The Department of Civil, Architectural, and Environmental Engineering, presents the Kappe Lecture of the American Academy of Environmental Engineers and Scientists.

Field Performance of Final Covers for Containment of Long-Lived Waste Forms: Lessons Learned from the Field

-- Dr. Craig Benson, BCEE, NAE
-- Dean Emeritus, Univ. of Virginia

Engineers design containment facilities to store long-lived waste forms that can be a threat to the environment for 1000s of years (e.g., low level radioactive waste). These designs are based on current knowledge and principles, but the facilities are required to have a service life of a millennium or more, far beyond any modern engineering experience. Over the last decade, we have had the opportunity to exhume and inspect final covers on containment facilities for long-lived waste forms that have been in-service for up to three decades, providing a glimpse of the degradation mechanisms and the condition that may exist in the future. We have also had the opportunity to construct and monitor more than 50 full-scale test sections simulating final covers, providing unique insight into field-scale hydrologic performance and the mechanisms controlling performance. These observations, along with lessons learned from studying natural analogs in the environs of containment facilities, have reframed and refined our perspective on design of final covers for waste containment over very long service lives that go far beyond our experience. This experience has shown that, when possible, designs that embed natural principles and/or are congruent with the natural surroundings tend to be the most resilient and the most effective in the long-term. In contrast, designs that are incongruent with natural surroundings tend to degrade more quickly, with their attributes and performance altered to be more consistent with the surroundings. Observations made in the field, and the lessons learned, will be shared in this presentation. Recommendations are provided that are important to current students and seasoned professionals.

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