

Purpose: To investigate radiation exposure from radioactive patients to the surrounding workers in a busy comprehensive imaging center.

Methods: Follow-up of oncology patients often include nuclear medicine and diagnostic CT examinations. Many patients present themselves for CT imaging after they have been administered radioactivity. An Ion-chamber survey meter (Victoreen 451p) was used to monitor the dynamic radiation environment in a CT facility. The survey meter was placed at a centrally located nurse station that was surrounded by 6 patient-preparation rooms (at 2.5m away) and 5 CT scanners. The radiation environment was monitored for 5 days and correlated with the clinical schedule to estimate the radiation from radioactive patients. Typically 190 patients/day are scanned at this CT facility; ~6% of which are radioactive (10 $^{99m}\text{TcMDP}$ and 1 $^{18}\text{F-FDG}$ patients). The typical doses for such procedures in our facility are 20mCi and 10mCi respectively. The air-kerma rate was modeled based on Gamma Factor and ICRP-53 biokinetic models for Tc-99m-labelled phosphates and $^{18}\text{F-FDG}$.

Results: In the absence of radioactive patients, the average radiation level was measured to be $0.05\mu\text{Sv/hr}$ and independent of the CT duty-cycle; thus validating the CT shielding design. The radiation level increased in the afternoon due to the presence of radioactive patients. The typical cumulative dose/day in the area was $1.3\mu\text{Sv}$, which is 3.25 times the background dose ($0.4\mu\text{Sv}$). Our model predicts that 11 $^{99m}\text{TcMDP}$ patients or 4 $^{18}\text{F-FDG}$ patients would contribute up to $5\mu\text{Sv/week}$ (25% of the weekly limit).

Conclusions: The presence of radioactive patients in the diagnostic CT facility may contribute non-negligible radiation exposure to the employees in the surrounding the CT suite. If the exposure of a non-radiation worker can potentially exceed 25% of the annual effective dose limit, then the site operator should ensure that the annual exposure of the maximally exposed individual does not exceed 1mSv.