Environment Agency issues new excretion factors for radiopharmaceuticals

When a radiopharmaceutical is administered to a patient in hospital for diagnostic or therapeutic purposes, a proportion will eventually enter the drainage system through the patient's urine or faeces. This proportion (known as the excretion factor) will depend on the chemical properties of the radiopharmaceutical and half life of the radioisotope used and is regulated by the Environment Agency.

The assumed excretion factors set by the Environment Agency have recently been reviewed and revised by the Institute of Physics and and Engineering in Medicine (IPEM), the British Nuclear Medicine Society (BNMS), the Society for Radiological Protection Medical Committee and the Environment Agency to incorporate the latest research and some of the newer radiopharmaceuticals (particularly therapeutic treatments). The latest factors are given below:

As before, where a patient has been administered Tc-99m and returns to another hospital after the scan, 30% of the administered dose is attributed to the administering hospital and 10% of administered activity to the hospital to which patient returns.

In practice, for anyone using the previous excretion factors, switching to new factors will not increase monthly aqueous waste figures and in many cases will reduce it (e.g. F18-FDG has been reduced from 30 to 20%). We advise our customers to adopt the new excretion factors with immediate effect when logging patient aqueous waste and they should be used when completing the Environment Agency pollution inventory waste returns for 2014. Please contact Andy Poole at RPC **(andrew.poole@stgeorges.nhs.uk)** if you require further advice on implementing this advice.

Excretion factors for diagnostic radiopharmaceuticals

Radionuclide	Chemical form	Common name	Excretion Factor (1%)
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

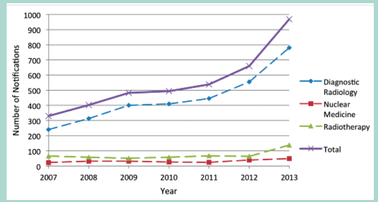
Excretion factors for diagnostic radiopharmaceuticals

Radionuclide	Chemical form	Common name	Treatment/ Palliation	Excretion Factor (1%)
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
90-Y	Somatostatin analogue	Dotatate, Dotatoc, Dotanoc	Neuroendocrine tumours	90
90-Y	Microspheres	SIR-Spheres, Therаspheres	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

Latest Care Quality Commission IR(ME)R Report Published

The latest IR(ME)R report from the CQC has been published and is available via their website at http://www.cqc.org.uk/content/report-shows-increase-radiation-incidents. The report provides an analysis of notifications of exposures "much greater than intended" (MGTI) for the year 2013.

The number of notifications has increased by 45% since 2012 (968 total notifications in 2013 vs. 669 in 2012). This was to be expected given the change in notification guidance which was implemented in September 2012, reducing the over-exposure factor for high dose procedures from 3 to 1.5. This is illustrated by the graph below, which shows a slight increase in notifications from 2011-2012, and a greater increase 2012-2013, the first complete reporting year since this was implemented.



81% of the total came from diagnostic radiology. The largest cause was operator/admin error (50.7%) followed by referral errors (32.4%), which follows the trend of previous years. Generally in diagnostic radiology, the impact upon patients of an exposure MGTI is relatively small. The exception to this include CT, which was influenced by the change in the reporting threshold, resulting in an increased number of CT notifications from 43% in 2009-2011 to 48% in 2012 and 56% in 2013.

An issue raised in analysis of radiology notifications was inconsistency in the dose value reported to the CQC. The report clarifies that the dose value reported should be that which was delivered in error, not the total dose, for example, of the dose given in error and the repeat (intended) dose.

More than a third of exposures "much greater than intended" in diagnostic radiology were caused by the wrong patient receiving an exposure. In light of this, and following several organisations reporting notifications of "operator errors" in which the patient identification (ID) checking procedure failed, the CQC have suggested a "6-point check". In addition to checking patient's demographics (name, address, date of birth), a 6 point check then requires checks of clinical information, the site requested and checks of previous imaging.

