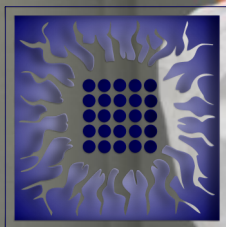


RADIOPHARMACEUTICALS AND SEALED SOURCES

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RADIONUCLIDE GENERATOR

Universal $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ generator, activity 2-40 GBq

Tc99m/G

This medicinal product is for diagnostic use only.

Sodium pertechnetate ($^{99\text{m}}\text{Tc}$) injection is produced by means of a ($^{99}\text{Mo}/^{99\text{m}}\text{Tc}$) generator. Technetium ($^{99\text{m}}\text{Tc}$) decays with the emission of gamma radiation with a mean energy of 140 keV and a half-life of 6.01 hours to technetium (^{99}Tc) which, in view of its long half-life of 2.13×10^5 years, can be regarded as quasi stable.

The radionuclide generator containing the parent isotope ^{99}Mo , adsorbed on a chromatographic column delivers sodium pertechnetate ($^{99\text{m}}\text{Tc}$) injection in sterile solution.

The ^{99}Mo on the column is in equilibrium with the formed daughter isotope $^{99\text{m}}\text{Tc}$. The generators are supplied with the ^{99}Mo activity amounts at activity reference time which deliver the ordered technetium ($^{99\text{m}}\text{Tc}$) amounts, assuming a 100% theoretical elution yield and 24 hours' time from previous elution and taking into account that branching ratio of ^{99}Mo is about 87%.

Indications:	<ul style="list-style-type: none">- thyroid scintigraphy,- salivary gland scintigraphy,-location of ectopic gastric mucosa (Meckel's diverticulum),-lacrimal duct scintigraphy,-labelling of various kits for radiopharmaceutical preparation
Pharmaceutical form:	radionuclide generator
Composition:	Al_2O_3 column containing adsorbed parent ^{99}Mo
Generator activity:	2, 4, 8, 12, 16, 20, 24, 30, 40 GBq at calibration date
Technical characteristics:	<ul style="list-style-type: none">-generator is a "wet column" system,-elution yield ($^{99\text{m}}\text{Tc}$): 90-110 % of nominal activity,-radiochemical purity: $^{99\text{m}}\text{TcO}_4^- > 95$ %,-impurity ^{99}Mo in the eluate: maximum 0.1 % of the total radioactivity-chemical purity: Aluminium < 5 ppm-pH = 4.0 – 8.0-clear, colorless solution, sterile and nonpyrogenic
Stability	After elution, sodium pertechnetate eluate use within 6 hours
Storage	up to 25 °C
Delivery	calibration on Monday at 10 am
Expiry date	12 days from calibration date

Kit for the Universal $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ generator elution

Content: 10 evacuated vials for elution, 10 evacuated protective vials, 5 vials with 10 ml of saline, 3 vials with 5 ml of saline, 2 vials with 3 ml of saline.

Expiry date: 12 months

Storage: up to 25 °C

RADIOPHARMACEUTICAL KITS

Kit for preparation of ^{99m}Tc -DTPA

TcP-2

Indications:	-renal scintigraphic imaging (dynamic renal scintigraphy for GFR measurement of each kidney and evaluation of urinary flow disorders), -GFR measurement from the plasma samples, -cerebral angiography, -brain scanning
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	-10 mg CaNa_3DTPA (calcium trisodium diethylenetriaminepentaacetic acid salt) -0.5 mg $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ -9 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 3-5 ml -radiochemical purity > 95 %, -pH = 4.0-7.5 -clear, colorless solution
Stability of sterile injectable solution	6 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	six months from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -Pyrophosphate

TcP-3

Indications:	<ul style="list-style-type: none">-Blood cell labelling for blood pool scintigraphy- Angiocardiography for:<ul style="list-style-type: none">• evaluation of ventricular ejection fraction• evaluation of global and regional cardiac wall motion• myocardial phase imaging- Organ perfusion and vascular abnormalities imaging- Diagnosis and localization of occult gastrointestinal bleeding-Determination of blood volume-Spleen scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	12 mg $\text{Na}_4\text{P}_2\text{O}_7$ (sodium pyrophosphate) 4 mg of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 2 mg of gentisic acid 8.4 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	<ul style="list-style-type: none">-volume of 3 ml-radiochemical purity > 90 %,-pH = 6.0-7.0-clear, colorless solution
Stability of sterile injectable solution	3 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	six months from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -DMSA

