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A Network Model and Computational Approach for the Mo-99 Supply Chain for Nuclear Medicine LADIMER NAGURNEY, University of Hartford, ANNA NAGURNEY, University of Massachusetts Amherst — Technetium-99m, produced from the decay of Molybdenum-99, is the most commonly used radioisotope for medical imaging, specifically in cardiac and cancer diagnostics. The MO-99 is produced in a small number of reactors and is processed and distributed worldwide. We have developed a tractable network model and computational approach for the design and redesign of the MO-99 supply chains. This topic is of special relevance to medical physics given the product's widespread use and the aging of the nuclear reactors where it is produced. This generalized network model, for which we derived formulae for the arc and path multipliers that capture the underlying physics of radioisotope decay, includes total operational cost minimization, and the minimization of cost associated with nuclear waste disposal, coupled with capacity investment (or disinvestment) costs. Its solution yields the optimal link capacities as well as the optimal MO-99 flows so that demand at the medical facilities is satisfied. We illustrate the framework with a Western Hemisphere case study. The framework provides the foundation for further empirical research and the basis for the modeling and analysis of supply chain networks for other very time-sensitive medical products.

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