Purpose:To quantify the effects of transient, DC magnetic fields on the normal operation of a True Beam linac and to verify normal and accurate treatment delivery capability. This is necessary to ensure normal linac operation and accurate treatment delivery in such an environment.

Methods:A data acquisition system was constructed consisting of a Lake Shore vector magnetometer and 3-axis probe including custom software to monitor and record the real-time vector magnetic field value at an in-air reference point near the linac. This data was correlated with various dosimetric and beam quality measurements taken simultaneously. Long duration measurements (2-5 minutes) of the four steering servo currents (Asymmetry Radial (AR), Position Radial (PR), Asymmetry Transverse (AT), and Position Transverse (PT)) were recorded and correlated with magnetic field measurements. Measurements of machine output, dose rate, and beam asymmetry were also recorded and correlated with magnetic field readings. These measurements were repeated for various combinations of gantry orientation and photon and electron beam energies.

Results:Linac output, dose rate, and beam asymmetry versus magnetic field demonstrated no dependence on magnetic field. Correlation plots of the four steering servo currents versus magnetic field indicated a strong dependence (correlation coefficient close to ±1.0) for 3 of the 4 steering servos at a gantry angle of 0° at a photon energy of 6MV. This dependence weakened for one of the servos (AT) and strengthened for one (AR) as the gantry angle was changed to 270°.
Extrapolation of the correlation plots of each servo to the engineering limits were used to obtain a maximum permissible magnetic field value for the room.

Conclusions:Effects of magnetic field on linac operation was systematically quantified. Results indicate that the linac is fully capable of normal and accurate treatment delivery despite the ambient magnetic field environment in the room.