In nuclear medicine the number of notifications increased from an average of 27 in 2006-2011 to 39 in 2012 and 49 in 2013, a figure which the CQC notes is relatively small. The error types were similar to those in radiology. Particular attention was drawn to referral errors for patients who were intended for a bone densitometry scan but instead received an isotope bone scan involving an injection of Technetium-99m. In 2013 two such incidences occurred.

The largest proportional increase in notifications came from radiotherapy, where change in guidance regarding what constitutes an exposure MGTI had an unexpected impact due entirely to notifications which involved the images taken during treatment planning and verification, making up more than half of radiotherapy errors. This led to the implementation of a new sub-category in 2013 of "planning/verification imaging" and raised questions about whether a repeat verification image after the first showed position mismatch constitutes a MGTI exposure. This issue will be discussed between stakeholders to clarify MGTI guidance in this area.

This report highlights the importance of honest and open discussion surrounding errors in radiation exposures within and between trusts in order to better instil a culture of radiation protection and to share good practice in order to prevent future incidents. RPC's customers should continue to report radiation incidents to us in the normal way and we will advise when notification to the CQC is necessary, as well as give advice on the reporting process.

Revised ARSAC guidance published

The ARSAC Notes for Guidance have been updated. These set out new training requirements for specialists wishing to become certificated for therapeutic procedures. Some serials have been removed from Appendix I part A, and two new procedures have been added. The DRLs for some procedures have changed and there are now a number of serials for some therapeutic procedures (including Ra-223, Lu-177 and Y-90). Current certificates are unaffected.

For full details, readers are advised to consult the ARSAC Newsletter Issue 10 Feb 2014 which gives a summary of the changes (at www.arsac.org.uk)

For further details on any of the articles in this publication or information on the services RPC provides, please ring
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Media Services, SGUL Ref –

RPC News
In partnership with Medical Physics at University Hospital Southampton NHS Foundation Trust

NHS trust fined over radiation risk assessment failures

United Lincolnshire Hospitals NHS Trust was fined £30,000 last October after an investigation by the Health & Safety Executive (HSE) uncovered a failure to properly assess the risks to staff using the CT scanner.

The problem began when a new interventional radiologist started using the scanner in fluoroscopy mode to perform biopsies. This involved viewing 'real time' images while standing next to the scanner. During insertion of the biopsy needles, his hands had been exposed to the primary X-ray beam, giving a dose more than twice the annual limit for extremities. The practice of other staff carrying out this procedure was to exit the room while X-rays were being generated.

The HSE investigation found that the CT risk assessment did not cover the use of the scanner in fluoroscopy mode and successfully prosecuted over a breach of the Ionising Radiations Regulations 1999 (IRR99). The Trust was also ordered to pay the HSE's costs of £15,128.

This case highlights the need to ensure that the prior risk assessments required by regulation 7 of IRR99 are properly carried out and further reinforces the message the HSE gave in 2011 regarding their inspections of NHS trusts that many of the prior risk assessments seen were 'not suitable or sufficient'.

Particular attention should be given to fully considering the risk to staff involved in interventional procedures where staff exposure can be high if safe working practices are not followed and the potential doses to extremities and eyes should also not be overlooked.

If you are in any doubt about the staff doses from a particular practice, RPC can provide guidance on how to assess the risks, document the findings and develop appropriate safe working procedures.

Contents

Hello and welcome to the latest edition of RPC News

As we have so many things to tell you about, this time we are treating you to an extended bumper newsletter.

We appreciate any feedback you have, and remember, if you have any issues that you would like to see featured in a future newsletter please get in touch.

Kathryn St John-Mosse
Editor

St George's Healthcare NHS Trust

THE RADIOLOGICAL PROTECTION CENTRE
Incorporating The John Perry Laboratory

New national reference doses for X-ray and fluoroscopy procedures published by the Health Protection Agency

In 1992 the National Radiological Protection Board (NRPB) established a national collation centre for measurements of radiation doses to patients undergoing diagnostic radiological examinations in the UK. X-ray departments throughout the country were invited to submit their patient dose data which are summarised and published every five years. The data provides a snapshot of radiological practice during each five year period and forms the basis of the UK National Reference Doses (NRD) published for many common, routine radiographic and fluoroscopic examinations by the NRPB, now The Health Protection Agency – Radiation Protection Division (HPA-RPD or just HPA for short). Many of our readers will be familiar with the NRDs published in the '2005 Review' and may be aware that new values are now available.

