

Task Group 117 Workshop: Radiological Protection in PET and PET/CT
Q&A Report | 18 September 2023

#	Question	Answered	Answered By	Contact
1	Regarding Facility Design, could you please indicate some reference documents for NM shielding requirements	As told during the presentation, the references in the Report include several relevant document. In particular, a good starting point is the following: Madsen, M.T. et al., 2006. PET and PET/CT shielding requirements. AAPM Task report 108, Med. Phys. 33, 4–15, but carefully read the Report and check all the references.	Mario Marengo	mario.marengo@unibo.it
2	In regard to DRL for PET CT, how should we set the benchmark for radiation level from PET? Is there any publication on this?	ICRP, 2017. Diagnostic reference levels in medical imaging. ICRP Publication 135. Ann. ICRP 46(1) U.S. PET/CT and Gamma Camera Diagnostic Reference Levels and Achievable Administered Activities for Noncardiac Nuclear Medicine Studies. Radiology 2019; 293:203–211 Diagnostic Reference Levels for Adult Nuclear Medicine Imaging Established from the National Survey in Korea. Nucl Med Mol Imaging. 2019 Feb; 53(1): 64–70	Keon Kang	kangkw@snu.ac.kr
3	For Saren Holm, can you explain the related between reduce scan time and avoid general anesthesia?thank you.	Using a Long Axis Field Of View (LAFOV) instrument it is possible with a standard activity (whatever that is) to reduce the scan time considerably (order of magnitude). In infants and small children a 10 minute examination will normally require general anesthesia (GA), whereas a one minute scan may be performed without GA. If the first attempt does not work, one can try again. In a more advanced setting, it may be possible to extract a one minute set of data with no motion from a longer acquisition.	Søren Holm	Soeren.Holm@regionh.dk
4	A question for Dr. Marengo: can you comment on the geometric model used to simulate the MC dose to the hands? I'd like to know the materials used to simulate the hands tissues, if you modelled the fingers separately and the position of the hand with respect to the source	In the text of the presentation were referenced 3 papers: Marengo M, Rubow S, https://doi.org/10.1016/j.apradiso.2023.110705 used Varskin based analytical calculation with a simplified geometrical model. McCann et al. https://doi.org/10.1088/1361-6498/ac0df5 used EGSnrc for MC simulation, with a simple gemterical finger model based on the previous works of Amato (Phys. Med. 46 160–7) and Italiano (Nucl. Instrum. Methods Phys. Res. A 891 1–5) Kollaard et al. https://doi.org/10.1088/1361-6498/ac31a2 reported an extensive review of measured data. Cross check the references in the Report, as well as those in the papers indicated above, particularly the reports of the ORAMED project.	Mario Marengo	mario.marengo@unibo.it
5	For Mario Marengo, in desain PET CT modality , do we need to test radiation exposure for PET and CT separately?thank you	In the design of a PET/CT facility it is necessary to consider both sources of radiation, the photons produced by the decay of the radiopharmaceutical in the body of the patient AND the X-ray emitted by the CT. They have different characteristics, si it is necessary to study both with specific attention. Emission data can be calculated in advance: for the radiopharmaceutical the Report contains data and references in Chapter 3. For the CT component, further to what indicated in the present report, I suggest to check the NCRP Publication 147. Moreover, manufacturers of the scanners always provide isodose maps for the CT component.	Mario Marengo	mario.marengo@unibo.it
6	How QC procedures initiated by physicists enhanced protection of PET/CT ?	QC is fundamental, as in all radiation medicine as a tool for the optimization. This acquires specific significations in the case of a multi-modality imaging system. The PET copmponent should perfectly tuned and calibrated, in order to provide optimal quality of iamges AND optimal quantitaile inofmratio (e.g. SUV) ; PET provides vital information in Oncology, Neurology and Cardiology ! The CT componet also should be perfectly tuned, in order to grant quality of the studies and limited radiation dose to patients, selecting the most appropriate protocol and checking CTDI dose index etc. For more details, read the report and cross check the references, in particulare IAEA Human Health Series No. 1.	Mario Marengo	mario.marengo@unibo.it
7	Dr. Marengo, thank you for your talk. Do you shield the transfer lines for the situation in which a source could get stuck in the line.	Transfer lines for liquid products must be replaced periodically. Therefore they must be removable; if there are multi-port switching valves, these must be accessible. A regular line replacement program allows to limit the risk of clogging; Furthermore, in terms of QC, the measurement of the transfer time from target to module allows to detect an increase in time, which announces a deterioration of the line, and allows proactive intervention.	Mario Marengo	mario.marengo@unibo.it
