

# Research & Research Training Office

## Special Seminar

July 9, 2007

R. Kerry Rowe FRSC, FCAE, FEIC, FASCE, FIE(Aust), FCSCE  
Vice-Principal (Research) and Professor of Civil Engineering  
Queen's University  
Professor, GeoEngineering Centre at Queen's-RMC  
Kingston, Ontario, Canada

### **Abstract:-**

#### **Long-Term Performance of Contaminant Barrier Systems**

Barrier systems for waste containment facilities typically include both permeable drainage and low permeability liner components and are constructed using a combination of natural and geosynthetic materials. This lecture describes the latest findings with respect to the long-term performance of these systems based on theoretical developments, laboratory studies and observed field behaviour. It draws together consideration of both soil mechanics and geosynthetics and demonstrates that the components of the barrier system should be considered as part of a system where the characteristics and performance of one component impact on that of another.

Field measurements and theoretical calculations show that composite liners are substantially better than single liners in terms of controlling leakage from landfills. It is shown that composite liners involving a GM over a geosynthetic clay liner (GCL) gave rise to substantially less leakage than those involving a compacted clay liner (CCL). The observed leakage through composite liners can be explained by the holes in, or adjacent to, wrinkles/waves in the GM and this leakage can be calculated using simple equations.

High density polyethylene (HDPE) GMs are shown to provide an excellent diffusive barrier to ions. However non-polar organic compounds readily diffuse through HDPE GMs and a combination of GM and an adequate thickness of liner and attenuation layer are required to control impact to negligible levels. The long-term performance of HDPE GMs is discussed and service life predictions are provided for MSW landfills.

The use of numerical models for predicting the service lives of engineered systems and long-term contaminant transport is demonstrated.