The latest review was published in June 2012 under the name 'HPA-CRCE-034 Doses to Patients from Radiographic and Fluoroscopic X-ray Imaging Procedures in the UK – 2010 Review'. This is the fourth in a series of five-yearly reviews of the database, and analyses the information collected during the period January 2006 to December 2010. 3% of the imaging departments that took part in the latest survey were still using film-screen technology with the remainder using CR or DR, although it is expected that film-screen technology has now all but disappeared. The data includes 165,000 entrance surface doses (ESD) and 185,000 dose-area products (DAP) for single radiographs, and 221,000 DAP measurements and 146,000 fluoroscopy times for complete examinations. These data were collected from 320 hospitals throughout the UK, representing nearly a quarter of all the hospitals with diagnostic X-ray facilities. Data on dental X-ray examinations were collected from 4000 dental practices, representing more than a third of all UK dental practices. NRDs, based on the rounded third quartile values of the distributions of room mean doses, are presented for 38 types of diagnostic X-ray examination on adults, 7 types of interventional procedures on adults, 3 types of medical X-ray examination on children, and for intra-oral and panoramic dental radiographs on adults and children. The NRDs are on average about 10% lower than corresponding values in the previous (2005) review, and are typically less than half the values of the original UK NRDs that were derived from the first survey in the mid-1980s (see Trends in Patient Dose with Time, below).

We will be sending out the new NRDs to our customers as amendments to the relevant section in their IRMER files in due course. In the meantime, all departments are required under the IRMER regulations to continue monitoring their patient doses by carrying out routine audits and to compare their mean doses to the corresponding NRDs.

The updated values are presented in Tables 1 – 4 and these new values should be adopted as soon as possible:

Table 1. Recommended national reference doses for individual radiographs on adult patients

Radiograph	Entrance surface dose (mGy)	Dose-area product (Gy.cm²)
Abdomen AP	4	2.5
Cervical Spine AP	-	0.15
Cervical Spine LAT	-	0.15
Chest AP	0.2	0.15
Chest LAT	0.5	-
Chest PA	0.15	0.1
Knee AP	0.3	-
Knee LAT	0.3	-
Lumbar spine AP	5.7	1.5
Lumbar spine LAT	10	2.5
Pelvis AP	4	2.2
Shoulder AP	0.5	-
Skull AP / PA	1.8	-
Skull LAT	1.1	-
Thoracic spine AP	3.5	1.0
Thoracic spine LAT	7	1.5

Table 2. Recommended national reference doses for diagnostic examinations on adult patients

Examination	Dose-area product (Gy.cm2)	Fluoroscopy time (min)
Abdomen	4.4	-
Barium (or water soluble) Enema	21	2.6
Barium Follow Through	8.4	2
Barium Meal	12	2.6
Barium Meal & Swallow	10	2.3
Barium (or water soluble) Swallow	7.5	2.1
Barium Small Bowel Enema	23	8.9
Barium Swallow (Video)	3.4	3.5
Chest	0.3	-
Coronary Angiography	31	4.3
Coronary Graft Angiography	47	13
Femoral Angiography	56	5.9
Fistulography	8	6.7
HSG	2	0.7
IVU	14	-
Lumbar Spine	6	-
MCU	7	1.6
Nephrostography	9	3.9
Proctography	14	1.3
Sialography	2.8	1.5
Sinography	7	1.7
T-tube cholangiography	5	1.8

Table 3. Recommended national reference doses for interventional procedures on adult patients

