

# Summary of Product Characteristics

## 1 NAME OF THE MEDICINAL PRODUCT

PULMOTEC Graphite crucible for the preparation of Technegas inhalation

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

One crucible (high purity graphite) 1.340 g which, heated to 2550° C, under ultra pure argon in the presence of sodium pertechnetate [Tc-99m], produces an aerosol of carbon micro-particles labelled with technetium [Tc-99m], called Technegas.

For a full list of excipients, see section 6.1.

## 3 PHARMACEUTICAL FORM

Kit for radiopharmaceutical preparation.  
Solid for inhalation powder.

## 4 CLINICAL PARTICULARS

### 4.1 Therapeutic Indications

For diagnostic use only.  
Scintigraphy of alveolar spaces, in particular in the context of the diagnosis of pulmonary embolism.

### 4.2 Posology and method of administration

#### Posology

The recommended activity of sodium pertechnetate [Tc-99m] to be deposited in the crucible is between 250 and 700 MBq for adults.

The activity present in the lungs after each inhalation varies from one patient to another. It is recommended to follow the pulmonary count rate during inhalation of Technegas, using a gamma camera equipped with a standard collimator (low energy, low/medium resolution), until a lung count rate of between 1.5 and 2 Kcps is obtained. Inhalation has then to be stopped. This corresponds for adults approximatively to 40 MBq of Technegas inhaled.

The activity to be administered to children is a fraction of the recommended activity for adults, according to the EANM Dosage Card (Paediatric and Dosimetry Committees EANM, 2016), and is given by the following calculation:

#### **A[MBq]Administered Baseline Activity\* x Multiple**

\*baseline activity = 49.0 MBq

Therefore recommended activity of sodium pertechnetate [Tc-99m] to be deposited in the crucible will vary between 100 MBq and 686 MBq for children following the table below:

Weight (kg)	Activity administered (crucible loading activity) (MBq)
3	100
4	100
6	100
8	104,9
10	132,8
12	153,9
14	174,9

16	196
18	217,1
20	238,1
22	259,2
24	279,8
26	300,9
28	315,1
30	336,1
32	357,2
34	378,3
36	392
38	413,1
40	434,1
42	447,9
44	468,9
46	490
48	504,2
50	524,8
52-54	553,2
56-58	588
60-62	622,8
64-66	658,1
≥ 68	686

Adequate quality images are obtained in children with a pulmonary count rate of 500-1000 cps in the lungs monitored as described for adults. It is recommended to follow the pulmonary count rate during inhalation of Technegas, using a gamma camera equipped with a standard collimator (low energy, low/medium resolution), until a lung count rate of between 0.5 and 1Kcps is obtained. Inhalation has then to be stopped.

#### Method of administration

Technegas is administered by inhalation, at most ten minutes after preparation, through the "Patient Administration Set". This contains a plastic tube, to be connected to the Technegas generator, fitted with a mouthpiece and a filter.

Staff should wear disposable gloves and are recommended to wear aprons and masks, especially when the patient has a productive cough.

Adult patients should be instructed to breathe through the mouthpiece selected from one of the models of administration described below, chosen to match the patient's ability:

1. Normal breathing with deep inhalation without breath-holding (recommended method).
2. Slow deep breathing from the residual functional capacity (end of calm expiration), followed by a 5-second breath-hold.
3. Rapid and deep inspiration from the residual functional capacity followed by a breath-hold of about 5 seconds at the end of the respiration.
4. Paediatric patients should be instructed to breathe through the mouthpiece or paediatric mask, in line with normal breathing, without breath-holding.

Dyspnoeic patients may remove the mouthpiece between the inhalations of Technegas.

As the first inhalation of Technegas contains no oxygen, pre-oxygenation of the patient is recommended prior to inhalation of Technegas, especially for patients with severely compromised respiration.

To yield uniform apex-to-base deposition, it is recommended to perform the administration with the patient in the supine position.

#### **4.3 Contraindications**

None known.

