Public Abstract

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Title:THE THERMAL-MECHANICAL ANALYSIS OF TARGETS FOR THE HIGH VOLUME PRODUCTION OF MOLYBDENUM-99 USING A LOW-ENRICHED URANIUM METAL FOIL

Molybdenum-99 diagnostic imaging is the most commonly practiced procedure in nuclear medicine today with the majority molybdenum-99 produced with proliferation sensitive HEU. International and domestic efforts to develop non-HEU production techniques have taking the first steps toward establishing a new non-HEU molybdenum-99 based supply chain. The focus of the research presented in this work is on the analysis of a new high U-235 density LEU based molybdenum-99 production target. Converting directly to LEU using current manufacturing techniques greatly reduces the molybdenum-99 yield per target making high volume production uneconomical. The LEU based foil target analyzed in this research increases the yield per target making economic high volume production with LEU possible.

The research analyzed the thermal-mechanical response of an LEU foil target during irradiation. Thermal-mechanical studies focused on deflections and stresses to assess the probability of target failure. Simpler analytical models were used to determine the proper shape of the target and to benchmark the numerical modeling software. Numerical studies using Abaqus focused on analyzing various heating and cooling conditions and assessing the effects of curvature on the target. Finally, experiments were performed to simulate low power heating and further benchmark the models. The results from all of these analyses indicate a LEU foil target could survive irradiation depending on the conditions seen during irradiation.