

SUMMARY OF PRODUCT CHARACTERISTICS

1 NAME OF THE MEDICINAL PRODUCT

KryptoScan™ generator

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Rubidium (^{81}Rb) bound as ion to a cation exchange resin which is in equilibrium with the daughter-product Krypton ($^{81\text{m}}\text{Kr}$) and serves as a generator for Krypton ($^{81\text{m}}\text{Kr}$) gas.

The generator is available with activities ranging between 75-740 MBq

Physical characteristics

Rubidium (^{81}Rb) decays with a physical half-life of 4.58 hours to its metastable daughter-product Krypton ($^{81\text{m}}\text{Kr}$) thus generating this short-lived radionuclide with a half-life of 13 seconds. Krypton ($^{81\text{m}}\text{Kr}$) decays by isometric transition to Krypton (^{81}Kr), emitting pure gamma radiation of 0.190 MeV which is internally converted. ^{81}Kr decays to stable ^{81}Br with a half-life of $T_{1/2} = 2.1 \times 10^5$ years.

3 PHARMACEUTICAL FORM

Radionuclide generator.

4 CLINICAL PARTICULARS

4.1 Therapeutic indications

- Investigation of pulmonary ventilation, according to the low radiation dose, this product can be especially recommended for paediatric examination.
- Combined with a pulmonary perfusion scintigraphy for diagnosis of pulmonary embolism.
- Pulmonary ventilation ($^{81\text{m}}\text{Kr}$) / perfusion (^{99}Tc -macroaggregation) studies are possible because of the different spectrometric windows of $^{81\text{m}}\text{Kr}$ and $^{99\text{m}}\text{Tc}$.

4.2 Posology and method of administration

Krypton images are acquired during the continuous inhalation of the short lived and otherwise inert radioactive gas, Krypton ($^{81\text{m}}\text{Kr}$). This is eluted with humidified air from a rubidium generator and administered to the patient through a face mask or airway.

In general adequate imaging is achieved when 200.000-350.000 counts are accumulated per gamma camera image. This corresponds to approx. 18 MBq/kg body weight. Most investigation requires a number of views = 4 to 6.

The activities for children may be calculated according to the following equation:

$$\text{Activity-child (MBq)} = \frac{\text{Activity-adult (MBq)} \times \text{body weight (kg)}}{70 \text{ (kg)}}$$

Continuous inhalation is stopped upon acquisition of approx. 300.000 counts per gamma camera image.

4.3 Contraindications

None known.

4.4 Special warnings and precautions for use

Radiopharmaceuticals may be used and administered only by authorised persons.

Radiopharmaceuticals intended for administration to patients should be prepared by the user in a manner which satisfies both radiological safety and pharmaceutical quality requirements.

4.5 Interaction with other medicinal products and other forms of interaction

Diazepam in sedative doses and general anaesthetic agents may affect the distribution of radioactive gases in the lung by slightly shifting the activity to the lung apex and reducing basal accumulation.

4.6 Fertility, pregnancy and lactation

When it is necessary to administer radioactive medicinal product to women of childbearing potential, information should always be sought about pregnancy. Any woman who has missed a period should be assumed to be pregnant until proven otherwise. Where uncertainty exists it is important that radiation exposure should be the minimum consistent with achieving the desired clinical information. Alternative techniques which do not involve ionising radiation should be considered.

Radionuclide procedures carried out on pregnant women also involve radiation doses to the foetus. Only imperative investigations should be carried out during pregnancy, when the likely benefit exceeds the risk incurred by mother and foetus.

Before administering a radioactive medicinal product to a mother who is breast-feeding consideration should be given as to whether the investigation could be reasonably delayed until the mother has ceased breast-feeding and as to whether the most appropriate choice of radiopharmaceutical has been made, bearing in mind the secretory activity in breast milk. If administration of Krypton ($^{81\text{m}}\text{Kr}$) gas is considered necessary, however, breast-feeding need not be specifically interrupted.

