Geosynthetic Testing for Waste Containment Applications

Robert M. Koerner, editor

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Foreword

This publication, *Geosynthetic Testing for Waste Containment Applications,* contains papers presented at the symposium of the same name held in Las Vegas, NV, on January 23, 1990. The symposium was sponsored by ASTM Committee D-35 on Geosynthetics. Dr. Robert M. Koerner, Professor of Civil Engineering at Drexel University, presided as symposium chairman. He is also editor of this publication.

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Overview

The purpose of the Symposium on Geosynthetic Testing for Waste Containment Applications was to focus attention on various geosynthetic testing efforts in the environmentally related application area of waste containment. In general, these containment facilities have to do with landfills, surface impoundments, and waste piles. The specific aims of the symposium were as follows;

- Assess the current state-of-the-art in geosynthetic testing as can be applied to waste containment.
- Focus upon the myriad of available geosynthetic material tests that are performed in isolation which are generally called "index" tests.
- Contrast these tests with soil/geosynthetic material tests which are generally called "performance" tests.
- Determine if, and what type of, full scale field tests are available.
- Determine if correlations exist between the above mentioned two types of laboratory tests and field performance.
- Identify needs for modification of these tests, or for additional tests which better predict field performance than those that are currently available.
- Provide a forum for information exchange among regulators and permitters, public and private owners, design and inspection consultants, testing and investigative firms, research and development organizations, manufacturers and fabricators, and installation contractors.

Slightly over half of the papers presented at the symposium and assembled in this Special Technical Publication have to do with geomembranes. This is understandable since the first line of defense of containment is a polymeric geomembrane barrier. Chemical resistance perspectives were presented in papers by Landreth, Mores et al., White and Verschoor, and Dudzik and Tisinger. These authors underscored the importance of the resistance of the base polymer with the liquid to be contained and the procedures for proper evaluation. The tests that are involved range from traditional ASTM physical and mechanical property tests on relatively large samples to chemical analysis, or fingerprinting tests, on very small samples.

Specific tests on geomembrane heat stability by Gray, transport behavior by Haxo, stress cracking by Halse et al., radiation effects by Whyatt and Farnsworth, and swelling by Thomas and Cadwallader are presented in their respective papers. These tests appear to be in a

transition stage between the research mode and consideration for adoption by ASTM. In fact, some of them are in Task Group status within Committee D-35 on Geosynthetics. The data base that they bring to the literature is very welcomed. Clearly, the manner in which geomembranes are currently being challenged has reached levels of sophistication unheard of a few years ago.

Geomembrane test methods and results which are performance related were the focus of a number of papers presented at the symposium and appearing in this publication. Included in this group are durability of geomembrane seams by Peggs and Carlson, accelerated testing by Schmachtenberg and Bielefeldt, an overview of various performance tests by R. T. Sprague and Frobel, three-dimensional testing by Koerner et al., and pyramid puncture testing by Pühringer. This latter group of tests and their results should see publication in future Committee D-35 test methods and standards.

Recognizing that containment facilities are "systems" brings out the importance of other geosynthetic materials in addition to geomembranes. Within this group are geotextiles (used as filters, separators, and protection layers), geonets (used as drainage layers for leachate and other liquids), geogrids (used to reinforce cover soils or reinforce the waste itself), geocomposites (used as surface water drains) and plastic pipe, or geopipe (used for leachate removal in the primary or secondary zones of a containment system). Chemical compatibility issues regarding geotextiles, geonets, and geopipe were brought out in papers by Verschoor et al., C. J. Sprague, and Allen and Verschoor. While the incubation protocol for these materials is reasonably straightforward, the actual testing is problematic since large test specimen sizes leave little possibility for a statistical data base to be generated. The papers in this group give insight into these difficulties and possible solutions.

These papers were followed by a paper on direct shear interface friction procedures and behavior by Bove. This topic is of great importance due to several failures of cover soils sliding on geomembranes and solid waste instability in contained liner facilities. ASTM Committee D-35 has a Task Group working on this specific situation and a future test method.

The geotextile filters used in waste containment facilities were examined and challenged in a number of papers in this volume. Ling et al. and Montero and Overmann described various aspects of geotextile permeability which was counterpointed by papers on geotextile clogging by Bhatia et al., Rohde and Gribb, and Koerner and Koerner. These two aspects of filter design are all important in the geotextile's proper performance: (1) the geotextile must be sufficiently open to allow flow and (2) it must be sufficiently closed to retain the upstream soil particles. Both of these features must be accomplished without complete clogging of the geotextile filter. Involved in such clogging potential are both sediment and biological mechanisms which are described in the various papers cited.

A paper on the outdoor exposure of geotextiles by Tisinger et al. is important since the only test method currently used by the geosynthetic's community is the xenon arc accelerated weathering test and its correlation to outdoor exposure is suspect. More work on the actual behavior of geosynthetics to photo-induced degradation and its preventative measures by use of carbon black or chemical stabilizers is certainly warranted.

The concluding two papers of the symposium were on final geosynthetic cover/closure performance. These papers were by Paruvakat et al. and Levin and Hammond. The behavior of covers on solid waste landfills cannot be overemphasized. The lifetimes and proper functioning of this part of the entire system must perform for extremely long time frames. The time depends greatly on the nature and contamination potential of the underlying solid waste.

In conclusion, it is felt that the papers presented satisfied the objectives of the symposium and gave the participants an accurate and current perspective of geosynthetic testing for

waste containment applications. It is hoped that this Special Technical Publication will serve the user community in a rational and logical manner as to the proper selection, testing, design, and use of geosynthetics.

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