AbstractID: 3694 Title: A shielding design for a high-energy doorless accelerator vault

Purpose: To design three doorless vaults capable of accommodating high-energy accelerators of at least 16 MV. This design must meet the state of Michigan standards currently set at 250 μSv per year for an uncontrolled area, and 5,000 μSv per year for a controlled area. Furthermore, the design must occupy a footprint similar to traditional vaults with shielded doors.

Method and Materials: Standard calculation protocols were used to calculate various thicknesses of shielding materials in the walls and the ceiling. We used commercial interlocking bricks in densities of 240 lb/cf and 288 lb/cf. Additional shielding materials used were steel plates, lead plates, standard polyethylene and 5% borated polyethylene. The mazes consist of high-density brick (Ledite) and 5% borated polyethylene panels at various points. The mazes are 24 feet in length, 6 feet in width but are staggered to reduce the cross-sectional profile. The opening is 6 feet wide and is at 90^0 to conventional openings. The space adjacent to the vaults, including the floor above, is occupied and uncontrolled. Two Siemens Oncor and a TomoTherapy unit were used in this study.

Results: We have carried out extensive measurements of dose equivalents at various points inside the treatment rooms as well as in the mazes, the walls, and adjoining areas. All areas comply with the state Michigan current standards. Annual equivalent dose at the opening of the rooms, using a workload of 59,000 Gy per year at 100% 16 MV, ranges from 200-2,000 μSv per year.

Conclusion: This design indicates the possibility of achieving acceptable dose at the opening of a high-energy linear accelerator without a shielded door. This can be accomplished in a standard accelerator footprint. The doorless design enhances patient comfort, patient and staff safety, and is cost-effective.

Conflict of Interest (only if applicable):