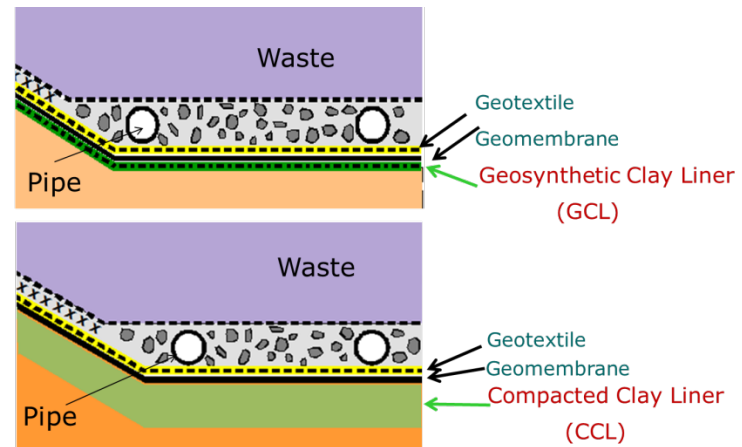


## Long-term Performance of Clay Liners for Landfill Applications

Composite barrier systems are used in modern landfills to isolate the landfill contents from the environment and, therefore, to provide environmental protection and prevent groundwater contamination problems. A typical composite liner system consists of a Geosynthetic Clay Liner (GCL) or compacted clay liner (CCL) overlain by a plastic geomembrane (high density polyethylene, HDPE) to minimize the escape of contaminants from the landfill.

GCLs consist of a dry bentonite clay layer between two layers of geotextiles for a total thickness of 0.5-1.0 cm in comparison to CCLs which consist of a 0.75-1.0 m thick layer of compacted clay with a permeability of less than  $1 \times 10^{-9}$  m/s.



Godfrey landfill testing site, Queen's University

This project studies the long-term hydraulic performance of landfill liner systems under simulated field conditions. Extensive experimental and numerical modelling has been performed to quantify the hydration, shrinkage and hydraulic conductivity of various liner systems under simulated landfill conditions.

GCL panel shrinkage in California, Thiel et al., 2005



This research leads to developing design guidelines and recommendations related to (a) the allowable exposure conditions for GCLs and CCLs used in composite liners; (b) the type of GCL or clay soil that should be used if the composite liner must be exposed for any period of time after construction; (c) the desirable water content of the foundation soil; (d) the effect of subsoil on the rate of moisture uptake by the GCL and the potential for shrinkage; and (e) changes that may be needed to improve the hydraulic performance of GCL and CCL under exposed landfill conditions. This information will be essential to both consultants designing these facilities and regulators who approve their construction.

