

Table of Commercial Isotopes of Working Group 3: Radioisotopes for Applications

Code:

Supply / Demand

1. Demand > supply
2. Demand = supply
3. Demand < supply

Impact: economic / multiple industries / multiple populations

1. Massive
2. Moderate
3. Minimal

Nuclides	Main Applications	Producer	Status of Supply	Missing	Current Demand	Future Demand	Impact	Special Considerations	Options for increased availability
Am-241	Process control, analysis, well logging, Safety	Russia	single source	No disposal pathway	1	1	1	linked to foreign weapons reprocessing	Recycle of Am/Be sources at LANL Activate LANL Am production line
Ba-133	Process Control & Security	RIAR	Single Source	Ok	2	2	2	Enriched Ba-132 needed	ORNL could produce – reactor irradiation
C-14	Geochem, Health Physics, Process control	Russia	Multiple Sources	Ok	2	2	3	N/A	ORNL & INL
Cd-109	Analysis, Process Control	Multiple cyclotrons	Multiple sources	Ok	2	2	2	N/A	N/A
CF-252	Process control, analysis, well logging, Safety NationalSecurity, Medical	ORNL & RIAR (Russia)	Dual source - capacity problem – all RIAR production sold until 2010	Apparent (6-9 month) gap between current available supply and industry demand.	1	1	1	ORNL – has capacity – Zero funding – current material in the reactor needs funding for the 9 month process exercise 4 year campaign needs to be examined	Long term planning Definition of “Full cost recovery” so industry can adjust their business plans to accommodate pricing increases
Cl-36	Health Physics Geochem	None	Last produced late 1970s (Canada – Nordion)	No known current production	1	1	3	Processing difficulties after irradiation	Reactor irradiation
Cm-244	Analysis	ORNL & RIAR	OK	Waste disposal pathway	2	2	2	None	Not an issue
Co-57	Process Control, Analysis, NDT, Mineralogy	Russia, Europe	Multiple Sources	Ok	2	2	2	N/A	Multiple Cyclotrons
Cs 137	Process control, Well logging, Formation evaluation, Agricultural	Russia	No current U.S. production Russian supply at risk	No new fission product separation	1	1	1	Specific activity concerns viz-a-viz feedstock age	US fission product separation

	Irradiation Health Physics								
Fe-55	Analysis, Process Control, Geochem	ORNL, MURR	Multiple sources	Ok	3	2	3	N/A	N/A
Gd-153	Health Physics, Process Control	Russia	Sole source	Reliable/available supply	2	2	1		ORNL & INL have produced and could restart production
Ge-68	Health Physics	Multiple Cyclotrons	Multiple sources	Ok	2	2	1		No issues
H-3	Analysis, Light Sources, neutron targets	Russia, DOE, Ontario Hydro	Multiple sources	Ok	1	1	1	Safe guard issues	
Ir-192	Non-destructive testing	EEC reactors + many Russian, Nordion	Zero production in U.S.	Infrastructure and cost effectiveness within U.S.	1	1	1	Cost transparency & facility infrastructure	ORNL & INL have produced and could restart production
Kr-85	Process control, safety	Russia	Single sourced	Fission process Reliable source	1	1	2	fission product separation – requires isotopic enrichment via centrifuge or thermo diffusion	ORNL could produce
Ni-63	Analysis	ORNL, RIAR	Multiple sources	Ok	2	2	1	N/A	N/A
Pb-210	Health physics & Geochem	None		Reliable source	1	1	3	Decay product of Ra-226	Anybody with a hot cell
Pm-147	Process control, Safety, Light sources	Russia	Single source	No fission product separation in U.S.	2	1	1	Fission product separation	ORNL & INL reactor irradiation
Po-210	Process Control, Safety, Health Physics	Russia	Single supply	Single user in U.S.	3	3	3		ORNL & INL reactor irradiation
Ra-226	Process control, Health Physics, Isotope Production	None	None	No available supply	1	3	3	See Lead-210 – required for production	Decay product
Se-75	NDT, Health Physics, Medical	ORNL, RIAR, MURR	OK	OK	2	2	2		
Si-32	Geochem, Ocean Science	None	No availability		1	1	2		ORNL, Canada
Sm-151	Analysis	Russia	Available	Ok	2	2	3	N/A	N/A
Sr-90	Process Control, Geochem,	Russia, PNNL	Available	Ok	2	2	1	Minimal availability ex.PNNL	US fission product separation
Th-228	Health Physics	None	Not Available	N/A	1	1	3	Requires U-232	
Th-230	Health Physics, Geochem	None	Not Available	N/A	1	1	3	Requires U-232	
U-232	Geochem	None	Not Available	N/A	1	1	1	Required for processing	Isotope separation

