

Public Abstract

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Title:THERMAL/MEHCANICAL/HYDRAULIC EXPERIMENTAL TOOLS FOR MOLYBDENUM-99 PRODUCTION TARGET ANALYSIS

As the nuclear community adapts to meet a constantly changing environment driven by policy development, so must the technology associated; in particular is the case of technology qualification. While government institutions and industry leaders have done much for the progression of nuclear materials, associated technologies must first be tested and qualified before they will see any practical use.

Technetium-99m (^{99m}Tc) is a diagnostic radiopharmaceutical that is currently used about 100,000 times daily for diagnostic imaging procedures globally. The parent isotope for ^{99m}Tc is molybdenum-99 (^{99}Mo), most commonly obtained through the irradiation of high enriched uranium (HEU). In accordance with the Department of Energy's Global Threat Reduction Initiative, an effort is underway to develop a process to produce ^{99}Mo using low enriched uranium (LEU). One method utilizes LEU cast in the form of a metal foil as opposed to current powder based dispersion designs for HEU.

New high-volume production LEU target concepts need to be analyzed to assure safe, reliable operation during all stages of production as use of a foil requires a significant modification to the current target design. The purpose of this research was to develop a set of experimental tools to assist in the qualification of target designs capable of economically producing ^{99}Mo using LEU. These experimental tools could then be used in the verification of numerical analysis and results through various thermal, mechanical, and hydraulic testing.

Methods included manufacturing target surrogates of different geometries. Heating loads and hydraulic flow-loops simulated the target in a reactor and testing measurements were used to quantify thermal resistance. Post evaluation of the target surrogates was also performed to compare testing results to theoretical values. Testing trends were compared to numerical and analytic models. A path forward is discussed in terms of the refinement of, and addition of new, qualification tools/techniques.