ENCLOSURE 3

MFN 11-211

Moly-99 Project Update Public Meeting Presentation

Moly-99 Project Update for the US NRC
August 2011

GE Hitachi Nuclear Energy

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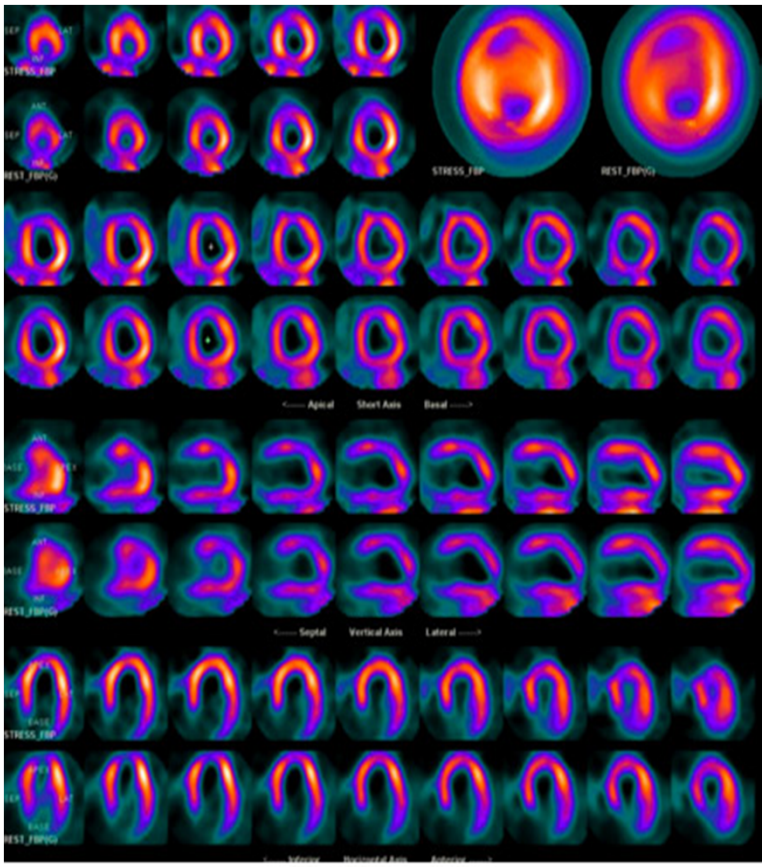
What is molybdenum-99?

- Used in approximately 85% of all nuclear medicine procedures …brain, heart, thyroid, lungs, liver, kidneys, skeleton, blood and tumors.
- Rapid uptake by target organ…is bound to another drug that transports it to the organ of interest
- Decay results in relatively low energy gamma…easily detected providing accurate imaging
- Short half-life results …allows for quick scans and lower patient dose, also lends BWRs to being ideal for activation



Myocardial perfusion SPECT – stress/rest

Myocardial perfusion SPECT- stress/rest scan in a patient with dilated cardiomyopathy.

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Current isotope production

- Aging & obsolete production facilities...54 year old Canadian reactor and HFR for Mo-99 experienced extended shutdowns.
- Isotopes from nuclear fuel...Mo-99 is obtained mostly from HEU targets
- Shortage resulting in high visibility in Washington...DOE awards grants to solve shortage crisis with reliable, domestic supply of ^{99}Mo w/o HEU use and NRC working group devoted to project

	Typical
Canada NRU – 1957 HEU Targets	40%
Netherlands HFR – 1961 HEU Targets	25%
Belgium BR-2– 1961 HEU Targets	20%
South Africa Safari – 1965 HEU Targets	10%
France Osaris– 1966 HEU Targets	5%
Australia Opal– 2008 HEU Targets	N/A