#### **4.4 Special warnings and precautions for use**

Radiopharmaceuticals should be received, used and administered only by authorised persons in designated clinical settings and receipt, storage, use, transfer and disposal are subject to the regulations and appropriate licences of the competent authorities.

Radiopharmaceuticals should be prepared in a manner which satisfies both radiation safety and pharmaceutical quality requirements.

Technegas should be administered ten minutes at most after preparation.

A careful assessment of the risk/benefit ratio should be made before use of the product in children, particularly since use of Technegas results in an increased effective dose and absorbed organ doses in children (see section 11. Dosimetry).

The 300 microlitre PULMOTEC crucible shall only be used in a TechnegasPlus generator (or later model). The 300 microlitre PULMOTEC crucible may be used in older model Technegas generators where those Technegas Generators have been modified and calibrated for use with the 300 microlitre PULMOTEC crucible by an authorised service agent.

#### **4.5 Interaction with other medicinal products and other forms of interactions**

None known.

No interaction studies in vitro or in vivo with inhaled or any medicinal drugs have been performed.

#### **4.6 Fertility, pregnancy and lactation**

##### Women of childbearing potential

When it is necessary to administer radioactive medicinal products 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.

##### Pregnancy

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

##### Breast-feeding

Before administering a radioactive medicinal product to a mother who is breast-feeding consideration should be given to whether the investigation could be reasonably delayed until the mother has ceased breast-feeding and whether the most appropriate radiopharmaceutical product has been chosen, bearing in mind secretion in breast milk.

If the administration of this radioactive product is essential, breast feeding must be interrupted for at least 12 hours and the excreted milk must be discarded.

#### **4.7 Effects on ability to drive and use machines**

No studies on the effect on the ability to drive and use machines have been performed.

#### **4.8 Undesirable effects**

The frequencies for undesirable effects are defined as follows:		
Very common	$\geq 1/10$	
Common	$\geq 1/100$ to $<$	1/10
Uncommon	$\geq 1/1000$ to $<$	1/100
Rare	$\geq 1/10000$ to $<$	1/1000
Very rare	$< 1/10000$	
Not known	Cannot be estimated from the available data	

Rare cases of dizziness, light headedness and nausea have been reported. These have been ascribed to hypoxia which may occur during inhalation of Technegas which initially contains no oxygen.

If a patient shows signs of hypoxia, he/she should immediately be allowed to breathe air and, if necessary, oxygen.

For each patient, exposure to ionising radiation must be justifiable on the basis of likely benefit. The activity administered must be such that the resulting radiation dose is as low as reasonably achievable bearing in mind the need to achieve the diagnosis.

Exposure to ionising radiation can lead to cancer or development of hereditary defects. The effective dose resulting from a inhaled activity of 40 MBq of this radiopharmaceutical being only 0.6 mSv (70 kg adult), these adverse events can be expected with a very low probability.

#### Reporting of suspected adverse reactions

Reporting of 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 HPRA Pharmacovigilance, Website: [www.hpra.ie](http://www.hpra.ie).

### **4.9 Overdose**

An overdose of carbon cannot happen. In case of radioactivity overdose, there is no way of increasing the elimination of radiopharmaceutical product and reducing the radiation exposure.

## **5 PHARMACOLOGICAL PROPERTIES**

### **5.1 Pharmacodynamic properties**

Pharmacotherapeutic group: Diagnostic radiopharmaceuticals; Technetium ( $^{99m}\text{Tc}$ ), inhalants. ATC code: V09EA02

In the concentrations used for diagnostic examinations, Technegas is an inert suspension and has no pharmacological effect.

### **5.2 Pharmacokinetic properties**

After inhalation, Technegas is absorbed on the walls of pulmonary alveoli and remains in the lungs. There is no intra vascular clearance and elimination of radioactivity is by the physical decay of the technetium-99m.

Part of the carbon micro-particles may be retained in the upper and central airways and is greater in patients with airway obstruction. These particles are cleared by ciliary action and, after swallowing, are eliminated through the gastro-intestinal tract without absorption.

### **5.3 Preclinical safety data**

Toxicological data on PULMOTEC are not available.