8	In my personal opinion the involvement of radiologist/nuclear medicine doctors in multidisciplinary groups is very important. These involment is mandatory if you want to reach a high level of individual justification. Unfortunately these does not always happen (depends on facility). What do you think about it?	I agree with you. The more effort is needed to increase awareness of nuclear medicine physicians as clinical partners. Main problem is that nulcear medicine physician is not so many, so cannot attend all the multidisciplinary coferences.	Keon Kang	kangkw@snu.ac.kr
9	At what wavelengths does its absorption occur?	The question is unclear, please feel free of writing by e-mail to the speaker, to ask for further details.	Mario Marengo	mario.marengo@unibo.it
10	Please throw some light on requirement of neutron monitoring (personnel and area) in a medical cyclotron facility engaged in producing PET isotopes.	Area monitoring can be performed using a variety of models of dosimeter commercially available. Frequently so called “REM meters” are used, they contain a thermal neutron detector surrounded by bulky material (often PE) to slow down the fast neutrons. Some recent multi detector system include a Li-doped crystal. The selection of the proper dosimeter requires attention, considering the energy range, dead time and sensitivity, as well as practical aspects like weight. Given the shielding involved by the vault, the streaming of neutrons is minimal (if any), and only is some specific point e.g. around the door of the bunker. Typically, personal neutron dose monitoring is not necessary. Confirmation dosimetry can also be done by periodically testing using TLDs, track etch detectors or bubble detectors	Mario Marengo	mario.marengo@unibo.it
11	How to access the dose to staff in PET and PET/CT?	Through the company/institution providing the approved dosimetric services	Josep M Martí-Climent	jnmartic@unav.es
12	What is your take on using cctv instead of providing viewing windows in PET-CT?	CCTV are highly suggested in PET/CT centers, in several locations. Within the scanner room, since the gantry of the scanner is large and once the patient is inside the “tunnel” it is not always fully visible. It is recommended to palce two CCTVs on both extermities of the scanner (e.g. feet and head) to better monitor patient conditions. In addition to this however, I personally recommend to have in addition also a lead loade glass windw, for direct vision, as a backup and to grant possibility of vision without using a dispoisitive. Please note that the recommendation of CCTVs applies also to another important zone of a PET/CT facility, that is the uptake/resting area after administration. In this area, several patient will remain for around 60 min simpultaneously. As a results, there will be a significant radiation dose rate, so that it is not good practice for the staff to stationate there to monitor patients. CCTV in each uptake/rest box represent a good and inexpensive solution for a remote control.	Mario Marengo	mario.marengo@unibo.it
13	When patients are returned to other hospitals they may travel by ambulance or other vehicle. Are there concerns in relation to dose limits for staff (ambulance drivers, carers etc) who may accompany patients on their return to another hospital on multiple occasions per year.	Average dose 1 meter away from patients after FDG PET imaging with 8 mCi FDG is 0.015 mSv/h. So the driver's dose go over 1 mSv if he or she is exposed more than 66 hours. It is less likely to occur.	Keon Kang	kangkw@snu.ac.kr

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14	Colin Martin states exposure tot staff of cyclotrons in a range of 0,5 - 2 mSv. That is really low when performing technical maintenance. Is this including cyclotron maintenance (also corrective maintenance)?	This strongly depends on the type of cyclotron, and the workload. There sare still in operation some positive ions cyclotrons for which internal activation can be relevant. In case of negative ions cyclotrons, internal activation is limited. The most activated component will be the targets; these should be removed before servicing the cyclo, and maintained. N.B. The dose levels that I put in were for someone working in the Contol area, not for maintenance, which would need to be considered separately and added in if the same staff were involved.	Mario Marengo	mario.marengo@unibo.it
15	As the CT is not used for regular diagnosis in PET/CT, so we can reduce the dose to patients by reducing the mAs and the Kv in manual mode, (and mAs reference in automatic mAs , Caredose4D). Are there any recommended parameter (mAs, Kv) for the PET/CT scan for adult and pediatric	The tube current can be as low as 10 mA and the tube voltage can be reduced to 80-90 kVp in small adult patients or children. References: https://www.imagewisely.org/-/media/Image-Wisely/Files/Nuclear-Medicine/Optimizing-Oncologic-FDG-PET-CT--Scans-to-Decrease-Radiation-Exposure.pdf https://eanm.org/publications/guidelines/gl_Principles_and_Practice_of_PET-CT_Part_1.pdf	Keon Kang	kangkw@snu.ac.kr