TcP-5

Indications:	Static (planar or tomographic) renal imaging: - morphological studies of renal cortex, - individual kidney function, - location of ectopic kidney.
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	2 mg DMSA (dimercaptosuccinic acid) 0.71 mg $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 8.6 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 8 ml -radiochemical purity > 95 %, -pH = 2.3-3.5 -clear, colorless solution
Stability of sterile injectable solution	6 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	six months from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -Ciprofloxacin

TcP-6

Indications:	-visualization of bacterial infections
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	2.0 mg ciprofloxacin hydrochloride 0.21 mg $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 1.5 mg of ascorbic acid 10.0 mg of mannitol
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 3 ml -radiochemical purity > 93 %, -pH = 3.0-3.5 -clear, colorless solution
Stability of sterile injectable solution	3 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -MDP

TcP-8

Indications:	- skeletal scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	12 mg of $\text{Na}_3\text{CH}_3\text{O}_6\text{P}_2$ (trisodium salt methylenediphosphonic acid) 0.48 mg of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 3 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 2-8 ml -radiochemical purity > 95 %, -pH = 3.5-7.5 -clear, colorless solution
Stability of sterile injectable solution	8 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -MAA

TcP-9

Indications:	-pulmonary perfusion scintigraphy - radionuclide venography
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	2 mg of MAA (macroaggregate of HSA) 0.3 mg $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 3 mg of glycine
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 5 ml - number of MAA particles per vial: $2.0 \pm 0.5 \times 10^6$ - particle size: 10-100 μm - pH of the solution: 3.8 – 7.5 - radiochemical purity: $\geq 90\%$ -white suspension which may separate on standing -clear, colorless solution
Stability of sterile injectable solution	6 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C - 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -tin colloid

TcP-11

Indications:	- liver and spleen scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	0.174 mg SnF_2 1.77 mg NaF
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	-volume of 5 ml - radiochemical purity: > 95 % - pH of the solution: 4.0 -7.0 -clear, colorless solution
Stability of sterile injectable solution	4 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	six months from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -EHIDA

TcP-14

Indications:	- hepatobiliary scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	40 mg EHIDA [N-(2,6-diethylacetanilide) iminodiacetic acid] 1.1 mg of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 3 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	- volume of 4 ml - radiochemical purity: > 95 % - pH of the solution: 4.0 - 6.0 -clear, colorless solution
Stability of sterile injectable solution	4 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -MIBI

TcP-15

Indications:	<ul style="list-style-type: none">-myocardial perfusion scintigraphy for the detection and localisation of coronary artery disease (angina pectoris and myocardial infarction)-assessment of global ventricular function. First-pass technique for determination of ejection fraction and/or ECG-triggered, gated SPECT for evaluation of left ventricular ejection fraction, volumes and regional wall motion.-scintimammography for the detection of suspected breast cancer when mammography is equivocal, inadequate or indeterminate.-localisation of hyperfunctioning parathyroid tissue in patients with recurrent or persistent disease in both primary and secondary hyperparathyroidism, and in patients with primary hyperparathyroidism scheduled to undergo initial surgery of the parathyroid glands.
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	1 mg of copper tetraMIBI tetrafluoroborate [Cu(MIBI) ₄]BF ₄ 0.075 mg of SnCl ₂ ·2H ₂ O 1 mg of L-cysteine hydrochloride monohydrate 2.6 mg Na-citrate dihydrate 20 mg of mannitol
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	<ul style="list-style-type: none">- volume of 1 - 5 ml- radiochemical purity: > 94 %- pH of the solution: 5.0 - 6.0-clear, colorless solution
Stability of sterile injectable solution	10 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date

Delivery from stock

Kit for preparation of ^{99m}Tc -DPD

TcP-17

Indications:	- skeletal scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials in the cardboard box
Composition (1 vial contain)	11 mg of DPD (2,3-dicarboxypropane-1,1-diphosphonic acid) 0.60 mg $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 2 mg of p-aminobenzoylglutamic acid 10 mg NaCl
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	- volume of 10 ml - radiochemical purity: > 95 % - pH of the solution: 7.0 - 8.0 -clear, colorless solution
Stability of sterile injectable solution	6 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of ^{99m}Tc -Antimony sulfide colloid

