AbstractID: 3848 Title: Secondary Neutron Spectra from High Energy IMRT and Conventional Treatment plans using Bonner Spheres and Au-197 Activation Foils

Purpose:
The purpose of this work is to measure and compare secondary neutron spectra both in-field and out-of-field from the delivery of high energy IMRT and conventional radiation therapy. Direct measurement of neutron spectra in phantom for IMRT has received little attention. Studies are needed to demonstrate the strength of the assumption that the spectra are the same for IMRT and conventional radiation therapy.

Method and Materials:
^{197}Au activation foils are placed on the surface of a special holder which is inserted into different Bonner Spheres. Seven levels of moderation were used: the bare foil holder and the holder inside 2", 3", 5", 8", 10", and 12" spheres. Net counts of the 411keV gamma peak were measured for each foil using a high purity Germanium detector with spectral analysis capabilities. The activity at the end of irradiation, and the production rate per unit mass of target ($Bqs^{-1}g^{-1}$) were calculated. Data were unfolded with MXD_FC33 algorithm, PTB (Germany) with a response matrix specifically calculated for this measurement system using MCNPX. The response matrix was verified by unfolding ^{197}Au-Foil Bonner Sphere system data from irradiations with ^{252}Cf.

Results:
The unfolded neutron spectra and neutron flux are evaluated. Ambient Dose Equivalent, H*(10) is calculated from spectral data. The data show an increase in the secondary neutron flux and H*(10) for IMRT compared to conventional radiotherapy. The IMRT spectra show a small shift to lower energies. Ratios of in-field to out-of-field flux for 18MV fall off approximately with the inverse square. The ratios of 18MV to 15MV IMRT and conventional out of field flux are 2.13 and 2.6, respectively.

Conclusion:
^{197}Au activation foils inside Bonner spheres technique for the measurement of neutron spectra inside the treatment room is an effective tool for the determination of neutron spectra from IMRT and conventional radiation delivery.