16	please explain about the dose of caregivers and the fetus of pregnant patient. Thanks.	As regards fetus doses, there are several relevant publications. Further to Stabine 2017, that is in the references of the Report, you can consider also: Russel et al: Health Physics Journal (73(5):747-755, 1997 and 73(5):756-769, 1997) Stabin M., New Generation Fetal Dose Estimates for Radiopharmaceuticals, 2017, doi:10.2967/jnumed.117.204214	Mario Marengo	mario.marengo@unibo.it
17	What authorized cyclotron maintenance activities are being conducted that would generate airborne radioactive material thus justifying the need for a mask as standard protective equipment?	In the acceleration chamber of a cyclo there could be powder coming form materials hit by the beam, or simply subject to thermal stress. In maintaing the vacuum chamber of a cyclo face masks are recommended ! see the references in ther Report, in particular Calandrino et al and Terranova et al.	Mario Marengo	mario.marengo@unibo.it
18	Nice lecture, I want to ask, patient was injected with fdg f18, he went to the active toilet and mistakenly he urinated on the floor, as the radiation protection officer, I locked the room till the next day, will I lock up or stop scanning if patient urinate on the machine during scanning?	Urinating on the scanning machine will affect the procedure through hot spots and high background, as well as exposure of other patients, so scanner would need decontamination. Action will depend on the level of contamination.	Makoto Hosono	hosono@med.kindai.ac.jp
19	Please explain the dose of the caregivers	around 10-20 microSv	Keon Kang	kangkw@snu.ac.kr
20	Do you recommend a fume hood for purely F18 PET CT center?	This depends on a series of factors, including national regulations on sterile dispensing of pharmaceuticals. What the Report we are presenting stresses, is that manual operation should be limited and in case made according very careful procedures. Nowadays, a variety of automated system for unit "doses" dispensing or for direct administration to patients are available. These should be carefully considered , given they represent a minimal fraction of the cost of a PET/CT scanner and can be installed within an hot cell, but also as "stand alone" equipment on a workbench	Mario Marengo	mario.marengo@unibo.it
21	Sometimes patients discharged after PET/PET-CT examinations must perform other investigations (for example ultrasound). This situation often encounters some (unmotivated) resistance from healthcare staff outside NM ward due to fear of radiation. A recommendation in this regard from ICRP would be helpful.	IAEA has a recommendation: https://www.iaea.org/resources/rpop/health-professionals/nuclear-medicine/pet-ct/staff	Keon Kang	kangkw@snu.ac.kr
22	For Dr.Marengo: In my experience the CT dominates the dose for the roof. What height is ICRP recommend for the walls?	Well, this has to be carefully studied. As you know, in a CT scanner there is not primary radiation, that is absorbed by the detector, but just scattered radiation, characterized by a low energy spectra. Consider also that the PET detector is shielded, to avoid interference from activity out of the FOV, and that the workload of the CT component of a PET/CT is typically lower than that of a stand alone diagnostic CT (the PET component is relatively slow). There is not a simple and direct recommendation on the height of lateral shields and of the roof shielding. As regards the CT, well known documents, like NCRP 147 and others give advice. As regards the PET component, refer to the Madsen et al, the reporto of AAPM 108. Frequently roofs, have a thickness > 20 cm in concrete.	Mario Marengo	mario.marengo@unibo.it
23	How do patients that are not ambulatory visit the rest room on their own?	The instruction depends on the patient. Avoid accompanying the patient if possible, but this will not always be possible,	Makoto Hosono	hosono@med.kindai.ac.jp
24	Wonderful presentations! We are wondering how to avoid fingers dosimeters being throw away together with disposable gloves?	Very good question! This requires awareness and education, I don't know of any magic tricks.... It sometimes helps if dosimetry services charge a good amount for any lost dosemeter....	Filip Vanhavere	filip.vanhavere@sckcen.be
25	Are boron nloaded platic blocks used for neutron protection in PET isotope production facilities (as for some high energy, i.e. >10MV, linear accelerator mazes, as used in radiotherapy)?	They can be used for some local shield e.g.around target stations. Extensive use is limited by cost, from one side; fire resistance should also been considered.	Mario Marengo	mario.marengo@unibo.it
26	What is the dose limts to discharge the patient post PET/CT scan?	Not a dose limit. Generally patient can be discharged. You may need to decide and set your own dose constraints for a special situation.		
