

## WHITE PAPER

Name: Beth Gross  
Affiliation: GeoSyntec Consultants  
E-mail: [bgross@geosyntec.com](mailto:bgross@geosyntec.com)

**Geoenvironmental Research Experience** (list projects in progress or completed within the past 5 years):

- Evaluation of Liquids Management Data for Double-Lined Landfills, U.S. EPA
- Waste Containment Systems: Problems and Lessons Learned, U.S. EPA
- Evaluation of Monitoring and Modeling Issues Related to Engineered Covers for Waste Containment, U.S. EPA
- Evaluation of Field Performance Data for Bioreactor Landfills

**Geoenvironmental Consulting Experience** (major projects only):

- Siting, Design, and Construction Monitoring of a Number of Industrial, Municipal, and Hazardous Waste Landfills
- Hydraulic Performance Evaluation of a Number of Landfills (Industrial, Municipal, Hazardous, and Low-Level Radioactive)
- Forensic Investigation of a Number of Landfill Slope Failures
- RI/FS for L&D Landfill Superfund Site

**Appraisal of Geoenvironmental Research, Education and Practice:**

### *Research*

- There is still a need to collect long-term performance data on geoenvironmental systems. However, it is difficult to obtain continuous funding for these projects over a significantly long time period.
- U.S. EPA-sponsored research affects policy faster than research sponsored by others. Currently EPA-sponsored research is limited and more focused on remediation technologies than on waste containment.

### *Education*

- There is a lack of awareness of civil engineering undergraduates about geoenvironmental engineering. If geoenvironmental classes are not offered, these students may not be aware of this field of study as they pursue higher degrees.
- Even if they have not studied geoenvironmental engineering, geotechnical engineering students have the background to learn this field.

- Because geoenvironmental engineering programs are generally not well developed, it is difficult for students to understand the multidisciplinary approach of this field and the classes that may be useful for them in their practice.
- It would be useful to integrate more chemistry into the geoenvironmental engineering classes where possible to maintain some minimum knowledge of chemistry.

### *Practice*

- Geoenvironmental research and practice over the past 20 years has led to the development of better design and construction techniques for waste containment and site remediation.
- Modern waste disposal facilities have very good performance. There is no evidence of leakage through these facilities; however, there may have been gas migration through the liner system at a few facilities.
- When waste containment is exclusive of treatment (e.g., dry MSW landfills), there is the potential for future impact to human health and the environment if the containment system degrades. Current waste disposal facilities will require on-going long-term maintenance and monitoring as long as containment is required.
- If we can develop better bioreactors, we will reduce the potential for future impact from waste disposal and reduce maintenance and monitoring requirements.
- In the U.S., we are better managing our chemicals and wastes by prohibiting the manufacture or the disposal of certain chemicals, by implementing pollution prevention techniques, such as process modification, recycling, and reuse, by promulgating minimum requirements for waste disposal facilities, and by other means. Because of this, we would expect that few newly developed sites would be added to the National Priority List (NPL). Of the 14 sites proposed for addition to the NPL in April 2003, most were contaminated long ago and several were old landfill sites. The three newest sites all involved chlorinated hydrocarbon contamination from recently-opened dry cleaning facilities. Most dry cleaning facilities currently use these solvents even though “greener” technologies are available.
- There are older waste disposal facility designs that do not incorporate the current state-of-practice and have not yet been constructed. This is more the case for cover systems than for liner systems. It would be prudent to review these designs before they are constructed to reduce the potential for waste containment system problems.

## **Perspective on Emerging Geoenvironmental Issues and Technologies:**

- Dry Landfills
  - Potential for gas migration
  - Long-term performance issues (e.g., cover system, effect of long-term internal shear stresses on textured geomembrane)
  - Site reuse
- Bioreactors
  - Better distribution of liquid within the waste mass
  - Better methods of monitoring the waste moisture content
  - Optimization
  - Effect on post-closure requirements
- In-situ Containment Systems
  - Non-destructive testing
  - Long-term performance issues