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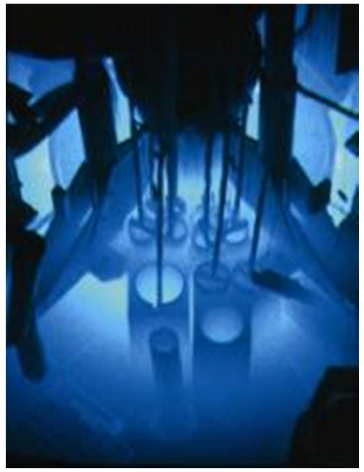
Molybdenum-99 to technetium generators



Molybdenum-99 (66h)

↘ β decay

Technetium-99m (6h)

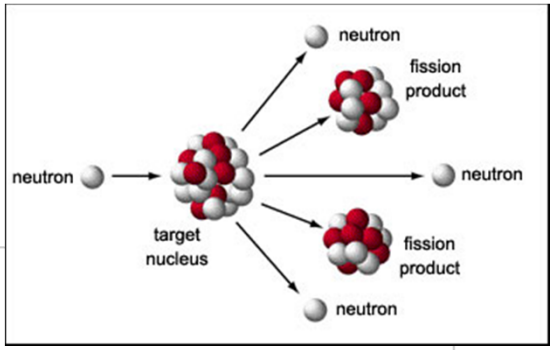
↘ Generator Elution

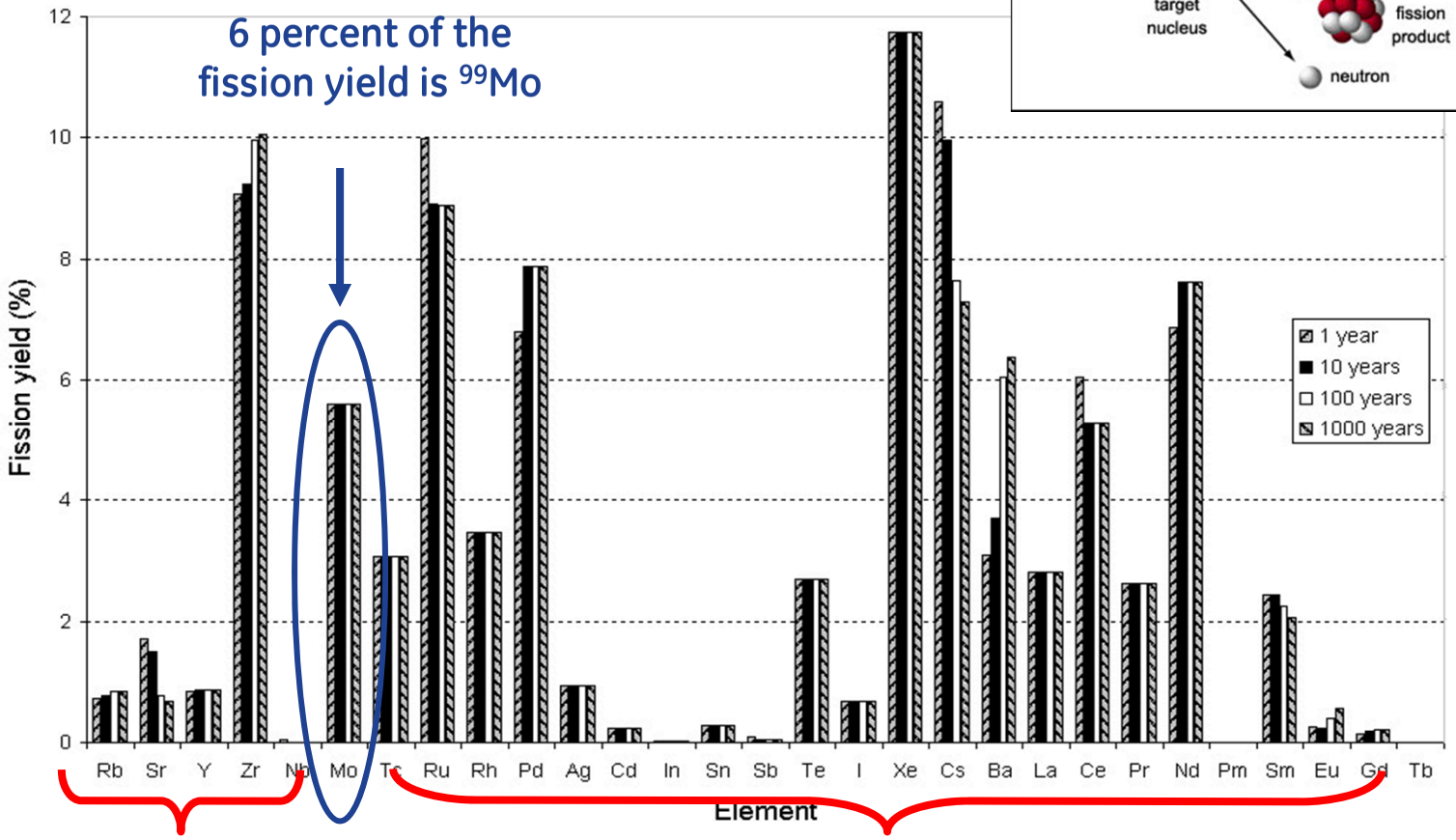
↘ Saline Addition

Patient

How is ^{99}Mo currently produced?

Currently Produced by Fission of Highly Enriched Uranium Targets





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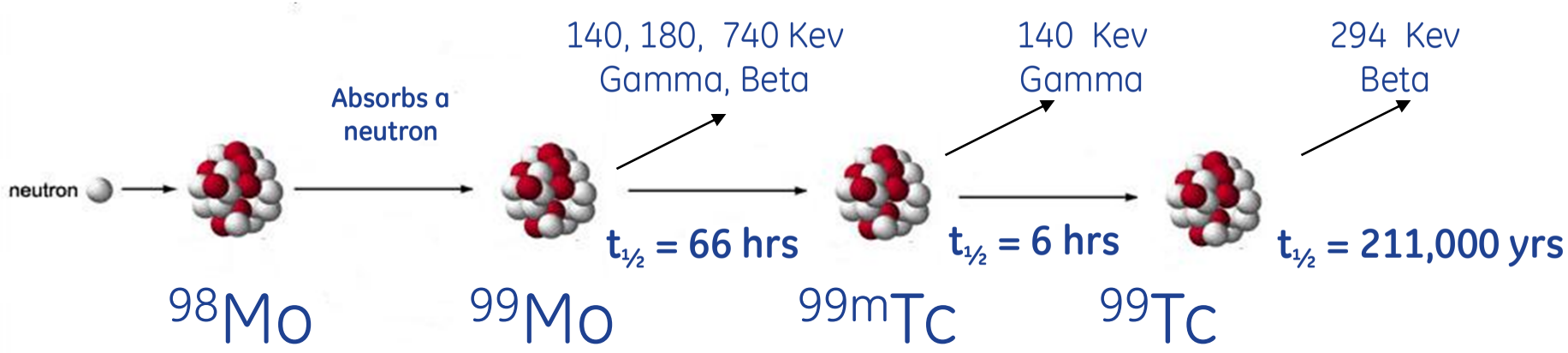
Fission Product Waste (Spent Fuel)

GEH method to produce ^{99}Mo

Our process uses neutron capture to produce the parent of ^{99m}Tc from ^{98}Mo



^{98}Mo	^{99}Mo	^{99m}Tc	^{99}Tc
42 Protons	42 Protons	43 Protons	43 Protons
56 Neutrons	57 Neutrons	56 Neutrons	56 Neutrons
98 = Atomic Wt	99 = Atomic Wt	99 = Atomic Wt	99 = Atomic Wt

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GEH's process advantages

	Traditional Method	GEH Method
Target Composition/National Security	HEU	Natural Molybdenum
Waste/Environment	HLW w/ TRU and Long Lived FPs	LLW and no RCRA waste
Chemistry	Complicated separations of Mo from Uranium, FPs, and TRU	Simpler process w/o FP and TRU complications
Supply Reliability	Aging reactors and unreliable supply	BWRs (>90% CF) produces reliable supply
Cost	Requires new build	Leverages current infrastructure