27	Is there a reference document for estimating internal radiation exposures?	If the question is related to the patient, you can find data in tables 6.1 and 6.2 in this draft which is now open to public consultation.	Keon Kang	kangkw@snu.ac.kr
28	When the occupational dose limits to the extremities are exceeded during the monitoring period, what will happen to the worker? Typically, we have steps when the worker exceeds whole-body dose, how 'bout for extremities?	This will depend on country regulations and enforcement. We would have improvement notices in the UK.	Makoto Hosono	hosono@med.kindai.ac.jp

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29	Question for Filip van Havere: Researcher Peter Covens has demonstrated that small local skin surface contaminations can be quite substantial. When using the common Hand-Foot monitor these contaminations are strongly underestimated (can be up to 200 times too low). We have confirmed Covens findings. Doesn't this require more attention, when using these HF-monitors? Every contamination they detect should be taken seriously, even if they are far below 4 Bq/cm2.	In general, there can be an underestimation. The monitors (like Hand and Foot monitors) should be calibrated. If they are calibrated with a uniform source, there can be an underestimation in case of a non homogeneous contamination because parts of monitor on the sides are less sensitive. I would doubt if you can reach a factor of 200, I don't have data in case of a point source. Also, I don't know which paper you reference to.	Filip Vanhavere	filip.vanhavere@sckcen.be
30	Do we have any specific safety guidelines for a patient died after the injection of PET tracer?	No. Since the physical half-life of PET radiopharmaceuticals is short, the exposure to staff and public cannot go over 1 mSv.	Keon Kang	kangkw@snu.ac.kr
31	Do you have any suggestions in case a member of the staff receives readings of 5-8 mSv per month on the finger dosimeter while working with Ga	5-8 mSv per year means that it can be up to 100 mSv per year. If the dosimeter is worn on the bases of the finger (which is normally the case), the real maximum dose per year can even exceed the limit. So in this case, it can be advised to do a more advanced study for this person, and find the best monitoring location and the best correction factor.	Filip Vanhavere	filip.vanhavere@sckcen.be
32	In pediatric hospital, can we send back our PET pediatric-patient back to common hospital room? Or we should prepare a special single patient room for a few hours?	No. Annual dose limit for children is also 1 mSv.	Keon Kang	kangkw@snu.ac.kr
33	To explain: if one has a 1 cm2 uniform skin contamination of 400 Bq/cm2, a large 200 cm2 detector will estimate this to be 2 Bq/cm2 on average across the whole area, which is quite an underestimation.	This should be taken into account by knowing the area of contamination	Filip Vanhavere	filip.vanhavere@sckcen.be
34	Could you give some comments on the statement that "The contribution of CT is greater than F-18, 3-4 meters away from the scanner"	Someone in the scanning room during a PET / CT scan will receive a higher dose from the CT component, if they are not protected. Shielding doors and viewing windows at least to meet the dose constraint for CT X-rays is important. The balance is then how much more you need to cut down the PET gamma-ray dose. Balance between size and thickness for viewing window and achieving dose constraint. See Table 3.2 for doses from different scan components.		
