Byproduct Generation of Molybdenum in Liquid Fluoride Thorium Reactors

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Tc-99m, derived from Mo-99, dominates world medical radioisotope use.

Tc-99m is predominantly used in cardiac scans, bone scans, and gall-bladder scans.

This industry has a value of approximately $2 billion per annum.
Research reactors producing molybdenum-99 exist around the world but the largest is in the Netherlands. The Canadian reactor ended production in October 2016.
250 MWe LFTR facility concept

Compact turbomachinery converts the thermal power of the reactor into electricity.

The reactor cell is located below ground in a shielded containment structure.
LFTR chemical processing concept

Chemical processing of the fluoride salts would be done in a shielded processing cell located next to the reactor cell.
Pathway of the radiopharmaceutical

1. Already-processed uranium is irradiated with neutron beams for one week in a nuclear reactor.

2. A chemical process separates molybdenum from the uranium.

3. High-purity solution of molybdenum-99 (Mo99).

4. Now in capsule form, the Mo99 is sent to a radiopharmacy.

5. At the radiopharmacy, the molybdenum capsules are placed in technetium generators that are sent to hospitals and clinics.

6. Medical experts extract the technetium generator solution used as contrast in tomography.
Fission-product molybdenum would be extracted from molten salt.
LFTR is the only technology that can produce electrical power and medical radioisotopes simultaneously. No other reactor type can accomplish both missions.
Small MSR would produce globally-significant Mo99

Modeling parameters:

- 10.5 kCi/d/MWt Mo99 generation rate
- 2.0 MW (thermal) reactor
- Molybdenum removal efficiency of 90%
- 3 day transport delay
- 713,000 6-day Ci per year Mo99 production
- 13,711 6-day Ci per week

Global implications:

- 1.1x global Mo99 consumption in 2006 at height of consumption prior to shortage
Our Mission, Our Passion

To supply the world with energy, water and fuel that is Safe, Efficient, Sustainable, and Reliable, achieved through the Liquid Fluoride Thorium Reactor.