# LINER AND FINAL COVER OPTIMIZATION MIXED WASTE STORAGE/DISPOSAL FACILITY AT LOS ALAMOS NATIONAL LABORATORY

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## ABSTRACT

Los Alamos National Laboratory is planning to construct a mixed waste landfill to serve the needs of the environmental restoration program. The landfill will consist of up to 19 steep-walled pits to safely dispose of mixed, low-level waste. The use of the steep-wall design required that the RCRA regulations for liner requirements be carefully review. Los Alamos is proposing to use geosynthetic clay liners (GCLs) on the pit side walls, which will be a unique application of this product. Laboratory (and possibly field) geotechnical testing is planned to test the GCLs prior to finalization of design. The final cover design will make use of a natural, graded soil cover system that will include a capillary break, a bio-barrier zone including boulders and cobbles, and a composite impermeable layer to further limit infiltration.

## DESCRIPTION OF PROJECT

The planned landfill disposal project will be one of the first proposed mixed waste landfills to serve a Department of Energy facility. The landfill will be constructed below grade in volcanic tuff, which will enable the use of steep side walls. The facility will also be one of the first to seek a variance from the January 1992 EPA double liner requirements, taking into account facility design and location. Emissions from the facility will be controlled by constructing a temporary building over each waste pit so that all waste handling and placement operation are conducted indoors. This will virtually eliminate liquid and airborne contaminants. The water-table is situated several hundred feet below the mesa top, so, coupled with an unsaturated zone monitoring system, this will preclude any contamination of ground water. After the building is removed, a multilevel, vegetative cover will be added that will take advantage of the local climate's favorability to high evapotranspiration to control seepage through the final cover. Wastes will either be treated prior to placement to meet land ban restrictions, or a variance will be obtained, and waste placement, including stabilization, will be managed to control settlement.

While remediation under the Los Alamos Environmental Restoration Program will not formally enter the remedial action phase until later this decade, voluntary interim measures can be implemented at any time during the investigation and evaluation process. The availability of the MWSDF will facilitate the timely remediation of contaminated sites and will allow site investigations to serve also as documentation that remediation has been successful. Figure 1 illustrates the design at this point in the planning process.

## REQUIREMENTS FOR PIT LINER DESIGN

The landfill will be excavated into the volcanic tuff formation found on the mesa tops at Los Alamos. Low-level radiological wastes have previously been placed in pits at Los Alamos in this manner. The pit dimensions for the mixed waste landfill will be limited so a temporary building can be built over the pit. This building will allow all waste placement operations to be accomplished indoors. The pit will be 45 feet deep, and benches will be used as intermediate side-wall-liner anchor locations.

In compliance with EPA RCRA regulations and applicable NRC/EPA guidance, the side and bottom of the disposal pits will be lined with a double-liner system. Because of the steep pit side walls (four vertical to one horizontal), it will be necessary to find an alternative to the three feet of clay required by EPA as the outer component of the secondary composite liner. The innovative Geosynthetic Clay Liners (GCLs) offered by several manufacturers were selected as a possible clay replacement. These liners would also require a regulatory variance.

Specific concerns that were addressed included past experiences with GCLs on steep slopes, approved regulatory variances from the specified liner thicknesses, anchoring approaches for the membranes, alternate cap designs, and chemical compatibility concerns.

## DETAILED INVESTIGATIONS

Hydrologic water balance modeling was conducted to document the differences in seepage through the proposed cap system. With the use of the cap systems tested at Los Alamos, the high evapotranspiration design allows virtually no seepage through the top cover layers. The underlying geomembrane and clay (or GCL) layers will serve as back-ups and will divert infiltration during spring snow melt. Cover slopes were set fairly flat to blend with local grades and to minimize erosion.

No precedents were found for regulatory variances in similar situations. Many applicants are proposing to use GCL as part of a composite in the primary liner system; capping systems are also being proposed in which GCLs would be used in areas or situations where clay would be unsuitable or economically unavailable. One other steep-walled installation is being proposed for mixed waste, but the side wall liner is being eliminated.

