19BME308 - Medical Radiation Safety

UNIT II - RADIATION SAFETY IN NUCLEAR MEDICINE AND RADIOTHERAPY

2.1 Design and Description of NM Department

Overview of Department Design Requirements

In order to minimize the external exposure of the nuclear medicine technologist, the radiopharmaceutical laboratory should be equipped with at least the following items,

- Clear and appropriate use of the radiation trefoil sign
- Fume cupboard
- Protective clothing and eyewear
- Rubber or plastic gloves
- Lead barrier and lead glass window at the radionuclide draw-up station
- Secondary containment trays
- Tongs and forceps for remote handling of radionuclides
- Lead containers and pots for radionuclide storage
- Syringe shields
- Secure and shielded storage cabinets
- Radiation detector

Imaging and Laboratory Rooms

Shielding of rooms in the nuclear medicine department is designed to ensure that dose constraints for staff and members of the public are not exceeded and also to prevent degradation of nuclear medicine images by radiation emitted from patients in adjoining locations, such as the injection room or the waiting room. Since the majority of planar and SPECT nuclear medicine imaging utilizes 99mTc, a lead thickness of 2 mm is routinely recommended for shielding in the walls of all rooms, including imaging rooms and the laboratory.

Radionuclide Therapy Rooms

Therapy rooms are often custom designed with walls constructed of brickwork or solid concrete to provide adequate shielding for the high activities of 131I usually employed. Floors should be covered with continuous vinyl sheets that are coved at the walls. Special facilities that should also be provided include a hand-wash basin at the entrance for staff and a separate hand basin, shower, and toilet for the patient. All pipes leading from the toilet should be shielded and routed either directly into the main sewer or to shielded storage tanks. The actual format depends on the total water outflow from the hospital and local regulations regarding the level of radioactivity that can be released directly into the sewer.

PET and PET-CT Facilities

The increasing use of PET and the recent introduction of PET-CT scanners provide special considerations with regard to facility shielding. The factors that affect the style and level of this shielding include the location of the PET center, for instance, whether it is integrated within the nuclear medicine department or whether it is in a separate self-contained site. If it is the former, attention needs to be given to the additional shielding requirements for rooms containing conventional gamma cameras and SPECT scanners so that their function is not compromised by the presence in the department of patients containing fluorine-18. Other important issues relevant to both locations are the number of patients scanned, the activity of 18F used, and the time each patient spends in the department. Shielding requirements in the case of PET/CT systems, consideration need only be given to the PET component because the shielding implications of the 0.511 MeV annihilation photons from 18F and other positron-emitting radionuclides are far greater than that for the x-rays produced by the CT scanner.

Reference: *Raymond Budd, Radiation Protection in Nuclear Medicine*