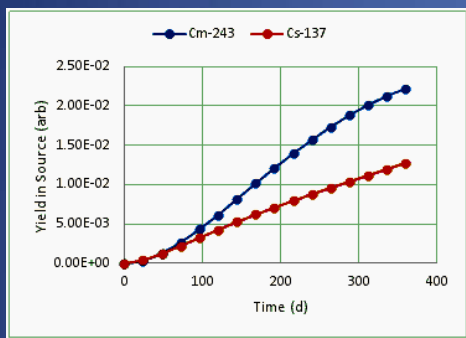


“Approach For The Isotopic Characterization Of Irradiated Start-Up Sources For Disposal At WIPP” Abstract ID # 15674

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ABSTRACT

The National Nuclear Security Administration, Global Threat Reduction Initiative (GTRI)/ Off-site Source Recovery Program (OSRP) requires an approved final disposition pathway for sealed irradiated startup sources with uncertain irradiation histories. To create this path a reliable method is required to determine yields of transmutation, fission and activation products contained within the source at the time of disposal. Because of the uncertain histories of these sources, a number of likely histories are modeled with the code ORIGEN in order to establish the bounds of the radioisotope yields. The ORIGEN simulations are confirmed with gamma spectroscopy, specifically examining the activities of several fission and transmutation isotopes. These calculations, coupled with other previously established characterization techniques for transuranic neutron sources, will be used to establish a waste profile that is in compliance with Waste Isolation Pilot Plant (WIPP) waste acceptance criteria.

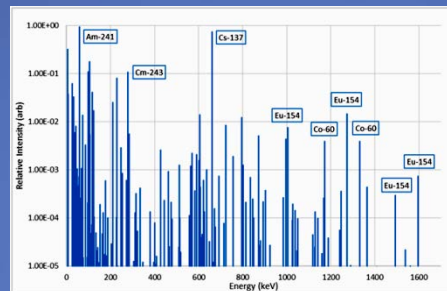


Cm-243 & CS-137 In-growth vs. Irradiation Time

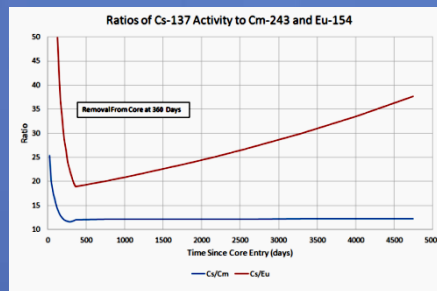
Gamma Spectroscopy

Gamma Spectroscopy can be used to determine the history of an irradiated AmBe source

- Observable isotopes have different ingrowth rates during irradiation
- The ratio of isotopes with similar half-lives (Cm-243 and Cs-137) is fixed upon removal from the radiation source, measurement of this ratio determines the total neutron flux
- Time out of core is determined by the ratio of isotopes with different half-lives (Cs-137 and Eu-154)



Simulated Source Spectra – 1y Irradiation, 12y Decay



Ratio Profile During and After 1y Irradiation

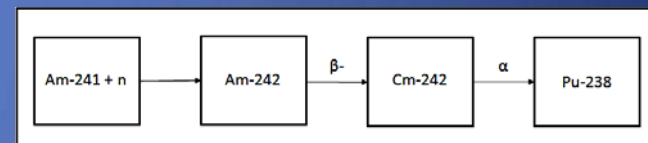
Path Forward

- Measure gamma spectra from irradiated sources with a known history
- Confirm ORIGEN simulations of irradiated sources
- Generate a table of useful isotopes for gamma spectroscopy
- Use ORIGEN simulations to create a disposal pathway for irradiated sources

Neutron Measurement

Neutron measurements from activated sources can be used to confirm gamma spectroscopic measurements

- Initial neutron emission of the source is determined by composition
- During irradiation the source transmutes Am-241 into Pu-238, changing the neutron emission rate
- The irradiation history determined with gamma spectroscopy can be confirmed by measuring the neutron emission rate



Am-241 Transmutation into Pu-238

Initial Alpha		1y Alpha		12y Alpha	
Isotope	Activity (Ci)	Isotope	Activity (Ci)	Isotope	Activity (Ci)
Am-241	10.41	Cm-242	388.70	Pu-238	20.46
		Pu-238	20.31	Am-241	2.56
		Am-241	2.60	Cm-244	1.53
		Cm-244	2.33	Cm-243	0.76
		Cm-243	0.99	Cm-242	0.16
Total	10.41	Total	414.93	Total	25.47

Alpha Activity Changes vs. Time After Irradiation

