GSI W-14 Webinar
"Lifetime Predictions of Covered and Exposed Geosynthetics"

Purpose and Background

A most frequently asked question regarding all types of geosynthetics is, "How long will they last?" This webinar answers the question for exposed geotextiles and geomembranes assuming that they were properly designed and installed. Furthermore, it compares these new results to earlier lifetime prediction results on a covered geomembrane.

N*onexposed (or covered) lifetime conditions* have been previously evaluated and published on a 1.5 mm thick high density polyethylene (HDPE) geomembrane. It used landfill incubation devices at four elevated temperatures of 85, 75, 65 and 55°C so as to reach 50% of retained strength and elongation. Considering the three stages of (i) depletion of antioxidants, (ii) induction time, and (iii) 50% reduction in mechanical properties, the lifetime extrapolation was made down to 20°C. The halflife for this geomembrane under these conditions is approximately 450 years! Since the incubation times were 10 years, other covered geosynthetics were not evaluated under the supposition that the nonexposed situation is generally a moot point for most geosynthetics in their customary applications.

For *exposed geosynthetics*, however, the situation is quite different. Ultraviolet radiation, elevated temperature and full oxygen are available which shortens the service lifetime, but how much? For evaluation of this situation we utilized laboratory ultraviolet fluorescent tube weathering devices per ASTM D7238 for incubation purposes. Seven different geotextiles, four TRMs, two geogrids and six different geomembranes were evaluated. Each different material was incubated at 80, 70 and 60°C until 50% reduction of strength and elongation occurred. The data was then extrapolated down to 20°C for laboratory halflife values and for comparison with the nonexposed condition. The ratio of nonexposed to exposed lifetime for HDPE geomembranes is approximately 5.0. The calculations for the nineteen exposed geosynthetics then progressed to using site-specific radiation so as to obtain an equivalent field life. Phoenix, Arizona conditions are illustrated although the procedure is applicable worldwide. Halflife predictions for the geotextiles vary from a few months for the needle punched nonwovens to up to 10-years for monofilaments and high antioxidant formulated products. Results for geomembranes vary from 47 to 97 years with HDPE being the highest. These exposed halflife results (which took 12-years and are still ongoing) are felt to be most interesting and are presented for the first time to an international audience.

Learning Objectives

Webinar participants will gain familiarity of how lifetime prediction of all polymeric materials are made, including geosynthetics. The technique is incubation at several high temperatures so as to accelerate degradation, measure property changes, and then to extrapolate down to site-specific (i.e., actual) temperatures so as to estimate lifetime.

The webinar is a result of over 10-years of U.S. EPA funding and then 12-years of GSI/GRI research focused on providing lifetime estimates of geosynthetics. For the *nonexposed* (buried) situation complete laboratory simulation is used. For the *exposed* situation laboratory fluorescent ultraviolet weathering devices are used. The former evaluates only HDPE geomembranes, the later nineteen different geosynthetics. For the nonexposed situation lifetimes are well beyond civil engineering application lifetimes, in this case 500 years. It is seen that the exposed situation lifetimes are within the usual civil engineering lifetimes expectations.

Webinar Benefits

- Learn about lifetime prediction methods for polymers
- Learn specifically about the methodology with respect to geosynthetics
- Learn about the nonexposed halflife of HDPE geomembranes
- Understand that lifetime of nonexposed geosynthetics are generally far greater than typical civil engineering applications and other components
- Learn about lifetimes of 19 different geosynthetics under simulated exposed conditions

Intended Audiences

Public and private regulators and facility owners, civil and industrial engineers, property developers, contractors and installers, academic and research groups, the general lay public and others desiring technically related information on this most frequently asked question.

Specific Topics Covered

1. Background
2. Covered Lifetime Using Lab Simulation
3. Results for Covered HDPE Geomembranes
4. Exposed Lifetime Using Weathering Devices
5. Results for 19 Different Exposed Geosynthetics
6. Summary-to-Date

Webinar Instructor

Dr. Robert M. Koerner's (Professor Emeritus of Civil Engineering at Drexel University and Director Emeritus of the Geosynthetic Institute) interest in geosynthetics spans over thirty-five years of teaching, research, writing and advising. He holds his Ph.D. in Geotechnical Engineering from Duke University. He is a registered Professional Engineer in Pennsylvania, a Distinguished Member of ASCE, a Diplomate of the GeoInstitute and a member of the National Academy of Engineering. Bob has authored and co-authored about 650 papers on geosynthetics and geotechnical topics in journals and at national and international conferences. His most widely used publication is the sixth edition of the textbook entitled *"Designing with Geosynthetics"*. He is the founding director of the Geosynthetic Institute which is a nonprofit research and development organization dedicated to the proper use of geosynthetics in its myriad applications. The institute also provides laboratory accreditation and inspection certification programs.