TcP-22

Indications:	- lymphoscintigraphy, -liver and spleen scintigraphy, -scintigraphy of the reticuloendothelial system bone marrow, -inhalation lung scintigraphy
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials of kit + 5 vials of buffer in the cardboard box
Composition (1 vial contain)	<i>Kit:</i> 1.56 mg Sb_2S_3 (antimony sulfide) 3 mg of potassium bitartrate 7.5 mg polyvinyl pyrrolidone <i>Buffer:</i> 3 ml of 0.1 M sodium citrate
Appearance	<i>Kit:</i> orange solution
Characteristics of sterile injectable solution	- volume of 5 ml - radiochemical purity: > 90 % - pH of the solution: 5.0 - 6.0 -clear, orange solution
Stability of sterile injectable solution	6 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

Kit for preparation of $^{99m}\text{Tc(V)}\text{-DMSA}$

TcP-23

Indications:	- detection of medullary carcinoma of the thyroid gland
Pharmaceutical form:	radiopharmaceutical kit
Package	5 vials of kit + 5 vials of buffer in the cardboard box
Composition (1 vial contain)	<i>Kit:</i> 1 mg DMSA (dimercaptosuccinic acid) 0.12 mg of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ 0.50 mg of ascorbic acid 6.7 mg NaCl <i>Buffer:</i> 1 % NaHCO_3
Appearance	lyophilized, white powder
Characteristics of sterile injectable solution	- volume of 4 ml - radiochemical purity: > 95 % - pH of the solution: 7.8 – 8.4 -clear, colorless solution
Stability of sterile injectable solution	4 hours at a temperature below 25°C
Storage of the kit	in a refrigerator (2°C- 8°C)
Expiry date of the kit	one year from the production date
Delivery	from stock

IODINE-131 RADIOPHARMACEUTICALS

Sodium iodide (^{131}I) solution

I131/4x

Indications:	<i>diagnosis:</i> scintigraphy of the thyroid gland <i>therapy:</i> -hyperthyroidism (treatment of Graves' disease, toxic multinodular goitre or autonomous nodules), -treatment of papillary and follicular thyroid carcinoma including metastatic disease
Pharmaceutical form:	oral solution
Package	10 ml glass vial, closed with rubber stopper and aluminum cap, placed in a lead container
Composition	sodium iodide (^{131}I) in 0.1 M bicarbonate buffer, activities 37 – 3700 MBq/ml at time of calibration
Characteristics of solution	- pH of the solution: 7.0 – 10.0 - radionuclidic purity: >99.9 % - radiochemical purity: > 95 % -clear, colorless solution
Calibration	at the user's request
Storage	at temperature below 25°C
Expiry date	21 days from the production date
Delivery	on request

Sodium iodide (^{131}I) capsules for diagnostic use

1131/K3

Indications:	scintigraphy of the thyroid gland
Pharmaceutical form:	capsule, hard
Package	polypropylene vial, closed with polypropylene stopper, placed in a lead container. One vial may contain up to 10 capsules of the same activity.
Composition	sodium iodide (^{131}I) activities of 0.37 – 37 MBq at time of calibration 260 mg of sodium hydrogen phosphate (Na_2HPO_4) 0.8 mg sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$)
Characteristics	- radionuclidic purity: >99.9 % - radiochemical purity: > 95 %
Calibration	at the user's request
Storage	at temperature below 25°C
Expiry date	21 days from the production date
Delivery	on request

Sodium iodide (^{131}I) capsules for therapeutic use

1131/KT

Indications:	-hyperthyroidism (treatment of Graves' disease, toxic multinodular goitre or autonomous nodules), -treatment of papillary and follicular thyroid carcinoma including metastatic disease
Pharmaceutical form:	capsule, hard
Package	polypropylene vial, closed with polypropylene stopper, placed in a lead container. One vial contains a single capsule.
Composition	sodium iodide (^{131}I) activities of 111 – 3700 MBq at time of calibration 260 mg of sodium hydrogen phosphate (Na_2HPO_4) 0.8 mg sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$)
Characteristics	- radionuclidic purity: >99.9 % - radiochemical purity: > 95 %
Calibration	at the user's request
Storage	at temperature below 25°C
Expiry date	21 days from the production date
Delivery	on request