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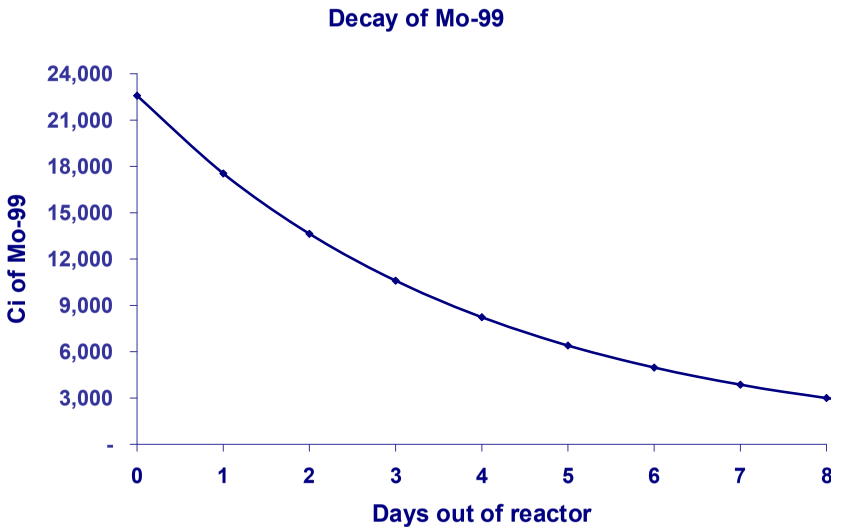
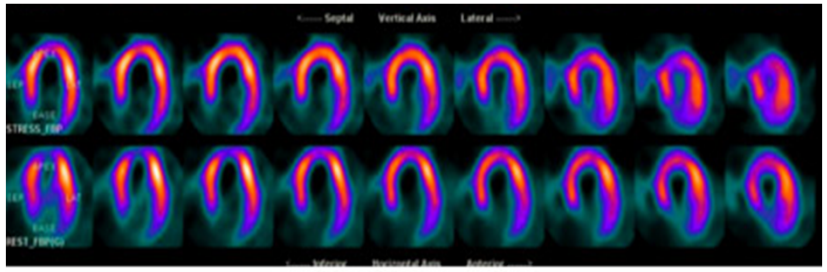
GEH's ^{99}Mo production goal

- GEH Goal...Produce up to 3,000 6-day Ci of ^{99}Mo/week which equals ~50% of domestic demand
- What is a 6-day Curie?...Amount of curies due to ^{99}Mo six days after the Tc generator is on manufacturer's shipping dock
- Short Half Life...Allowing two days for transport and generator fabrication, approximately 23,000 Ci of ^{99}Mo is required upon removal from reactor
- BWR Activation...Epithermal neutrons are responsible for majority of activation, calculated specific activity is approximately 1-2 Ci ^{99}Mo/g initial Mo
- Manageable Mass...Specific activity requires activation of <30 kgs of Mo every week





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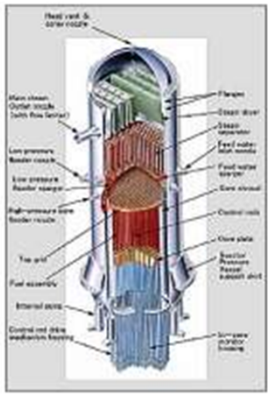
Molybdenum Life Cycle



Reactor (research or BWR) irradiation ^{98}Mo to ^{99}Mo

Chemistry metal to gel

^{99m}Tc Generator Applications

Mixed by pharmacist for use

Patient Application

Mo Target Preparation

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Benefits of ^{99}Mo project

- Saves lives…Consistently supply important medical isotope for the USA
- National Security…Allows White House to achieve their goal of producing molybdenum-99 without the use of HEU
- Environmentally Favorable…System can generate the U.S.A.'s medical isotope supply without creating HLW
- Asset Utilization…Provides important medical isotope without the need for new reactors, while leveraging proven and licensed equipment

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