35	What about radiation protection of pregnant radiographers, should be removed from controlled zone or it is possible to continue working with PET/CT scanning of patients?	Annual dose of pregnant radiographers is 1 mSv. If she is within this limit, she can work on. If not, she has to change her role.	Keon Kang	kangkw@snu.ac.kr
36	Thanks for your excellent presentation M. Filip. Regarding the use of I-131 in iratherapy as a radiopharmaceutical products. We have a problem with the 2 decontamination tanks of contaminated urine which are full because of the patient load. Do you think that we need to resize the installation?	Sorry, this is out of scope of the document	Filip Vanhavere	filip.vanhavere@sckcen.be
37	Does TG117 consider the positron dose rate for F-18 where protection measures have failed vs. exceeding the skin dose constraint (e.g. 150mSv in EU & UK)? [At a UK meeting (IPEM RPA Update 2022) the dose rate at an epidermal depth of 70 micro-metres was reported as 1470mSv/hr/MBq, with the possibility of skin contamination and/or needlestick injuries being a focus of interest. For this reason, relevant personnel at one institution were designated 'classified' workers, or in EU parlance, 'Category A' workers.]	It is correct that the positrons can in some conditions contribute to the skin dose, they should be taken into account. Often the positrons are mostly sopped in the syringe, vial or even the gloves, but some contribution to the skin dose is possible. Normally, the ring dosimeters also measure the positrons, if the detector window is of the correct thickness.	Filip Vanhavere	filip.vanhavere@sckcen.be
38	What should we do for RP in case when the PET patient has occupational dose as nuclear worker close to the year limits recommended by NCRP, and additional dose from PET/CT?	Over 30 scans per day have already been routine for some time in centers that have radiopharmaceutical availability, and a high number of referrals. The limit is already there, and it is not on the number of scans, but of the effective dose.	Keon Kang	kangkw@snu.ac.kr
39	As the neutron radiation in a med cyclotron is largely stable (does not fluctuate if the irradiation time is same) and does not change with time Can we simply have gamma monitors and avoid neutron monitoring?	Neutron dose rate will change according to beam current. The real problem is that most neutron detectors will have a very short life in the intense neutron field produced by a non self-shielded cyclotron. Most centers use only gamma monitoring inside the vault, as these are relatively inexpensive and can be changed as a part of the maintenance contract.	Mario Marengo	mario.marengo@unibo.it
40	Are there considerations in the publication for radiometals?	The text of the publication also refers to the use of radiometals such as 68Ga. The general considerations made regarding the design, optimization and radiation protection of staff apply in general to all PET radionuclides	Mario Marengo	mario.marengo@unibo.it
41	Is there an opinion on an upper number of PET/CT scans recommended for a patient, noting that some have multiple follow up scans before and after cancer treatment?	No. Most of us consider that each exposure should be considered on its merit. The LNT model suggests that the risk per unit dose is the same. If patient management requires an examination, then it should be carried out.		
42	With all these new theragnostic technologies that are coming, and they are frequently used close or in the same PET facility, what are your recommendations for planning for protection in terms of shielding and staff exposures if you have very little space?	We tried to cover this through design of the department to minimize contact or line of sight exposure situations as the patient travels through the department. Inserting walls with appropriate shielding capacity, usually in concrete wherever needed. Especially barriers in the patient uptake areas.		

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43	What would be the best way to implement dosimetry in the extremities in a country where doesn't exist this service?	There are indeed countries where there is no dosimetry service. In principle it is possible to get serviced from another country, if postal services are reliable enough. In such cases, a larger monitoring period can be accepted. If there is a service for whole body doses, it should not be too difficult for this service to also provide ring dosimeters. Most (not all) commercial dosimetry readers can also read the detectors from extremity dosimeters, next to those from the whole body. It depends a bit on the type of dosimeters.	Filip Vanhavere	filip.vanhavere@sckcen.be
44	2Keon Kang: the patient is nuclear worker with 20 mSv accumulated per year. And additional PET/CT dose of 10 mSv. Should we limit his professional activities in that case?	Medical dose is separate and no dose limit. It cannot be added to occupational dose limit. Some patients can receive 200 mSv from radiotherapy.	Keon Kang	kangkw@snu.ac.kr
45	What is dose differences between proximal organs and distal organs during PET scan using less than 30 minutes half life isotopes?	Well, I am not sure what you refer to as proximal and distal organs in a systemic irradiation like that following administration of a radiopharmaceutical. In ICRP Publication 128 you have a useful compendium of organ doses from a huge number of radiopharmaceuticals, including very short lived. Check that to see if contains the information you need.	Mario Marengo	mario.marengo@unibo.it
46	Are post-imaging waiting rooms necessary with the current dose activities and imaging times in your experience in PET-CT?	No	Keon Kang	kangkw@snu.ac.kr
47	In the shielding calculation of a PET facility, which is the height of the walls that should be considered?	Around 2 m usually. For CT room there may need to be lead to the ceiling in limit x-ray scatter.		