MIBG-¹³¹I (meta-iodobenzylguanidine) injection for diagnostic use

1131/110

Indications:	<ul style="list-style-type: none">-confirmation in suspected neuroectodermally derived tumours including neuroblastoma, phaeochromocytoma and ganglioneuroma,-staging of the disease,-follow-up of neuroblastoma under chemotherapy, particularly in stage IV and IVs patients,-before and after surgery of the primary tumour,-follow-up after treatment to exclude a sub-clinical relapse, especially in the bone marrow and also in the case of any clinical abnormality during follow-up, particularly bone pain,-before planning MIBG therapy
Pharmaceutical form:	solution for injection
Package	10 ml glass vial, closed with rubber stopper and aluminum cap, placed in a lead container. The vial contains a volume of solution corresponding to the activity determined on the calibration day.
Composition	<ul style="list-style-type: none">-meta-iodobenzylguanidine (¹³¹I) activities of 10 – 74 MBq/ml at time of calibration-ascorbic acid
Characteristics	<ul style="list-style-type: none">-pH 3.5 – 8.0-radionuclidic purity: >99.9 %- radiochemical purity: > 94 %- clear, colorless or slightly yellow solution
Calibration	at the user's request
Storage	in a refrigerator (2°C- 8°C), protect from light
Expiry date	14 days from the production date (expiry date is stated on the label)
Delivery	on request

Hippurate-¹³¹I injection for diagnostic use

1131/11

Indications:	<ul style="list-style-type: none">- kidney blood flow resolution (effective renal plasma flow - ERPF)• renal tubular function• urine outflow from the pyelocalyceal system• vesico-ureteral reflux (examination during miction)• renal function impairment in transplanted kidney• diagnostics of renovascular hypertension
Pharmaceutical form:	solution for injection
Package	10 ml glass vial, closed with rubber stopper and aluminum cap, placed in a lead container. The vial contains a volume of solution corresponding to the activity determined on the calibration day.
Composition	-sodium 2-[¹³¹ I]iodohippurate activities of 3.7 – 74 MBq/ml at time of calibration
Characteristics	<ul style="list-style-type: none">-pH 6.0 – 8.5-radionuclidic purity: >99.9 %- radiochemical purity: > 96 %- clear, colorless solution
Calibration	at the user's request
Storage	in a refrigerator (2°C- 8°C)
Expiry date	21 days from the production date
Delivery	on request

SEALED RADIOACTIVE SOURCES

Sealed radioactive sources for the use in industrial gamma-radiography

^{192}Ir activities up to 1.8 TBq

^{75}Se activities up to 4 TBq

Application for charging radiographic devices used in detection of defects inside the metals and the assess of the structure of different objects.

Sealed radioactive sources for industry needs

Sealed radioactive sources are mainly used for control of process systems and automation in industry.

^{60}Co activities up to 370 GBq

^{137}Cs activities up to 1 TBq

^{241}Am activities up to 740 GBq

Application -checking the level of explosive liquids, liquids under high pressure as well as solid materials in chemical reactors

- measuring the density of liquids, powder or solid, as well as adjusting the density of various types of liquids (hydromixtures) during their production

^{90}Sr activities up to 370 GBq

^{85}Kr activities up to 370 GBq

Application - measuring the thickness of thin foils made of metal, paper and polymer
- school resources

Delivery on request

SERVICE ACTIVITIES

Quality control

Laboratory for radioisotopes, INN "Vinča" has experience, qualification and facilities to provide the high level of service in the field of quality control:

- radiopharmaceuticals
- radioimmunoassay and immunoradiometric assay
- sealed radioactive sources and temporary containers for storage and transport of radioactive materials.

Services of labeling pharmaceuticals with various radionuclides

Installation and deinstallation of sealed radioactive sources in devices

The Laboratory for radioisotopes is able to replace used sealed radioactive sources in all devices in which they are used in:

- cobalt therapy - replacement in medical institutions,
- gamma defectoscopy - replacement in the Laboratory for radioisotopes,
- industry - contracted,
- all other devices that use sealed radioactive sources.

