

Standards of Radioactivity – A to Z of Batch Stock

Version 2.0 – September 2023

- [1]. Delivery of Plutonium-239 products outside the UK is subject to Export Control Regulations.
- [2]. Delivery of Radium-226 products outside the UK is subject to Export Control Regulations.
- [3]. Delivery of Thorium products outside the UK is subject to Export Control Regulations.
- [4]. Delivery of natural Uranium products outside the UK is subject to Export Control Regulations.
- [5]. Delivery of Uranium-232 products may be subject to UK Export Control Regulations.
- [6]. Delivery of Uranium-233 products outside the UK is subject to Export Control Regulations.
- [7]. Delivery of Zirconium-93 products outside of the UK is subject to Export Control Regulations.

Radionuclide	Approximate activity per unit mass	Nominal Mass	Product Code	Chemistry	Detected impurities (~% of activity per unit mass at certificated reference time)
²²⁷ Actinium (Ac-227)	Research and development currently in progress – please register interest with radioactivity@npl.co.uk				
²⁴¹ Americium (Am-241)	10 Bq/g	10 g nominal	R13-01	0.5 mol dm ⁻³ nitric acid	None detected
	300 Bq/g	10 g nominal	R13-02		
	4 kBq/g	10 g nominal	R13-03		
	100 kBq/g*	10 g nominal	R13-05		
²⁴³ Americium (Am-243)	1 Bq/g	10 g nominal	R18-00	1 mol dm ⁻³ nitric acid	²⁴¹ Am < 0.05%
	100 Bq/g	10 g nominal	R18-20		
¹³⁷ Caesium (Cs-137)	10 Bq/g	10 g nominal	R03-01	0.1 mol dm ⁻³ nitric acid containing 50 µg g ⁻¹ inactive caesium	None detected
	100 Bq/g	10 g nominal	R03-02		
	350 kBq/g	1 g or 3 g nominal	R03-05	0.1 mol dm ⁻³ hydrochloric acid containing 10 µg g ⁻¹ inactive caesium	
¹⁴ Carbon (C-14)	100 Bq/g	10 g nominal	R19-02	Aqueous sodium carbonate containing 5 mg g ⁻¹ inactive sodium carbonate and 1 mg g ⁻¹ formaldehyde	None detected
	2 kBq/g	10 g nominal	R19-03		

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*Requires a Type A package

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¹⁴ Carbon in glucose (C-14)	100 Bq/g	10 g nominal	R43-02	Aqueous D-[1- ¹⁴ C]-glucose also containing 1 mg g ⁻¹ inactive glucose and 1 mg g ⁻¹ formaldehyde	None detected
	2 kBq/g	10 g nominal	R43-03		
	100 kBq/g	10 g nominal	R43-05		
³⁶ Chlorine (Cl-36)	1 kBq/g	10 g nominal	R38-03	0.001 mol dm ⁻³ hydrochloric acid containing 90 µg g ⁻¹ sodium chloride	None detected
²⁴⁴ Curium (Cm-244)	1 kBq/g	5 g nominal	R25-03	2 mol dm ⁻³ nitric acid	²⁴³ Cm < 0.1% ²⁴³ Am < 0.1%
¹²⁹ Iodine (I-129)	100 Bq/g	10 g nominal	R14-02	0.001 mol dm ⁻³ sodium hydroxide	None detected
	1 kBq/g	10 g nominal	R14-03		
²¹⁰ Lead (Pb-210)	1 Bq/g	10 g nominal	R22-00	2 mol dm ⁻³ nitric acid containing 50 µg g ⁻¹ inactive lead and 50 µg g ⁻¹ inactive bismuth	None detected
	40 Bq/g	10 g nominal	R22-01		
	350 Bq/g	10 g nominal	R22-02 (D)	1 mol dm ⁻³ nitric acid containing 50 µg g ⁻¹ inactive lead and 50 µg g ⁻¹ inactive bismuth	
	37 kBq/g	5 g nominal	R22-03 (D)		
⁶³ Nickel (Ni-63)	2 kBq/g	10 g nominal	R48-03	0.1 mol dm ⁻³ hydrochloric acid containing 100 µg g ⁻¹ inactive nickel	None detected
²³⁷ Neptunium (Np-237)	1 kBq/g	5 g nominal	R21-03	3 mol dm ⁻³ nitric acid	²³⁹ Pu/ ²⁴⁰ Pu < 0.01% ²²⁹ Th < 0.01%
	10 kBq/g	3 g nominal	R21-04		
²³⁶ Plutonium (Pu-236)	Research and development in progress – please register interest with radioactivity@npl.co.uk				
²³⁸ Plutonium (Pu-238)	10 Bq/g	10 g nominal	R45-01	2 mol dm ⁻³ nitric acid	None detected
	100 Bq/g	10 g nominal	R45-02		
	1 kBq/g	10 g nominal	R45-03		