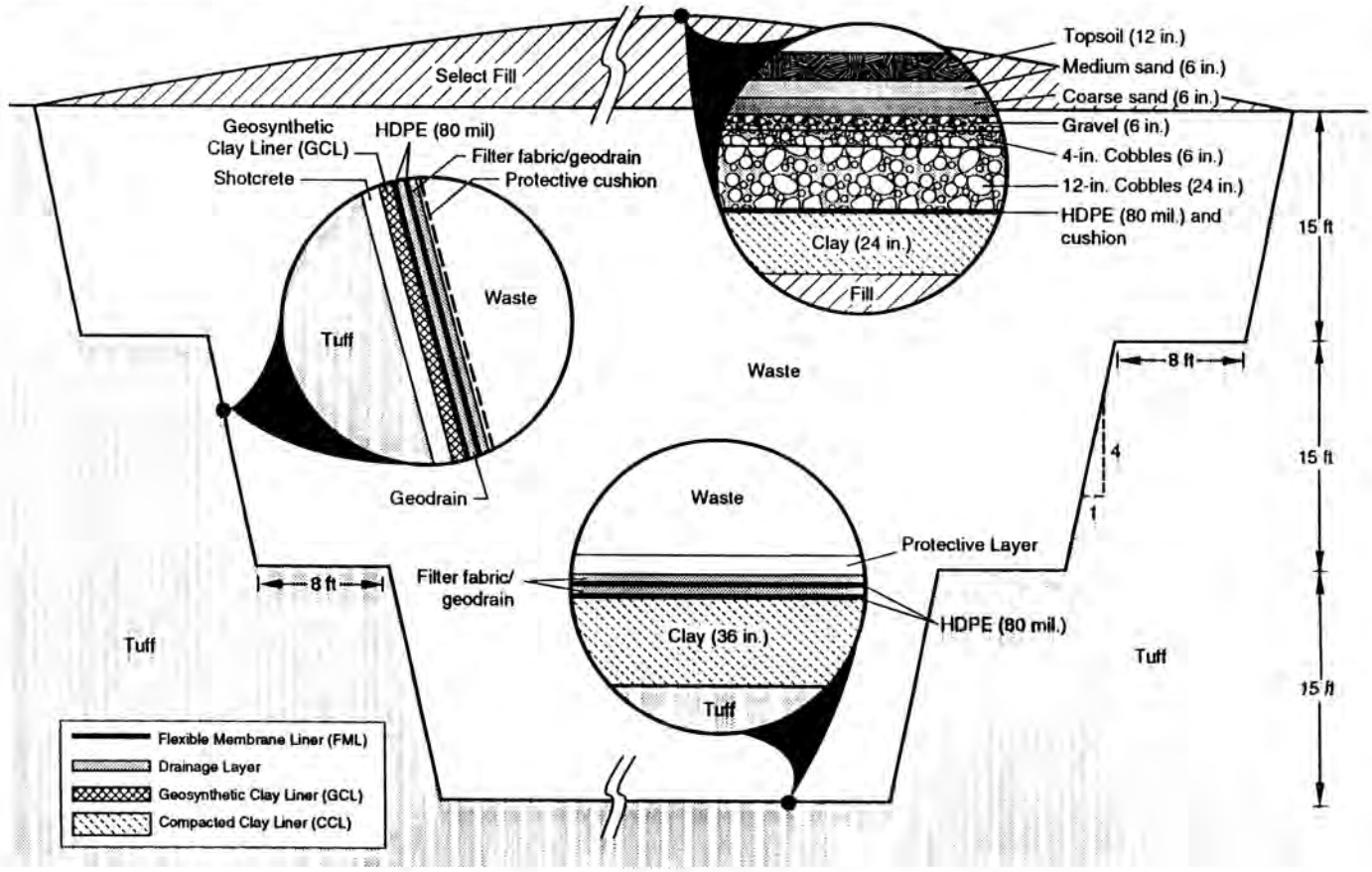


Fig 1. MWSDF recommended design schematic cross section.

It was determined that the pit walls must be prepared with shot-crete before any liner system can be placed. Studies are planned to determine the physical characteristics of the liner system in the proposed sequences and combinations. Comparative testing is planned for the three GCLs in combination with geomembranes, geonets, filter fabrics, and cushions. The data obtained from the laboratory tests will allow the designer to select side-wall liner components and to accurately predict anchoring requirements.

## FINDINGS AND RECOMMENDATIONS

The vegetation layer is very effective in virtually eliminating seepage through the cap. Long-term performance will be improved by reliance on natural materials to maximize evapotranspiration. A flexible geomembrane will be included below the natural materials to control expected infiltration during snow melt.

A geosynthetic clay liner will be designed for the cap and will underlie the geomembrane. While more expensive than clay, the GCL will better withstand settlement, and its installation can be scheduled easier.

The use of a GCL on the side walls will limit the vertical height between benches to less than 15 feet. Because the complexity of the required anchoring systems and the small probability and minimal contribution of infiltration on the sides, elimination of the geosynthetic side-wall layer may be considered, pending regulatory agreement.

The 3-foot clay layer will be retained as the lower component of the secondary liner, as per RCRA regulation. A GCL, as a lower component of a primary composite, is not necessary because the facility is located in a semi-arid climate.

If placed wastes are not stabilized or precompacted prior to placement, the voids between containers, and any voids in and around bulk wastes, must be filled to prevent any unplanned (and unacceptable) settlement of the cap.

Future analysis will address specific physical parameters of standard and custom-designed geosynthetics, modeling of the liner systems for strength and performance, and support of permitting and performance assessment requirements.