4.7 Effects on ability to drive and use machines

Effects on the ability to drive or to operate machines have not been described.

4.8 Undesirable effects

For each patient, exposure to ionising radiation must be justifiable on the basis of likely clinical benefit. The activity administered must be such that the resulting radiation dose is as low as reasonably achievable bearing in mind the need to obtain the intended diagnostic or therapeutic result.

Exposure to ionising radiation is linked with cancer induction and a potential for development of hereditary defects. For diagnostic nuclear medicine investigations the current evidence suggests that these adverse effects will occur with negligible frequency because of the low radiation dose incurred.

For most diagnostic investigations using a nuclear medicine procedure the radiation dose delivered (EDE) is less than 20 mSv. Higher doses may be justified in some clinical circumstances.

No adverse/undesirable effects have been reported for this agent.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system:

Yellow Card Scheme

Website: www.mhra.gov.uk/yellowcard

4.9 Overdose

Also, in the unusual event of radiation overdose caused by an unrequired but prolonged period of krypton gas inhalation, due to the rapid washout from the lungs during normal ventilation, patients need only be removed from the source of radiation to a fresh and uncontaminated atmosphere.

5 PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

ATC-Code: V09E X (Other respiratory system diagnostic radiopharmaceuticals)
Krypton is an inert gas which is not metabolized and in the concentrations applied Krypton ($^{81\text{m}}\text{Kr}$) shows no pharmacodynamic effects.

5.2 Pharmacokinetic properties

Krypton ($^{81\text{m}}\text{Kr}$) is an inert gas with a short biological half-life. Due to its rapid decay the effective half-time of lung elimination is equal to the physical half-life of 13 seconds. Peripheral Krypton ($^{81\text{m}}\text{Kr}$)-activity is exhaled after the first passage.

5.3 Preclinical safety data

No data available.

6 PHARMACEUTICAL PARTICULARS

6.1 List of excipients

PTFE (polytetrafluoroethylene) membrane with immobilized poly(styrenedivinylbenzene) cation exchange resin with sulphonic acid functional groups.

6.2 Incompatibilities

None known.

6.3 Shelf life

The shelf life of the product is 20 hours after activity reference date. The expiry date is stated on the generator label.

6.4 Special precautions for storage

Do not store the generator at temperatures above 25°C. Use a lead shielding. Storage should be in accordance with the national regulations for radioactive materials.

6.5 Nature and contents of container

The radionuclide generator contains the mother-radionuclide ^{81}Rb immobilized on a membrane. The daughter-radionuclide $^{81\text{m}}\text{Kr}$ is eluted by passing environmental air over the membrane. The produced gas from the generator

contains therefore the radionuclide ^{81m}Kr mixed with environmental air. The generator containing ^{81m}Kr is placed in a lexan housing and then in a shielding. The shielding is fixed within a synthetic housing.

6.6 Special precautions for disposal

Waste must be disposed of in accordance with National Regulations for radioactive material.

7. MARKETING AUTHORISATION HOLDER

Curium Netherlands B.V.
Westerduinweg 3
1755 LE Petten
Netherlands

8. MARKETING AUTHORISATION NUMBER(S)

PL 12288/0006

9. DATE OF FIRST AUTHORISATION / RENEWAL OF THE AUTHORISATION

07/08/2008

10. DATE OF REVISION OF THE TEXT

30/06/2023

11 DOSIMETRY

Data from ICRP publication 53 (Vol.18; No 1-4, 1987) "radiation dose to patients from radiopharmaceuticals".

Absorbed dose per unit activity administered (mGy/MBq) ICRP 53.