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²³⁹ Plutonium (Pu-239) [1].	50 Bq/g	10 g nominal	R24-01	2 mol dm ⁻³ nitric acid	²⁴⁰ Pu < 0.5% ²⁴¹ Pu < 0.2%
	1 kBq/g	10 g nominal	R24-03		
²⁴⁰ Plutonium (Pu-240)	Research and development in progress – please register interest with radioactivity@npl.co.uk				
²⁴¹ Plutonium (Pu-241)	10 Bq/g	10 g nominal	R35-01 (D)	2 mol dm ⁻³ nitric acid	²³⁸ Pu < 0.02% ²³⁹ Pu < 0.01% ²⁴⁰ Pu < 0.05% ²⁴² Pu < 6 × 10 ⁻⁴ % ²⁴⁴ Pu < 3 × 10 ⁻⁹ % ²⁴¹ Am – Decay product
	150 Bq/g	10 g nominal	R35-02		
	4 kBq/g	5 g nominal	R35-03 (D)		
²⁴² Plutonium (Pu-242)	1 Bq/g	10 g nominal	R15-00	2 mol dm ⁻³ nitric acid	²⁴¹ Am < 0.3% ²⁴¹ Pu < 5 %
	12.5 Bq/g	10 g nominal	R15-20		
²⁰⁹ Polonium (Po-209)	100 Bq/g	5 g nominal	R33-02	6 mol dm ⁻³ hydrochloric acid	None detected
	10 Bq/g	5 g nominal	R33-01		
²³¹ Protactinium (Pa-231)	100 Bq/g	5 g nominal	R49-02	7 mol dm ⁻³ hydrochloric acid	None detected
²²⁶ Radium (Ra-226) [2].	100 Bq/g	10 g nominal	R36-02	1 mol dm ⁻³ hydrochloric acid	None detected
	2 kBq/g	10 g nominal	R36-03		
	40 kBq/g	5 g nominal	R36-04		
²²⁸ Radium (Ra-228)	10 Bq/g	5 g nominal	R42-01 (D)	2 mol dm ⁻³ nitric acid	²²⁶ Ra < 0.3 %

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⁹⁰Strontium (Sr-90)	100 Bq/g	10 g nominal	R01-03	1 mol dm ⁻³ nitric acid containing 50 µg g ⁻¹ strontium and 50 µg g ⁻¹ yttrium	None detected
	2 kBq/g	10 g nominal	R01-05		
	40 kBq/g	10 g nominal	R01-04		
⁹⁹Techetium (Tc-99)	100 Bq/g	10 g nominal	R11-02	0.1 mol dm ⁻³ ammonium hydroxide	None detected
	1 kBq/g	10 g nominal	R11-03		
²²⁹Thorium (Th-229) [3].	1 Bq/g	10 g nominal	R26-00	2 mol dm ⁻³ nitric acid containing 10 µg g ⁻¹ ammonium cerium nitrate	None detected
	10 Bq/g	10 g nominal	R26-01		
	100 Bq/g	10 g nominal	R26-02		
Tritium (H-3)	10 Bq/g	10 g nominal	R30-01 (D)	Tritiated water	None detected
	100 Bq/g	10 g nominal	R30-02 (D)		
	5 kBq/g	10 g nominal	R30-04		
Tritium in Glucose (H-3)	1 kBq/g	10 g nominal	R44-03	D-[3- ³ H]-glucose containing 1 mg g ⁻¹ inactive glucose and 1mg g ⁻¹ formaldehyde	None detected
Natural Uranium (U-234, U-235 & U-238) [4].	100 Bq/g ~50 Bq/g ²³⁴ U ~50 Bq/g ²³⁸ U ~2.5 Bq/g ²³⁵ U	10 g nominal	R47-02	2 mol dm ⁻³ nitric acid	None detected
	200 Bq/g ~100 Bq/g ²³⁴ U ~100 Bq/g ²³⁸ U ~5 Bq/g ²³⁴ U	10 g nominal	R47-03		

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²³²Uranium (U-232) [5].	1 Bq/g	10 g nominal	R20-00	2 mol dm ⁻³ nitric acid	None detected
	10 Bq/g	10 g nominal	R20-15		
	100 Bq/g	10 g nominal	R20-02		
	5 kBq/g	5 g nominal	R20-03		
²³³Uranium (U-233) [6].	1 Bq/g	10 g nominal	R46-00	2 mol dm ⁻³ nitric acid	²²⁹ Th < 0.3 %
	10 Bq/g	10 g nominal	R46-01		
	100 Bq/g	10 g nominal	R46-02		²²⁹ Th < 0.2 % ²³² U < 0.4 %
	1 kBq/g	10 g nominal	R46-03		
²³⁴Uranium (U-234)	10 Bq/g	10 g nominal	R50-01	2 mol dm ⁻³ nitric acid	²³² U < 1.5 %
	100 Bq/g	10 g nominal	R50-02		
²³⁶Uranium (U-236)	10 Bq/g	10 g nominal	R41-01	2 mol dm ⁻³ nitric acid	²³⁵ U < 0.005 %
	100 Bq/g	10 g nominal	R41-02		
	900 Bq/g	5 g nominal	R41-03		
⁹³Zirconium (Zr-93) [7].	Research and development in progress – please register interest with radioactivity@npl.co.uk				

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NPL Mixed Nuclide: Our NPL Mixed Nuclide is produced annually. Please enquire for further details.

Radionuclides	Approximate activity per unit mass	Nominal Mass	Product Code	Chemistry
²⁴¹ Americium, ¹⁰⁹ Cadmium, ⁵⁷ Colbalt, ¹³⁹ Cerium, ⁵¹ Chromium, ¹¹³ Tin, ⁸⁵ Strontium, ¹³⁷ Caesium, ⁵⁴ Manganese, ⁸⁸ Yittrium, ⁶⁵ Zinc and ⁶⁰ Colbalt <i>(Am-241, Cd-109, Co-57, Ce-139, Cr-51, Sn-113, Sr-85, Cs-137, Mn-54, Y-88. Zn-65 & Co-60)</i>	10 kBq/g	10 g nominal	R08-04	4 mol dm ⁻³ HCl with 10 µg g ⁻¹ of appropriate carrier elements
		1 g nominal	R08-02	
Mixed Carrier Solution	n/a	500 g nominal	R08-Carrier	

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