Construction and manufacturing of containers for transportation, use and storage of radioactive materials

At the request of the user, the Laboratory for radioisotopes carries out construction, and according to possibilities, production of prototypes and serial of devices for the safe use of radioactive materials, namely:

- containers for transfer and storage of radioactive materials,
- storage facilities for radioactive materials,
- devices for using sealed radioactive sources in various fields of application.

Servicing and repair of devices with installed sealed radioactive sources

At the request of the user, the Laboratory for radioisotopes carries out servicing and repair of all devices with sealed radioactive sources, i.e. in cases of failure or damage to the devices as a result of which its usual and safe use is called into question. Depending on the nature of the damage and the wishes of the user, the intervention can be carried out in the premises user or in the Laboratory for radioisotopes.

GENERAL CONDITIONS OF ORDERING

Radiopharmaceuticals and radioactive isotopes listed in this catalog are produced in the Laboratory for Radioisotopes, Vinča Institute of Nuclear Sciences.

The Laboratory for radioisotopes is the only radiopharmaceuticals manufacturer in the Republic of Serbia. The radiopharmaceuticals shown in this catalog are produced by modern technologies.

Orders can be placed by letter, phone or fax.

Each order must contain the following information:

- name and address of the customer
- address to which delivery should be made
- catalog code and product name
- the requested activity
- the requested quantity
- delivery date and calibration date

Send orders by mail to:

Vinča Institute of Nuclear Sciences

Laboratory for radioisotopes

11001 Belgrade

p.p. 522

Phone/Fax: 381 11 6308 436

<http://www.vinca.rs/070/>

All products are delivered properly packed, in accordance with the regulations of the Republic Serbia and international regulations. In case the delivery is made in return packaging, this is especially emphasized.

Appendix

MEASURE UNITS

Bequerel → Curie:

$$1 \text{ Bq} = 2,7027 \times 10^{-11} \text{ Ci}$$

$$1 \text{ Bequerel (Bq)} = 27.027 \text{ Picocurie (pCi)}$$

$$1 \text{ Kilobequerel (kBq)} = 27.027 \text{ Nanocurie (nCi)}$$

$$1 \text{ Megabequerel (MBq)} = 27.027 \text{ Microcurie (}\mu\text{Ci)}$$

$$1 \text{ Gigabequerel (GBq)} = 27.027 \text{ Millicurie (mCi)}$$

$$1 \text{ Terabequerel (TBq)} = 27.027 \text{ Curie (Ci)}$$

Curie → Bequerel:

$$1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$$

$$1 \text{ Nanocurie (nCi)} = 37 \text{ Bequerel (Bq)}$$

$$1 \text{ Microcurie (}\mu\text{Ci)} = 37 \text{ Kilobequerel (kBq)}$$

$$1 \text{ Millicurie (mCi)} = 37 \text{ Megabequerel (MBq)}$$

$$1 \text{ Curie (Ci)} = 37 \text{ Gigabequerel (GBq)}$$

$$1 \text{ Dekacurie (daCi)} = 0.37 \text{ Terabequerel (TBq)}$$

Rad → Gray:

$$1 \text{ Rad} = 0.01 \text{ Gy}$$

$$1 \text{ Millirad (mrad)} = 10 \text{ Microgray (}\mu\text{Gy)}$$

$$1 \text{ Rad} = 10 \text{ Milligray (mGy)}$$

$$1 \text{ Rad} = 1 \text{ Centigray (cGy)}$$

Gray → Rad:

$$1 \text{ Microgray (}\mu\text{Gy)} = 0.1 \text{ Millirad (mrad)}$$

$$1 \text{ Milligray (mGy)} = 100 \text{ Millirad (mrad)}$$

$$1 \text{ Centigray (cGy)} = 1 \text{ Rad}$$

$$1 \text{ Gray (Gy)} = 100 \text{ Rad}$$

Rem → Sievert:

$$1 \text{ Millirem (mrem)} = 10 \text{ Microsievert (}\mu\text{Sv)}$$

$$1 \text{ Rem} = 10 \text{ Millisievert (mSv)}$$

$$1 \text{ Rem} = 1 \text{ Centisievert (cSv)}$$

Sievert → Rem:

