

There has been a significant growth in the installation of Dual Energy X-ray Absorptiometry (DEXA or DXA) Bone Mineral Densitometry units. The Radiation Protection Services (RPS) has received numerous inquiries from facility owners, managers and operators concerning the radiological safety pertaining to the room design and operation of DEXA units. In view of this, RPS carried out a study of stray radiation levels around three different types of DEXA units, during the period from January to April 2001. Based on the finding of the study, RPS has developed recommendations on the room layout, shielding requirements and personal protection.

#### **FINDINGS FROM RPSs STUDY**

The DEXA units studied are of different designs. The stray radiation level produced vary, based on their beam geometry, technique factors and workload (number of patients)

- a) Units utilizing a pencil beam, operating at lower kVp and tube current, produces less stray radiation than other units using a full width fan-beam, operating at higher kVp and tube current.
- b) For a specific unit, the stray radiation level is higher towards the south (operator's side) and east (in the patient's cranial direction) sides from the center of the scanning table (see attached diagrams).
- c) An operator working full time and situated at 2 meters away from the center of a fan-beam x-ray unit could receive an annual radiation dose of about 1 mSv\*, for a workload averaging 30 scans/day, 5 days/week, 50 weeks per year (i.e. totalling 7,500 scans per year). A closer distance/ greater workload may result in a higher exposure.

*(A copy of RPS's DEXA Stray Radiation Assessment Report is available on request or online at <http://www.bccdc.ca/NR/rdonlyres/CFADB368-EB32-4E8B-9DB0-5AF002CAD624/0/RIN11.pdf>)*

#### **OUR RECOMMENDATIONS**

- a) The size of the examination room should be large enough to allow an adequate clearance for the operator's workstation and be an enclosed area with door(s) at the entrance(s). An appropriate x-radiation warning sign (such as those used for x-ray rooms) should be displayed at entrances accessible to patient/public.
- b) Standard drywall construction (two layers, each of 5/8" or 16mm) is sufficient to provide radiation shielding for persons in adjacent areas, to within 1 mSv/year\*, for a workload of up to 7,500 scans per year. No specific shielding is required for doors. Lead protection in the walls is not required unless the workload exceeds 7,500 scans per year. In such case, a shielding assessment should be done prior to installation.
- c) The operator's workstation is best positioned towards the patient's feet (and away from the head direction), keeping a clearance of not less than 1 meter from the edge of the scanning table. If this cannot be achieved, the workstation has to be located with a minimum clearance of 2 meters from the edge of the table. (Please refer to sample floor plans in the appendix.)
- d) A full time worker in a new DEXA facility should wear a quarterly personnel dosimeter for an initial period of one year to assess the annual occupational dose. This arrangement also applies to existing facilities after a change of equipment or room layout, or when there is a significant increase in workload.
- e) The operator's personal dosimeter should be worn at the upper body (i.e. chest) on the side facing the x-ray source. If worn on the opposite side, attenuation of the radiation received by the wearer's body will lead to under assessment of the operator's dose.
- f) If the quarterly dosimeter reading exceeds 0.25 mSv\*, consideration should be given to the provision of a transparent lead acrylic x-ray shield, placed between the operator and the scanner. Wearing of lead aprons is not advisable in most practical situations.

#### **WORKSAFEBC OCCUPATIONAL HEALTH & SAFETY REGULATION**

- \*The WorkSafeBC Occupational Health & Safety Regulation, Part 7 Section 7.32, defines an "action level" of 1 mSv/year for the protection of workers, as well as a maximum permissible dose of 20 mSv/year. Owners of x-ray equipment are responsible for ensuring that workers and other persons are adequately protected.
- The International Commission on Radiological Protection (ICRP) has recommended a dose limit of 1 mSv/year for the general public, in their publication. (ICRP60-1990, para.191).
- Doses should be kept as low as reasonably achievable below the dose limits.

For further information contact:

Francine Anselmo, Head, Medical X-ray Program  
Radiation Protection Services, Environmental Health Services  
BC Centre for Disease Control  
Main Floor, 655 12<sup>th</sup> Ave W  
Vancouver BC V5Z 4R4  
Tel: 604.707.2456 | Fax: 604.707.2441



## Appendix: Sample floor plans