								other isotopes	
Mo-99	Medical	NRU, Canada Petten, Netherlands Safari, South Africa BR-2, Belgium	Medium and long term questionable	Intermediate and long term supply with Maple Project cancellation and license expiration of NRU and HIR	2	1	1	FDA sNDA or CBE filing for existing mfr to convert to LEU, or DMF for new supplier w/ sNDA for generator mfr	MURR and BWTS have Proposed LEU production techniques
Ge-68	Medical	LANL, BLIP, Cyclotron Co, iTHEMBA	Radiochemical Only		2	If product approved 1, otherwise 2	2		
Ge-68/Ga-68 generator	Medical	The Cyclotron Co., Eckert & Ziegler	Radiochemical Only	Current generators not sterile or pyrogen-free	2	If product approved 1, otherwise 2	1	FDA hurdles Long shelf-life generator does not have attractive market potential	Potential <i>work for others</i> DOE Project to develop sterile pyrogen free generator
Cu-67	Medical	Trace Life Sciences, BLIP, LANL	DMF, Radiochemical Radiochemical	If FDA drug approved, address capacity	2	If product approved 1, otherwise 2	1	Scale-up production if drug FDA approved	Scaleup for production quantities and backup suppliers
Lu-177	Medical	ORNL, MURR, Petten	Radiochemical Specific activity and radionuclide purity is an issue, Radiopharmaceutical purity in the near future	Desire carrier free production	2	2	1	Carrier free and radionuclidic impurities, FDA hurdles	Project to develop and evaluate carrier free projection and scale up
Ac-225	Medical	ITU (Karlsruhe)OR NL	Limited Availability	Need additional stock of Th-229	1	1	If product approved 1 otherwise 2	Needs to be extracted from U-233 weapons waste, or produced on reactor or cyclotron	Congressional ban needs to be lifted to allow recovery of Th-229 from U-233 waste
At-211	Medical	NIH, Duke Univ of Washington	Limited Availability, Radiochemical grade only	Lack of local structure for scale-up production	1	1	If product approved 1, otherwise 2	Availability of 25 MeV or greater (α,n) on Bi-209 (100%), FDA hurdles, cGMP production	Build Infrastructure for production and commercial scale-up
Research Medical Isotopes	Medical	Many	Limited due to lack of funding		1	1		Lack of trained personnel and facilities	Projects to increase funding, training and facilities

Working List for National Security Science Working Sub-Group

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Nuclides	Main Applications	Producer	Status of Supply	Missing	Current / Future Demand	Impact	Special Considerations	Options for Increased Availability
He-3	Detector technology	DOE-DP	1	Purified materials	1	1	Detector material. No helium no neutron detectors	Investigate possible release in existing inventories
Ni-63	Detector technology	DOE-NE	1 (supply lags demand)		1	2		
Cf-252	Calibration standard	DOE-NE/DP	1	Processing facilities.	1	1	ANSI standard for certifying radiation detection instruments.	Reinstate irradiation and processing
Am-241	Calibration standard	DOE-NE/DP	1	Capital investment	2 with investment	2	ANSI standard for certifying radiation detection instruments.	Reinstate processing
Co-57	Calibration standard		3		3	3	ANSI standard for certifying radiation detection instruments.	
Ba-133	Calibration standards	DOE-NE	2		2	3	ANSI standard for certifying radiation detection instruments.	
Th-228	Calibration standard	DOE-DP	1	No current efforts for separation	1	1	ANSI standard for certifying radiation detection instruments.	
Co-60	Calibration standard	DOE-NE	3	Infrastructure and cost effectiveness within U.S.	3	3	ANSI standard for certifying radiation detection instruments.	
U-232	Calibration standard	DOE-DP	1		1	2	ANSI standard for certifying radiation detection instruments.	

Co-57	Short-lived RDD surrogate		3	Reliable source	3	3		
Sr-85	Short-lived RDD surrogate	DOE-NE	3		3	2		
Others	Short-lived RDD surrogate	DOE-NE/DP	2		2	3		
Reference materials (multiple isotopes)	Nuclear forensics	DOE	1	Inadequate supplies	1	1		
U-233	Isotope dilution spikes/nuclear forensics	DOE-DP	2		1	1		
Pu-242/244	Isotope dilution spikes/nuclear forensics	DOE-DP	1 for highly enriched	High purity required	1	1	High purity required	Reestablish mass separator capability for radioactive and stable isotopes.
Th-229	Isotope dilution spikes/nuclear forensics	DOE-DP	2	High purity required	2	1	High purity required	Reestablish mass separator capability for radioactive and stable isotopes.
Am-243	Isotope dilution spikes/nuclear forensics	DOE-DP	1 for highly enriched	High purity required	1	1	High purity required	Reestablish mass separator capability for radioactive and stable isotopes.
Np-226	Isotope dilution spikes/nuclear forensics	DOE-DP	1 for highly enriched	High purity required	1	1	High purity required	Reestablish mass separator capability for radioactive and stable isotopes.
Pu-236	Isotope dilution spikes/nuclear forensics	DOE-DP	1 for highly enriched	High purity required	1	1	High purity required	Reestablish mass separator capability for radioactive and stable isotopes.
Multiple common isotopes	Emergency responder training	Multiple sources	2		2	3		
Multiple common isotopes	Reachback training	Multiple sources	2		2	3		
Rb-83	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Y-88	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	

Zr-88	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Rh-101	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Ag-105	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Eu-149	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Tb-157	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Lu-173	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Ta-179	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
W-181	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Au-195	Weapons physics/ stockpile stewardship	DOE-DP	2		2	1	Capability maintenance essential	
Multiple reactor isotopes	Weapons physics/ stockpile stewardship	DOE-DP	1 or 2		1 or 2	1	Capability maintenance essential	

