Radiation therapy delivery and treatment planning systems are undergoing changes to accommodate requirements for intensity modulated radiation therapy (IMRT). For the same single fraction tumor dose delivered, the total number of MUs for IMRT is much greater than for a comparable conventional treatment and the treatment is delivered as a temporal sequence of small radiation portals. Treatment facility shielding design and calculation assumptions may require modification to account for these differences. For example, the exposure contribution from the linear accelerator head leakage will be significantly greater than with conventional treatments necessitating modifications in workload assumptions for primary and secondary barriers. Beam directions for IMRT may also differ from conventional therapy leading to an adjustment in the use-factor assumptions. Conventional-facility shielding design calculations use the largest possible field size for barrier calculations. With conformal radiation therapy much smaller fields are typically used so this assumption is not appropriate and an average of actual treatment field sizes should be considered. IMRT-facility shielding design and calculation considerations will be addressed as a part of the upcoming AAPM Task Group 57 report. Meanwhile, IMRT shielding has been addressed by two recent peer-reviewed publications.

These publications address IMRT shielding requirements from different viewpoints but share common conclusions. 1) IMRT facility primary and secondary barrier calculations require separate workloads. 2) Primary barrier workload is related to the total dose delivered to patients. 3) Secondary barrier has two workload considerations; the scatter dose component workload is proportional to patient dose and volume and the leakage radiation workload is based on the total number of monitor units required for IMRT delivery. Because the delivered doses and volumes will not change significantly for IMRT, the workload for scatter radiation shielding will be comparable to conventional therapy. The leakage barrier workload for IMRT facilities may be a factor of 2 to 5 larger than for conventional therapy, although a factor as large as 10 has been reported. The leakage barrier workload will be a function of the IMRT delivery device efficiency with respect to use of monitor units (MUs) due to the modulation complexity. The primary barrier workload for Multileaf Collimator IMRT delivery will be comparable to conventional therapy. Due to the rotational nature of tomotherapy delivery, a single treatment consists of a series of gantry rotations, each which delivers the prescribed dose to abutting portions of the target volume. The tomotherapy primary barrier workload must account for the average number of rotations per treatment. When designing a facility, workloads from other procedures such as total body irradiation and stereotactic radiotherapy should also be considered.

One of the two recent IMRT shielding publications discusses measurement techniques for verification of barrier calculations. Due to the modulated nature of dose delivery, IMRT facility surveys will have different requirements compared to conventional therapy. The survey meter exposure rate mode may not be appropriate for the facility survey due to the constantly changing instantaneous exposure rates from IMRT fields. The surveys may have to be performed with a survey meter in the integrate mode.

AbstractID: 7198 Title: IMRT Shielding