. The covers built include two baseline covers: a conventional Resource Conservation and Recovery Act (RCRA) Subtitle D Soil Cover, a conventional RCRA Subtitle C compacted clay cover, and four alternative covers utilizing, respectively, a geosynthetic clay liner, a capillary barrier, an anisotropic barrier, and evapotranspiration. One half of each test plot will be evaluated under ambient conditions and the other side will be evaluated under "stressed" conditions controlled by a rain simulation system. The demonstration is intended to evaluate the various cover designs based on their respective water balance performance, ease of construction (including the use of local materials), and cost.

The key to gaining general acceptance of any new environmental technology is obtaining regulatory acceptance. The ALCD is addressing this issue by involving environmental divisions from the western states and the EPA in the project. This is key in obtaining acceptance of the new technologies and is encouraging interstate cooperation. The Western Governors' Association through its Committee to Develop On-Site Innovative Technologies (DOIT) has worked with Sandia to promote this interstate cooperation.

BENEFITS

- This effort should result in effective landfill cover designs that are longer lasting and less expensive for arid and semi-arid regions.
- The ALCD costs should be less expensive than current systems because this effort should result in more efficient landfill cover designs tailored to specific site requirements by a decision support system.

- The use of native soils will greatly reduce costs normally associated with clays and membranes that are required by the EPA.
- Costs for the alternative cover technologies are less than half that of current EPA RCRA Subtitle C traditionally covers.
- National interest is widespread waiting for data. This data can then be used to apply for permits for the use of the alternative cover technologies in lieu of traditional cover technologies saving millions and ultimately billions of dollars nationally.

CAPABILITIES/LIMITATIONS

The ALCD will yield data that will enable the deployment of better performing, cheaper landfill covers savings the DOE millions of dollars. The covers will be longer lasting and will be easier and more reliable to build than currently used technologies. The covers tested in the ALCD are generally limited to dry environments such as that found in the Southwestern part of the United States where DOE has a large number of facilities and landfill to be closed.

COLLABORATION/TECHNOLOGY TRANSFER

The ALCD has collaborated with the Environmental Protection Agency, State Environmental Departments in 15 Western states, the EPA's Risk Reduction Laboratory, US Forest Service, City of Albuquerque, Los Alamos National Laboratory, Western Governor's Association, Department of Defense, and the Bureau of Land Management.

ACCOMPLISHMENTS

The test covers have all been constructed as well as the entire test facility. The automated data acquisition system is up and running. Monitoring has recorded a year and a half of data. Many reports have been published gaining a widespread national interest. The project has been presented as the featured topic at the annual American Society of Civil Engineers (ASCE) convention in San Diego and will be the featured article in an upcoming Civil Engineering Magazine article.

Papers and Reports:

- Dwyer, S.F. "Alternative Landfill Cover Demonstration", Proceedings Geotechnical Special Publication No. 53: Landfill Closures Environmental Protection and Land Recovery, San Diego, CA, (October 1995).
- Dwyer, S.F. "Cost Comparisons of Alternative Landfill Covers", Proceedings, International Containment Technology Conference and Exhibition, St. Petersburg, Florida (February 1997).
- Webb, S.W., J.T. McCord, S.F. Dwyer "Prediction of Tilted Capillary Barrier Performance", Proceedings, International Containment Technology Conference and Exhibition, St. Petersburg, Florida. (February 1997).
- Dwyer, S.F. "Landfill Covers for Dry Environments", Proceedings, International Topical Meeting on Nuclear and Hazardous Waste Management - SPECTRUM96, Seattle Washington. (August 1996).
- Dwyer, S.F. "Quality Assurance Plan - Alternative Landfill Cover Demonstration" Internal Sandia National Laboratories Document. (1995).
- Dwyer, S.F. "Construction Specifications and Drawings - Phase I, Alternative Landfill Cover Demonstration" Internal Sandia National Laboratories Document. (1995).
- Dwyer, S.F. "Construction Specifications and Drawings - Phase II, Alternative Landfill Cover Demonstration" Internal Sandia National Laboratories Document. (1996).
- Dwyer, S.F. "Test Plan - Alternative Landfill Cover Demonstration". Internal Sandia National Laboratories Document. (1994).
- Dwyer, S.F. "Commercialization Plan for the ALCD" DOE Report. (1994).
- Dwyer, S.F. "Large-Scale Field Study of Landfill Covers at Sandia National Laboratories", Conference Proceedings, Landfill Capping in the Semi-Arid West: Problems, Perspectives, and Solutions, Eds. T. D. Reynolds and R. C. Morris, Jackson Lake Lodge, Grand Teton National Park. (May 21 and 22, 1997).

- Lopez, J., S.F. Dwyer, J. N. Swanson. "TDR Calibration for the Alternative Landfill Cover Demonstration (ALCD)". Sandia Report, SAND97-2317. (September 1997).

TECHNICAL TASK PLAN (TTP) INFORMATION

TTP No./Title: AL2-8-C2-21 - Alternative Landfill Cover Demonstration

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Aerial view of Alternative Landfill Demonstration Site near Albuquerque, New Mexico