An Application of Stochastic Modeling to Pitting of Spent Nuclear Fuel Canisters

Abstract:

Lifetime extension of dry storage canisters requires the ability to accurately predict and monitor material degradation so that corrective maintenance actions can be taken at time. Monitoring and inspection of dry storage facilities in combination with material property prediction and environmental conditions are necessary. One of the primary concerns with respect to the long-term performance of the storage casks is the potential for corrosion initiation due to deliquescence of salts deposited on the canister surface as aerosols; in regions of high residual weld stresses, this may lead to localized stress corrosion cracking (SCC). Dust and aerosols in the air being drawn though ventilation openings in the overpack of passively-ventilated dry canister storage systems may be deposited on the stainless steel canister outer surfaces. Under these conditions, localized corrosion attack can occur. Deterioration by Chloride Initiation CISCC at Independent Spent Fuel Storage Installations (ISFSIs) can lead to canister penetration, potentially releasing helium and radioactive gases, and permitting air ingress which could pose a threat to fuel rod integrity. The seminar will be focused on the development of probability distribution functions for maximum pits depth propagation rate based on experimental data. The key parameters characterizing the probability distributions of pits at each stage depend on environment, material conditions, and stress intensity. It is shown that a basic stochastic approach to estimate probability distributions based on the median and maximum pits depths can be used to estimate the distribution of maximum pit depth at future times.

Bio:

Dr. Shayer has over 40 years of experience supporting the nuclear industry and the U.S. regulatory commission in safety analysis evaluation, and solution of complex safety problems in nuclear technologies. He is well grounded in various computational methods used in reactor core physics, thermal hydraulic, radiation transport, dose rate and material degradation assessments, criticality safety analysis, probability risk assessment and reliability analysis. In these areas, he has served as manager, program manager, and project leader, and instructor. In December 1998, Dr. Shayer joined SAIC as a senior nuclear research scientist in Energy Solutions Group, of using nuclear technology for detection of contraband and explosive materials. He served as a technical reviewer for U.S Nuclear Regulatory Commission (NRC) for the evaluation of Safety Analysis Report for nuclear shipping cask and independent spent fuel storage installation. He has participated in preparation of several environmental impact statements for U.S. Department of Energy (DOE). Dr. Shayer's recent research work includes; material degradation and aging effects of nuclear fuel and structural materials, advanced fuel cycle, new reactor concept design, nuclear waste transmutation and compaction, radiation physics, innovative radiation shielding for terrestrial and space applications. He is supported the National Ignition Facility (NIF) at LLNL to develop diagnostic systems for neutrons and gammas detection, radiation safety analysis, and materials degradation. Dr. Shayer has extensive academic experience. He was on sabbatical at North Carolina State University and University of California at Berkeley, and served as a senior lecturer in Israel Institute of Technology (Technion) and Ben-Gurion University. Instructing graduate and undergraduate physics and engineering courses. He is author of 8 patents and numerous papers and technical publications (over 150). He participated in the development of five computer codes in reactor core physics, thermo- hydraulic, and radiation\particles transport.

Dr. Shayer hold a Ph.D., in Engineering Science from Tel-Aviv University