47		I am reporting here a reply that I gave to a previous similar question: Well, this has to be carefully studied. As you know, in a CT scanner there is not primary radiation, that is absorbed by the detector, but just scattered radiation, characterized by a low energy spectra. Consider also that the PET detector is shielded, to avoid interference from activity out of the FOV, and that the workload of the CT component of a PET/CT is typically lower than that of a stand alone diagnostic CT (the PET component is relatively slow). There is not a simple and direct recommendation on the height of lateral shields and of the roof shielding. As regards the CT, well known documents, like NCRP 147 and others give advice. As regards the PET component, refer to the Madsen et al, the report of AAPM 108. Frequently roofs, have a thickness > 20 cm in concrete.	Mario Marengo	mario.marengo@unibo.it
48	Thinking on digital PET when more than 30 studies per day are possible, do you consider a limit of studies per day performed by the same technologist? Or if the limit is not reached this is not an issue?	Over 30 scans per day have already been routine for some time in centers that have radiopharmaceutical availability, and a high number of referrals. The limit is already there, and it is not on the number of scans, but of the effective dose. However, I prefer not to concentrate on the limits, but rather on the optimization process. In my experience, technologists working at around 30 scans per day have annual effective doses < 3 mSv.	Mario Marengo	mario.marengo@unibo.it
48		This should be determined before starting operation through setting dose constraints and making comparisons with the potential and measured doses. This will depend on protection measures and planned operation of each facility. Dose constraints will depend on the country regulations and facilities in each department.	Makoto Hosono	hosono@med.kindai.ac.jp
49	Is there a difference between the passive dosimeters used in Radiology and those that are appropriate for PET-CT (considering difference in photon energies)?	Normally, passive dosimeters for staff are approved for a certain energy range (and the same should go for active dosimeters). So this energy range should agree with the area in which they are used. The energy range in radiology and PET are different, so this could in principle be different. This said, most of the passive dosimeters around are approved and work in a wide range of energies, and should be able to cover both radiology and PET energy ranges. But it could be good to ask your dosimetry provider	Filip Vanhavere	filip.vanhavere@sckcen.be
50	Repeated PET/CT scans, if justified, should not hamper the need for it since there is no dose limit for medical exposures. The important keywords here are justification and optimisation of the exposure.	Totally agree: for each examination, justification has to be guaranteed, through guidelines, clinicians or tumour board discussions, and an exam should be performed whenever it is expected to have clinical impact into patient management	Ana Isabel Santos	aisantos.mednuc@gmail.com
51	One may not know if there is a clinical need, the patient benefit being monitoring that disease hasn't returned	Each type of disease has proposed follow-up strategies, and during follow-up, if there is any suspicion of recurrence, then an exam will be justified. Routine exams for follow-up, to my knowledge, are not an accepted justification	Ana Isabel Santos	aisantos.mednuc@gmail.com
52	Some facilities allow doing purely Diagnostic CTs in their PET-CT facilities whenever their general CT scanners are down. Do you see it appropriate if these patients may be exposed to radiation from radioactive sources?	Not ideal, but centres have to make the best use of the facilities they have available. If it means patient dose not have examinations or have to wait this may increase the risk to their health.	Makoto Hosono	hosono@med.kindai.ac.jp
53	Dear Keon, thank you for your answer. Undoubtedly the occupational dose is separate from diagnostic dose. What is your opinion, should the occupational annual recommended dose limits for nuclear workers be modified in case when the worker has an additional diagnostic PET/CT dose?	No. Dose limit does not have a biologic background. There is no threshold of cancer risk.	Keon Kang	kangkw@snu.ac.kr
54	A follow-up on previous question by someone about PET/CT using it purely for dx CT. When allowed, should the patient be considered as member of the public due to exposure other than clinical CT x-ray? If so, does this mean monitoring the patient's dose for public exposure, which can be significant if using a PET/CT in a nuclear facility compared to a diagnostic CT in radiology. But the current update on the guidelines does not give priority to public exposure. This should be studied for recommendation	The guide corresponds to a patient undergoing a PET/CT scan. If the facility were to be used for CT diagnosis only, the patient is effectively a member of the public for all other exposures that may take place, so their protection should be ensured at that level.	Josep M Martí-Climent	jnmartic@unav.es