Organ	Adult	15 Years	10 Years	5 Years	1 Year
Adrenals	3.4E-06	5.7E-06	8.3E-06	1.3E-05	2.1E-05
Bladder wall	6.8E-08	7.6E-08	2.0E-07	4.7E-07	1.2E-06
Bone surface	1.7E-06	2.2E-06	3.2E-06	4.8E-06	9.3E-06
Breast	4.6E-06	4.6E-06	8.9E-06	1.3E-05	1.8E-05
GI-tract:					
Stomach wall	2.5E-06	3.2E-06	4.4E-06	6.7E-06	1.1E-05
Small intestine	2.7E-07	4.7E-07	8.6E-07	1.6E-06	3.4E-06
ULI wall	3.2E-07	5.5E-07	1.2E-06	1.9E-06	3.5E-06
LLI wall	1.4E-07	1.5E-07	3.0E-07	8.0E-07	2.0E-06
Kidneys	1.2E-06	1.9E-06	2.9E-06	4.5E-06	8.4E-06
Liver	3.4E-06	4.8E-06	6.6E-06	9.5E-06	1.6E-05
Lungs	2.1E-04	3.1E-04	4.4E-04	6.8E-04	1.3E-03
Ovaries	1.7E-07	1.7E-07	4.1E-07	8.0E-07	1.9E-06
Pancreas	3.5E-06	4.4E-06	6.4E-06	9.8E-06	1.8E-05
Red marrow	2.1E-06	3.3E-06	4.2E-06	5.3E-06	8.2E-06
Spleen	3.1E-06	4.1E-06	6.0E-06	9.2E-06	1.6E-05
Testes	1.7E-08	2.3E-08	7.4E-08	1.3E-08	5.6E-07
Thyroid	1.2E-06	2.1E-06	3.7E-06	6.0E-06	1.1E-05
Uterus	1.3E-07	1.8E-07	3.5E-07	7.2E-07	1.8E-06
Other tissue	1.8E-06	2.3E-06	3.2E-06	4.7E-06	8.5E-06
Effective dose equivalent (mSv/MBq)					
	2.7E-05	4.0E-05	5.7E-05	8.8E-05	1.7E-04

For this product the effective doses equivalent resulting from an administered activity of 3000-9000 MBq, (range of actual exposure) expected activities in adults, is 0.08-0.24 mSv.

Due to the difference in half-lives the amount of ^{81}Kr per 37 MBq $^{81\text{m}}\text{Kr}$ is about 2 nCi (2 $\mu\text{Bq/MBq}$). Thus the contribution of ^{81}Kr to the total radiation burden of the patient is negligible.

12 INSTRUCTIONS FOR PREPARATION OF RADIOPHARMACEUTICALS

Preparation for elution

- 1 Remove the Krypton ($^{81\text{m}}\text{Kr}$) generator from the transport packing.
- 2 Remove the stopper from the bottom and store it in the special cut-away in the transport packing.
- 3 Place the generator in the ventilation device.
- 4 Close the cover of the Krypton ventilation device.
- 5 Take the Krypton supply cable from the ventilation tubing set and connect

- it to the Krypton ventilation device.
- 6 Connect the other side of the tubing set to the face mask.
 - 7 Put the plug into a socket.
 - 8 Adjust flow rate to maximum volume.

Administration

- 1 Position the patient in front of the gamma camera (equipped with a ^{99m}Tc collimator).
- 2 Put the face mask on the face of the patient; make sure there is no leakage.
- 3 Switch on power manually or by remote control.
- 4 Start accumulation of counts and continue until the required number is reached.
- 5 Switch power off.

Handling of the expired generator

- 1 Replace the stop that was removed earlier.
- 2 Store the generator in a suitable place for decay until a level of activity acceptable for return transport is reached.
- 3 Prepare the generator for return transport following the return procedure.

NB: IN CASE OF PROBLEMS OR OTHER ISSUES PLEASE CONSULT YOUR LOCAL REPRESENTATIVE.

The administration of radiopharmaceuticals creates risks for other persons from external radiation or contamination from spills of urine, vomiting etc. Radiation protection precautions in accordance with national regulations must therefore be taken.