$$1 \text{ Microsievert (}\mu\text{Sv)} = 0.1 \text{ Millirem (mrem)}$$

$$1 \text{ Millisievert (mSv)} = 100 \text{ Millirem (mrem)}$$

$$1 \text{ Centisievert (cSv)} = 1 \text{ Rem}$$

$$1 \text{ Sievert (Sv)} = 100 \text{ Rem}$$

CHARACTERISTICS OF RADIONUCLIDES

Radionuclide	T _{1/2}	Decay Mode (%)	Emission	E (keV)	Intensity
^{99m} Tc	6.02 h	γ IC	γ	140	89.3
			e-	119	8.7
				121-142	2.14
				2	99.1
				15-18	2
			X _k	18-21	7.2
¹³¹ I	8.02 d	β-	e-	248 max	2.1
				334 max	7.3
				606 max	89.5
			e-	46	3.5
			γ	80	2.6
				284	4.6
	364	81.3			
	637	7.2			
	722	1			

RADIOACTIVE DECAY CALCULATION OF ^{131}I ($T_{1/2} = 8.02 \text{ d}$)

Hours/ Days	0	4	8	12	16	20	24	28	32	36	40	44
0	1.0000	0.9857	0.9716	0.9577	0.9440	0.9305	0.9172	0.9041	0.8912	0.8784	0.8658	0.8535
2	0.8413	0.8292	0.8174	0.8057	0.7942	0.7828	0.7716	0.7606	0.7497	0.7390	0.7284	0.7180
4	0.7077	0.6976	0.6876	0.6778	0.6681	0.6585	0.6491	0.6398	0.6307	0.6217	0.6128	0.6040
6	0.5954	0.5869	0.5785	0.5702	0.5620	0.5540	0.5461	0.5383	0.5306	0.5230	0.5155	0.5081
8	0.5009	0.4937	0.4866	0.4797	0.4728	0.4661	0.4594	0.4528	0.4463	0.4400	0.4337	0.4275
10	0.4214	0.4153	0.4094	0.4035	0.3978	0.3921	0.3865	0.3809	0.3755	0.3701	0.3648	0.3596
12	0.3545	0.3494	0.3444	0.3395	0.3346	0.3298	0.3251	0.3205	0.3159	0.3114	0.3069	0.3025
14	0.2982	0.2939	0.2897	0.2856	0.2815	0.2775	0.2735	0.2696	0.2657	0.2619	0.2582	0.2545
16	0.2509	0.2473	0.2437	0.2403	0.2368	0.2334	0.2301	0.2268	0.2236	0.2204	0.2172	0.2141
18	0.2110	0.2080	0.2050	0.2021	0.1992	0.1964	0.1936	0.1908	0.1881	0.1854	0.1827	0.1801
20	0.1775	0.1750	0.1725	0.1700	0.1676	0.1652	0.1628	0.1605	0.1582	0.1560	0.1537	0.1515
22	0.1494	0.1472	0.1451	0.1430	0.1410	0.1390	0.1370	0.1350	0.1331	0.1312	0.1293	0.1275
24	0.1256	0.1239	0.1221	0.1203	0.1186	0.1169	0.1152	0.1136	0.1120	0.1104	0.1088	0.1072
26	0.1057	0.1042	0.1027	0.1012	0.0998	0.0984	0.0970	0.0956	0.0942	0.0929	0.0915	0.0902
28	0.0889	0.0877	0.0864	0.0852	0.0839	0.0827	0.0816	0.0804	0.0792	0.0781	0.0770	0.0759
30	0.0748	0.0737	0.0727	0.0716	0.0706	0.0696	0.0686	0.0676	0.0667	0.657	0.0648	0.0638
32	0.0629	0.0620	0.0611	0.0603	0.0594	0.0586	0.0577	0.0569	0.0561	0.553	0.0545	0.0537
34	0.0529	0.0522	0.0514	0.0507	0.0500	0.0493	0.0486	0.0479	0.0472	0.0465	0.0458	0.0452
36	0.0445	0.0439	0.0433	0.0427	0.0420	0.0414	0.0409	0.0403	0.0397	0.0391	0.0386	0.0380
38	0.0375	0.0369	0.0364	0.0359	0.0354	0.0349	0.0344	0.0339	0.0334	0.0329	0.0324	0.0320