Institute of Physics and Engineering in Medicine

IPEM

ADVICE NOTICE:

Excretion Factors: the percentage of administered radioactivity released to sewer for routinely used radiopharmaceuticals.

1. Background

When a patient has a nuclear medicine investigation or undergoes therapy, some of the administered radioactivity is excreted and discharged to sewer. The percentage excreted (the excretion factor) depends on the radiopharmaceutical used and the patient's physiology. To enable simple calculations, average excretion factors have been established for commonly used radiopharmaceuticals, and are given in the Tables below. These factors should be used: when determining appropriate permit limits, demonstrating compliance with these limits, in radiological impact assessments and to provide data on annual releases for the pollution inventory. Excretion factors were published previously in the Environment Agency's Radioactive Substances Act Guidance (RASAG) and can be found in the Medical and Dental Guidance Notes[1], but values were not given for some newer radiopharmaceuticals. The Institute of Physics and Engineering in Medicine (IPEM), British Nuclear Medicine Society (BNMS) and Society for Radiological Protection Medical Sectorial Committee together with Environment Agency representation have therefore conducted a review of the data.

As part of this review, it was confirmed that all of the activity excreted, even that which occurs after the patient has left the hospital premises, should be included in the permitted limits. This is because much of the activity discharged after the patient has left the premises is likely to go to the same sewage treatment works, or at least the same river, as the hospital's sewer, and so needs to be included to enable a simple, conservative dose assessment. In addition the Environment Agency has to provide data on total annual releases of certain radionuclides to comply with international treaties. The average excretion factors shown below therefore include all of the activity likely to be excreted. In many cases the figure is based upon the methodology outlined in Appendix 17 of the Medical and Dental Guidance Notes[1], which takes account of radioactive decay. Other values are taken from peer reviewed literature or manufacturer's data. Where no figure is given for a radiopharmaceutical, a precautionary value of 100% should be assumed.

If the radiological impact assessment using these excretion factors gives rise to concern, a hospital may be asked to provide evidence to demonstrate that a significant proportion of the release goes to different sewage works or rivers. This should only be considered for longer lived radionuclides administered to outpatients, where a significant proportion of the release happens after the patient has left hospital, and patients receiving this radiopharmaceutical are drawn from a wide catchment area. Evidence should be based upon simple, conservative assumptions about the patient population and should not require the hospital to keep records of the home locations of individual patients.

Where hospitals make use of holding tanks calculated releases to sewer will need to be adjusted to take account of these.

When a radiopharmaceutical is administered at one hospital but the patient receives ongoing treatment at another hospital all of the excreted activity should be accounted for. In some cases, for example 131-Iodine therapy for thyrotoxicosis where a patient returns to a nursing home shortly after receiving the radiopharmaceutical, all of the excretion can be assumed to occur at the nursing home. Where a patient has a diagnostic test using a 99m-Tc labelled radiopharmaceutical, and returns to another hospital after the investigation is complete, the assumption in the previous guidance, that 10% of the administered activity is attributed to the institution that the patient returns to, may be followed. In other cases RWAs should make simple, conservative assumptions, and discuss the matter with the local regulator if necessary.

All applications for variations or new permits should use the figures below. Where hospitals want to move to using the new values voluntarily this should be encouraged. Other hospitals will be asked to examine the impact of the revised excretion factors on their calculated releases to sewer at the next inspection visit. In most cases it is expected that they will be able to move to using the new figures within their current permitted limits, and should do so. Where sites will exceed their current limits then the Compliance Assessment Report will clarify the actions the hospital is required to take. Revised values do not need to be applied retrospectively. It is expected that all hospitals will be using the new factors by the end of 2016.

Excretion factors will be subject to regular review by representatives of the medical sector and the Environment Agency; the IPEM Nuclear Medicine Special Interest Group should be contacted in the first instance where new evidence is available. When revised figures are published these should not trigger an application for a variation, but should be used when the next application is made.

Although the text above refers to the Environment Agency, the other UK Environmental Regulators (SEPA, NIEA, NRW) support this approach.

2. Summary

When calculating the percentage of administered activity that should be assumed to be released to the sewer following administration of a radiopharmaceutical the excretion factors in the tables below should be used.

3. Excretion factors for diagnostic radiopharmaceuticals

Radionuclide	Chemical form	Common name	Excretion Factor (%)
99m-Tc	all forms		30
123-I	Ioflupane	DaTSCAN	30
123-I	MIBG		60
123-I	all other forms		100
111-In	Somatostatin analogue	OctreoScan	90
111-In	all other forms		100
67-Ga	Gallium citrate		30
201-Tl	Thallous chloride		30
18-F	FDG		20
18-F	all other forms		30
68-Ga	Somatostatin analogue	Dotatate, Dotatoc, Dotanoc	30
PET tracers with half-life < 15 min	all forms		0

4. Excretion factors for theraputic radiopharmceuticals

Radionuclide	Chemical form	Common name	Treatment/ Palliation	Excretion Factor (%)
131-I	Sodium Iodide		Thyroid cancer	100
131-I	Sodium Iodide		Thyrotoxicosis	50
131-I	MIBG		Neuroendocrine tumours	90
177-Lu	Somatostatin analogue	Octreotate, Lutathera	Neuroendocrine tumours	90
90-Y	Somatostatin analogue	Dotatate, Dotatoc, Dotanoc	Neuroendocrine tumours	90
90-Y	Microspheres	SIR-Spheres, Theraspheres	Liver metastases Liver tumours	5
32-P	Phosphate		Polycythemia vera	30
169-Er	Colloid		Radiosynovectomy - small joints	0
186-Rh	Colloid		Radiosynovectomy - medium joints	0
90-Y	Colloid		Radiosynovectomy - large joints	0
90-Y	Ibritumomab Tiuxetan	Zevalin	Non-Hodgkin's Lymphoma	10
89-Sr	Strontium chloride	Metastron	Bone metastases	70
153-Sm	EDTMP	Quadramet	Bone metastases	50
223-Ra	Radium chloride	Alpharadin, Xofigo	Bone metastases	80

5. Acknowledgements

IPEM Nuclear Medicine Special Interest Group (NMSIG)
IPEM Radiation Protection Special Interest Group (RPSIG)
British Nuclear Medicine Society (BNMS)
SRP Medical Sectorial Committee
Environment Agency (EA)
Scottish Environmental protection Agency (SEPA)
Northern Ireland Environment Agency (NIEA)
Natural Resources Wales (NRW)

6. References/bibliography

[1]Medical and Dental Guidance Notes: A Good Practice Guide on All Aspects of Ionising Radiation Protection in the Clinical Environment. *IPEM 2002. ISBN 1903613094.*

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