A single administration of inhaled radioactivity of 5.5 MBq in a rat was well tolerated with most of the radioactivity inhaled found in the lung.

Studies of oral administration of solution of Technegas in rats showed that the radioactivity remained almost exclusively in the gastro-intestinal tract.

No study of effects on reproductive functions, of a mutagenic and carcinogenic potential has been carried out.

## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

None.

### **6.2 Incompatibilities**

Not applicable.

### **6.3 Shelf life**

Four years

Technegas should be used within 10 minutes after preparation.

### **6.4 Special precautions for storage**

Do not store above 25° C.

### **6.5 Nature and contents of container**

For PULMOTEC 135 microlitre crucibles:

Five thermoformed blister packs (PVC – cardboard) of 10 PULMOTEC, 135 microlitre crucibles in a cardboard box.

For PULMOTEC 300 microlitre crucibles:

Five thermoformed blister packs (PVC – cardboard) of 10 PULMOTEC, 300 microlitre crucibles in a cardboard box.

### **6.6 Special precautions for disposal and other handling**

The administration of radiopharmaceuticals creates risks for other persons from external radiation in particular for the chest or by contamination from vomiting and sputum. Radiation protection precautions in accordance with national regulations must therefore be taken.

Radioactive waste must be disposed of in accordance with national and international regulations.

## **7 MARKETING AUTHORISATION HOLDER**

Cyclomedica Ireland Limited Unit A5 Calmount Business Park Ballymount Dublin 12 Ireland

## **8 MARKETING AUTHORISATION NUMBER**

PA1034/001/001

## **9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION**

Date of first authorisation: 29<sup>th</sup> September 2000

Date of last renewal: 23<sup>rd</sup> February 2010

## **10 DATE OF REVISION OF THE TEXT**

December 2021

## **11 DOSIMETRY**

Technetium (Tc-99m) decays with the emission of gamma radiation with a mean energy of 140,5 KeV and a half-life of 6 hours, to technetium (Tc-99) which can be regarded as stable.

The biokinetic model for Technegas assumes that 95% of the inhaled material is deposited in the lungs with 5% in the main bronchi airways, with a biological half-time of 4 days.

The material absorbed from the GI-tract is assumed to behave as orally administered  $^{99m}\text{Tc}$ -pertechnetate (ICRP, 1987). (ICRP Publication 80)

<b>Absorbed dose per unit activity administered (mGy / MBq)</b>					
<b>Organ</b>	<b>Adult</b>	<b>15 years</b>	<b>10 years</b>	<b>5 years</b>	<b>1 year</b>
<b>Adrenals</b>	0.0068	0.0091	0.013	0.020	0.034
<b>Bladder</b>	0.00032	0.00045	0.00074	0.0012	0.0028
<b>Bone surfaces</b>	0.0049	0.0063	0.0088	0.014	0.026
<b>Brain</b>	0.00025	0.00033	0.00058	0.00094	0.0015
<b>Breast</b>	0.0067	0.0073	0.013	0.019	0.027
<b>Gall bladder</b>	0.0023	0.0032	0.0055	0.0084	0.011
<b>GI-tract Stomach</b>	0.0044	0.0062	0.0088	0.0013	0.022
<b>SI</b>	0.00087	0.0013	0.0022	0.0039	0.0078
<b>Colon</b>	0.0014	0.0019	0.0034	0.0059	0.012
<b>ULI</b>	0.0019	0.0025	0.0046	0.0077	0.015
<b>LLI</b>	0.00074	0.0010	0.0018	0.0034	0.0070
<b>Heart</b>	0.013	0.017	0.023	0.032	0.048
<b>Kidneys</b>	0.0020	0.0030	0.0046	0.0072	0.0013
<b>Liver</b>	0.0057	0.0078	0.010	0.015	0.025
<b>Lungs</b>	0.11	0.16	0.22	0.33	0.63
<b>Muscles</b>	0.0028	0.0036	0.0049	0.0073	0.013
<b>Oesophagus</b>	0.0082	0.010	0.015	0.019	0.027
<b>Ovaries</b>	0.00041	0.00055	0.0011	0.0020	0.0042
<b>Pancreas</b>	0.0052	0.0073	0.010	0.016	0.028
<b>Red bone marrow</b>	0.0033	0.0038	0.0050	0.0066	0.011
<b>Salivary glands</b>	0.0028	0.0036	0.0063	0.0098	0.018
<b>Skin</b>	0.0012	0.0013	0.0022	0.0033	0.0059
<b>Spleen</b>	0.0048	0.0063	0.0093	0.015	0.025
<b>Testes</b>	0.000061	0.000091	0.00020	0.00033	0.0011
<b>Thymus</b>	0.0082	0.010	0.015	0.019	0.027
<b>Thyroid</b>	0.0029	0.0039	0.0069	0.011	0.020
<b>Uterus</b>	0.00030	0.00046	0.00083	0.0016	0.0036
<b>Remaining organs</b>	0.0027	0.0035	0.0047	0.0068	0.012
<b>Effective dose (mSv / MBq)</b>	0.015	0.022	0.031	0.047	0.087

