Cryogenic Medical Isotope Generation (CMIG)

Low cost isotope generation using cryogenics

Benefits

RTI radioisotope production technology reduces costs, substantially reduces production complexity, and minimizes regulatory burdens:

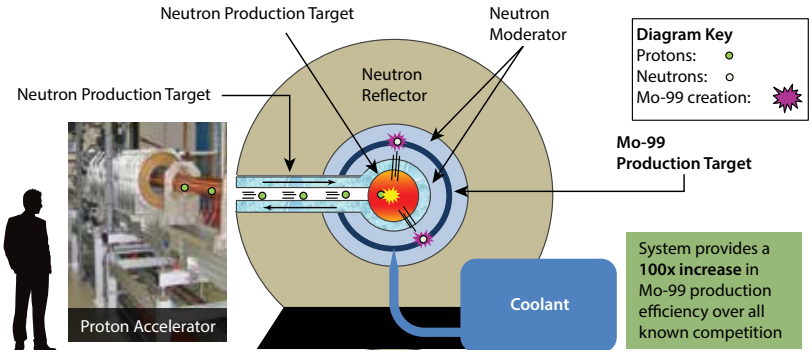
- **Much Lower Capital, Unit Costs:** Use a single small system rather than a reactor or "fleet" of accelerators
- **Flexible Production:** Variable production schedule allows swift reaction to changing market conditions
- **Fewer Geographical Barriers:** cost and lack of fissile material allow market entry in places that can't currently produce imaging radioisotopes
- **Reduced Radioactivity:** Absence of uranium, plutonium, and other radioactive source materials reduces regulatory burden substantially

A Known Crisis

Demand for medical imaging procedures is forecast to increase steadily, with yearly demand growth rates of >5% expected. Medical isotopes like Molybdenum-99 are necessary for many types of imaging procedures, such as brain and heart scans. The yearly U.S. value of raw Molybdenum-99 product is between $200 and $300 million, with the U.S. currently consuming half of the world's output. This Mo-99 raw material (necessary to produce many different radiotracers) is experiencing large cost increases because the government-run infrastructure (nuclear reactors) that produces it is old, unreliable, very expensive, and in the process of shutting down. Governments have declared the need for private industry to develop new methods. However, known private-sector replacement technologies are even more expensive, and suffering from lackluster rollout. To ensure long-term patient access to radiotracer-based imaging procedures, a new isotope production method is needed that cuts costs drastically. RTI has invented that method.

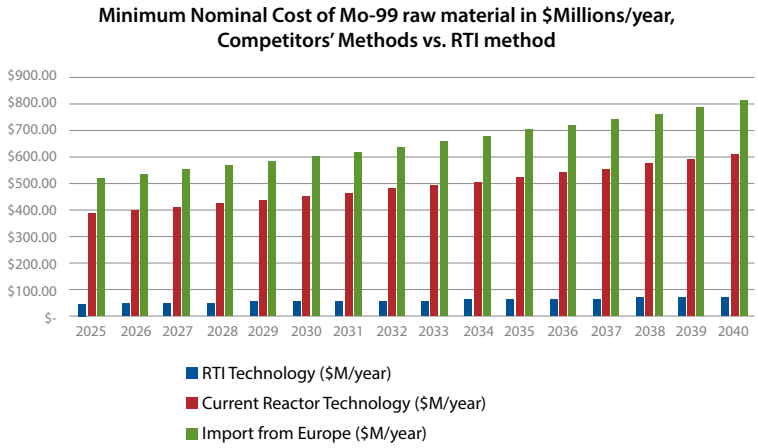
The Solution

RTI International has developed a novel, cryogenic method of accelerator-based isotope radioisotope production which will substantially reduce the cost of Molybdenum-99 raw material. This will ensure cost-effective Mo-99 production for technetium generator manufacturers and radiopharmacies in North America, and it will allow SPECT (Singe Photon Emission Computed Tomography) procedures to expand on a global basis. RTI's patent-pending method will allow the production of North America's entire Technetium-99m demand with the use of *a single accelerator system*, substantially reducing capital costs in comparison to other accelerator or reactor production methods. This will allow levelized production costs a factor of ten lower than those of emerging competitors.



The Technology

RTI International's proprietary high-efficiency neutron capture accelerator technology can comfortably produce 5000+ "6-day Curies/week" of Molybdenum-99 for the US and Canada, using no uranium, plutonium, or other radioactive source material. By applying routine accelerator technology to a novel, patent-pending, neutron moderating system, the neutron capture target can be modified to absorb neutrons at a much higher rate than status quo systems can. This will reduce the needed beam current to levels where accelerator costs can be reduced drastically. This in turn will reduce production costs (see below) by up to an order of magnitude over the currently proposed isotope production replacement methods.



Current Methods vs. RTI Method – mostly cost vs. mostly profit. These projections were arrived at using standard Net Present Value levelized costing analysis, and included standard US corporate tax rates and capital depreciation. Elevated debt and equity rates were assumed for the RTI technology relative to those used for competing methods, for the sake of conservatism. Much-lower RTI costs are due to higher capital costs and operational costs for competing technologies.

Competitive Advantage

RTI anticipates CMIG will produce isotopes at levelized costs 1/10th that of emerging competitors, and will be safer, less regulated, and internationally deployable. A table showing cost comparison of existing Mo-99 production technologies with CMIG is included below.

Production Technology	New Isotope Production Reactor	Traditional Accelerators	Cryogenic Accelerators
Method	**Fission**	**Bremsstrahlung**	**Cryogenic Neutron Capture**
Accelerator Efficiency	N/A	0.1%	10% or more
Yearly Operating Cost	> $200M	> $80M	< $20M
Capital Cost	> $800M	> $600M	< $125M
Levelized Unit Cost per 6-Day Curie	**> $2,000**	**> $1,000**	**< $200**
Geographic Deployability	Cost & Proliferation Limited to First World	Too expensive to deploy outside of First World	Deployable even without nuclear infrastructure
Nuclear Regulatory Costs	Enormous – fission & uranium wastes	Minor – no fission or uranium wastes	Minor – no fission or uranium wastes. No direct FDA regulation.

For More Information

Please contact RTI for further discussion of commercialization, partnering, or funding opportunities.

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