

Public Abstract

First Name:Andrew

Middle Name:Martin

Last Name:Casella

Adviser's First Name:Sudarshan

Adviser's Last Name:Loyalka

Co-Adviser's First Name:Brady

Co-Adviser's Last Name:Hanson

Graduation Term:SS 2007

Department:Nuclear Engineering

Degree:PhD

Title:Modeling of Molecular and Particulate Transport in Dry Spent Nuclear Fuel Canisters

When transporting or storing spent nuclear fuel, it is necessary to account for all associated radioactive materials. To aid in this task, four models have been constructed to track molecular and particle transport within a spent fuel canister and through hypothetical microscopic pinhole breaches in the canister wall. The first of these models determines the depressurization time of a canister after the formation of a breach for the case in which no particles are suspended in the fill gas within the canister. The second model uses Monte Carlo techniques to track the transport of fission gas and helium through nano-scale pathways within the spent fuel inside the canister. The third model expands the first model to account for particle release and deposition within the breach for cases in which suspended particles are present. The fourth model uses Monte Carlo methods to remove several limitations of the third model, including particle deposition patterns, effects of particle size, and breach geometry. The results generated by these models provide a better understanding of the time-dependent behavior of hypothetical damaged spent fuel canisters and may prove to be useful tools in the future monitoring and handling of spent fuel canisters.