## 12 INSTRUCTIONS FOR PREPARATION OF RADIOPHARMACEUTICALS

Technegas is generated exclusively using the medical device called Technegas generator. It is essential to follow the instructions described below to ensure proper quality of the product inhaled.

Handling of the Technegas generator is detailed in the instruction manual for the medical device.

Technegas is produced by heating to 2550°C the PULMOTEC crucible to which a solution of sodium pertechnetate [Tc-99m] (Eur.Ph.), from a standard Technetium (Tc-99m) Generator, is added and dry-evaporated.

The preparation of the Technegas is performed under an atmosphere of inert argon of purity equal to at least 99.99 %.

1. Using forceps supplied with the Technegas Generator, remove the PULMOTEC crucible from its protective packaging and place it on a glass watch or other suitable support.
2. Rinse only the hole of the PULMOTEC crucible as follows: using a needleless syringe, fill the hole of the crucible with  $\geq 95$  % ethanol and empty it by upturning the crucible. Do NOT use methylated alcohol as it may leave residues after evaporation that could lead to pyrolysis products in the Technegas generation stage.

3. Wear disposable gloves to prevent any eventual contamination during the following operations.
4. Open the Technegas Generator drawer and, using forceps, insert the wetted crucible between the support electrodes (Brass Contacts with carbon inlay) of the generator.
5. Rotate the crucible to ensure good electrical contact is made with the support electrodes. Ensure the hole is upright.
6. Using a syringe and needle, load the crucible (note that the walls of the crucible hole must be wet with ethanol) with 250 to 700 MBq of sodium pertechnetate [Tc-99m]:
  - a. For PULMOTEC 135 microlitre crucible, the maximum volume for each fill cycle is 0.1 ml.
  - b. For PULMOTEC 300 microlitre crucible, the maximum volume for each fill cycle is 0.3 ml.

NB: When loading the crucible ensure that the meniscus is concave or flat and not convex. If the meniscus is convex, draw back the excess of sodium pertechnetate [Tc-99m] using the syringe.

7. Close the drawer of the Technegas Generator and proceed to evaporate of sodium pertechnetate [Tc-99m] solution.

NOTE: At this stage of preparation, an additional load of sodium pertechnetate [Tc-99m] may be introduced to obtain the desired activity. To perform this, simply repeat the steps 6 and 7.

8. Proceed to the heating cycle to generate the Technegas.
9. Administer Technegas within 10 minutes of preparation, following the instructions given above (cf. section 4.2).
10. PULMOTEC is intended for single use. The Technegas Generator machine breaks the crucible at the end of the synthesis to prevent accidental re-use. Crucible fragments should be considered as radioactive waste.

The Technegas generator includes several automatic security devices to ensure safe and effective generation and delivery of the diagnostic agent.

The purge phase allows automatic elimination of air introduced during preparation and check the chamber seal.

The Technegas generator inhibits delivery of the diagnostic agent if the maximum temperature is not reached or if the Technegas has been prepared for more than 10 minutes.