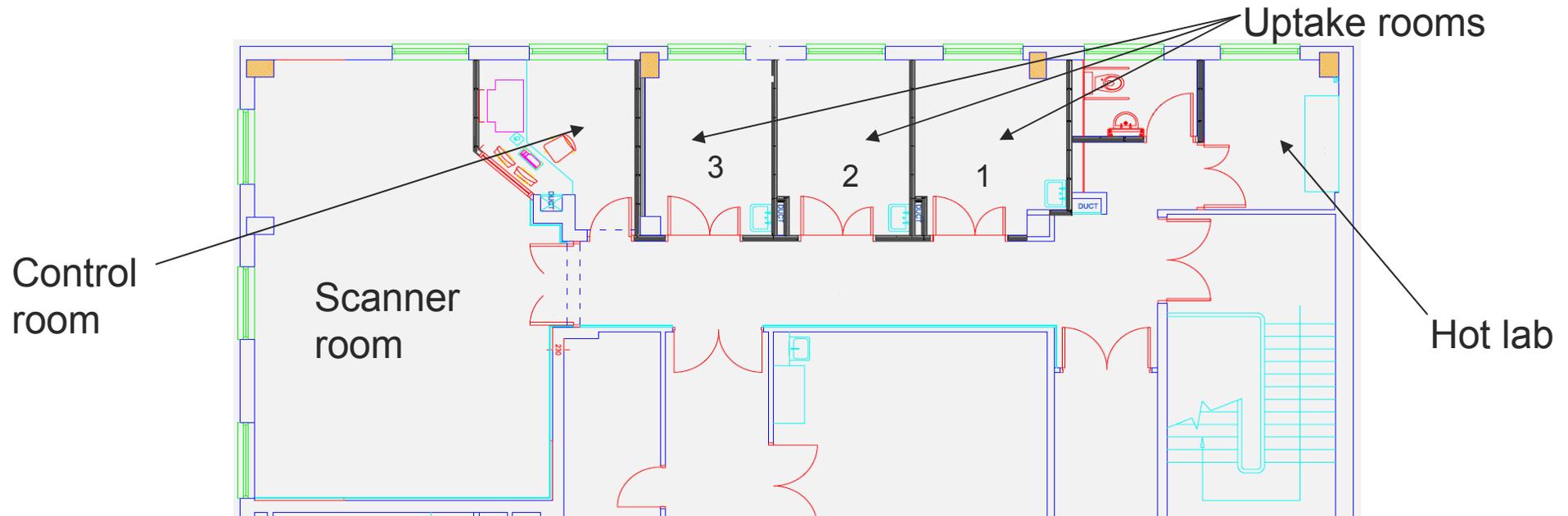


Staff doses in a new PETCT facility – Risk assessments versus reality.

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Background

- New PET-CT facility installed at Charing Cross Hospital, London, September 2008 (Siemens Biograph 64).
- 4mm leaded doors.
- 17mm lead equivalent glass (control room-scanner room).
- 15 mm lead lined partition walls.



[Aims & Objectives]

- Compare predicted environmental dose rates and staff doses with those measured during the initial months of the service.
- Assess the relative contributions to staff doses from the various working operations during routine ^{18}F -FDG PET-CT scanning.
- Identify changes in facility design, staffing and/or working practices that may lead to dose reductions.

Methods

Prior to start of service:

- Environmental instantaneous dose rates measured at key staff locations with syringes containing ~400MBq of ^{18}F positioned at patient locations.
- Values of dose/MBq handled from the literature were used to calculate expected staff doses based on projected patient throughput and staffing levels of 10 patients per day, injected with 375MBq, scanned equally by 2 members of staff each working 13 weeks per year in PET-CT.

Post 5 months of service provision:

- Measurements from 5 months of environmental and staff whole body OSL dosimetry badges were analysed.
- Personal dose rate logging of both staff members during a) dose manipulations, b) injecting and c) patient contact were recorded to analyse relative contributions to daily doses.
- Instantaneous dose rate logging of extremity doses were recorded and analysed to assess finger doses during dose manipulations.

Results

Initial environmental dose rate survey:

Source & location	Measurement position	IDR ($\mu\text{Sv h}^{-1}$)
390 MBq Scanner couch	30cm from source	350
	1m from source	45
	Outside double doors	2
	Directly outside north window	5
	Control room desk	1.5
390 MBq Scanner couch 449 MBq Uptake bed 3	Control room desk	1.5
449 MBq Uptake bed	In corridor, uptake room 3 doors closed	1.5
	In corridor, uptake room 3 doors open	5
	Directly outside west window	20
390 MBq Uptakes bed 1 449 MBq Uptake bed 3	Uptake bed 2	1.5

- Worst case dose value from literature 22 nSv/MBq for ^{18}F PET-CT*
- This predicts 8.25 μSv per patient handled

*T. Seierstad et al. Doses to nuclear technicians in a dedicated PET/CT centre utilising ^{18}F Flourodeoxyglucos (FDG). *Radiation Protection Dosimetry*, Vol.123 (2), 246-249. 2007

Results

- All environmental OSL dosimetry badges produced monthly readings that equated to average dose rates less than the initial environmental dose rate survey values.
- Average whole-body staff dose per patient handled was **2.88±0.75 µSv**
- Relative contributions to whole body dose were as follows;
 - **injecting 56.3%** (31.2%-75.6%)
 - **patient contact 24.2%** (3.6% - 47.3%)
 - **dose manipulations 6.5%** (1.7%-18.4%).
- Mean dose to the **right and left hand fingers per patient** during assaying was **148µSv and 96µSv** respectively.
- The mean dose to the **right and left hand fingers during injecting** was **106.2 µSv and 131.6 µSv** respectively.
- Large variations in extremity doses for assaying and injecting between staff members.

Conclusions

- Assessment of environmental doses confirmed appropriate facility design and confirmed the prior risk assessment dose survey.
- Whilst average whole-body staff dose/patient handled were lower than reported in the literature, monthly and annual whole-body doses were higher than predicted due to patients per staff member per month being underestimated.
- Large contributions to doses from injections and large variation in extremity doses between staff performing dose manipulations/injections has highlighted the need to identify best practice techniques and investigate using further shielding/injection devices.
- Extremity doses are the limiting factor in determining minimum staffing and maximum patient throughput with regards to keeping these doses within legislative limits.