Examination	Dose-area product (Gy.cm2)	Fluoroscopy time (min)
Biliary Injection	43	14
Facet Joint Injection	6	28
Hickman Line Insertion	3	34
Nephrostomy	13	25
Oesophageal Stent	13	21
Pacemaker (permanent)	7	63
PTCA (single stent)	40	35

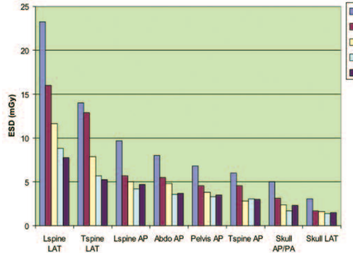
Table 4. Recommended national reference doses for complete examinations on paediatric patients

Examination	Standard age (y)	Dose-area product (Gy.cm2)
MCU	0	0.1
	1	0.3
	5	0.3
	10	0.4
	15	0.9
Ba Meal	0	0.1
	1	0.2
	5	0.2
	10	0.7
	15	2
Ba Swallow	0	0.2
	1	0.4
	5	0.5
	10	1.8
	15	3.0

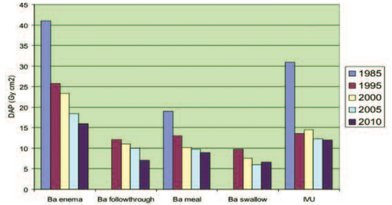
Trends in patient dose with time

There has, not surprisingly, been a progressive reduction in mean doses and NRDs for nearly all radiographs and examinations as technology and practices improve steadily with time. The reduction between the doses in the '2005 Review' and the current '2010 Review' is the smallest so far, indicating perhaps, that doses are bottoming out and that we may not see major reductions in the future unless there is a radical change in technology. The marginal increase in doses between the '2005 Review' and the '2010 Review' for some radiographs is not thought to be significant but might also to be due to the initial transition between film-screen technology and digital formats. The following graphs show the trend in mean doses with time for a selection of radiographs, complete examinations and interventional procedures.

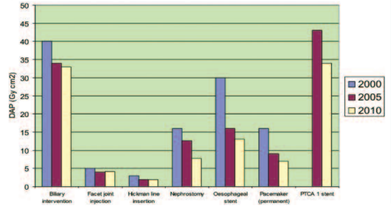
Mean room entrance surface dose per radiograph (adults)



Mean room dose-area product per examination (adults)



Mean room dose-area product per interventional procedure (adults)



Application of the pregnancy rule for theatre procedures involving fluoroscopy

We have been asked on several occasions to help with confusion over whether to apply the 10-day or 28-day LMP pregnancy rule for theatre-based procedures involving fluoroscopy or fluorography (i.e. digital acquisition). A department's standard pregnancy rule for diagnostic imaging may not be written in a way that clearly defines how to deal with these circumstances.

As usual, the pregnancy status need only be considered for exposures between the knees and diaphragm. For examinations that involve only fluoroscopy (i.e. no digital acquisition images are obtained), a review of previous screening times should be performed. If the average time does not exceed two minutes of screening and the maximum time for the most difficult case will not exceed five minutes, then the 28-day rule applies. If the mean fluoroscopy time exceeds two minutes or the maximum could exceed five minutes, the 10-day rule applies. The 10-day rule should be used for all procedures that use fluorography. If the patient is outside these dates, the IR(ME)R practitioner would be required to decide whether the procedure is justified at that time.

For this procedure to work efficiently, the date of LMP should be established sufficiently far ahead of the procedure.

Royal College of Radiologists' iRefer Guidelines now free to NHS

Readers of RPC News will be aware of the recent publication of the Royal College of Radiologists referral guidelines "iRefer: Making the Best Use of Clinical Radiology". Following their publication in 2012, many sites were resistant to implement the new guidelines because of the cost (both for hardcopies and the licence fee for online access). However, the RCR have recently made these available free of charge to the NHS. The online version can be directly accessed on the NHS network using the domain http://www.irefer.nhs.uk/. NHS professionals wishing to access the guidelines via a non-NHS internet connection can gain free access via the e-LfH Portal. To do this, users should log in to **http://portal.e-lfh.org.uk/** (an account using a valid NHS email address will need to be set up, if this has not already been done) and select the 'Launch iRefer' link in the left hand menu. The guidelines have also made available as a smartphone app for both Android and iOS operating systems at £2.99 (see **www.irefer.org.uk** to purchase the app).

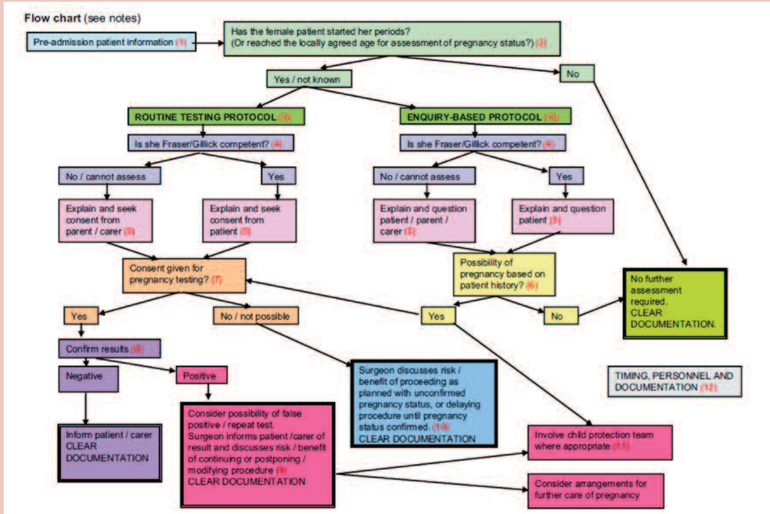
Others who wish to access a full online version can access the guidelines via a subscription service and details are given at **http://www.irefer.org.uk/index.php/subscribe-to-irefer**

RPC's radiology customers should note that it may not be necessary to purchase any paper copies of the guidelines if they are confident that all referrers have access to a full electronic copy via one of the routes described above.

New Guidance on Potential Pregnancy in 12-16 Year-olds

IR(ME)R2000 requires that females of childbearing age (suggested age range 12-55 years) should, where relevant, be asked about their pregnancy status by the operator carrying out a medical exposure. The employer should have written local procedures covering this subject. Dealing with this issue in females under 16 years has always been a sensitive and problematic issue.

Recent guidance from The Royal College of Paediatrics and Child Health (RCPCH) on enquiring about pregnancy status in 12 16 year-olds emphasises that local procedures must be developed to include specific policies on this sensitive subject. Although the guidelines are aimed at patients undergoing elective surgery they can also be applied to radiological procedures. These are summarised in the flowchart below, available in the guidance.



In order to reduce embarrassment and sensitivity around the subject it is useful to have pre-admission patient information available (on display or in leaflets) aimed at female patients under the age of 16 (and their carers). Once it has been determined that the patient has started her period or is at the locally agreed age for assessment of pregnancy status, directed enquiry or consented urine testing will allow pregnancy status to be ascertained. It is worth considering that in patients under 16, enquiry-based protocol may not yield accurate responses from the patient due to hesitance to disclose sexual activity (particularly if a parent/carer is present), fear of revealing under-age sexual activity, an unawareness of possible pregnancy and/or the erratic nature of the menstrual cycle in adolescence. Judgement should be made on the patient's ability to consider the implications and risks to themselves and whether parents or carers should be involved in discussions on sexual activity. Questioning may be carried out in confidence unless safeguarding considerations override this.

Consented urine testing may be carried out where it is determined that there is a possibility of pregnancy or for higher risk procedures where considered appropriate locally. Should consent for testing be unobtainable, risk/benefit discussion of proceeding with unconfirmed pregnancy status will be necessary and must be documented.

The RCPCH guidance includes additional notes to the flow chart to provide advice on developing local policies. It is available for free via their website at http://www.rcpch.ac.uk/pregnancychecks and our customers are advised that it should be read before updating your IR(ME)R procedure on dealing with possible pregnancy.