Purpose: Analyze the characteristics of TLD LiF-100 powder between multiple LiF crystal batches.

Methods: The RPC used TLD LiF-100 encapsulated powder to verify the output for photon and electron beams for 4 to 23 MV X-ray beams and 6 to 23 MeV electron beams, respectively, from the past 15 years. During that time period, the RPC commissioned more than 15 batches of TLD powder. Commissioning of each batch of powder encompassed determining the system sensitivity (dose response), linearity, energy and fading characteristics of each batch of powder to determine the correction factors for the calculation of dose. The system sensitivity is the signal/mg per unit known dose of 60Co for each reading session. Other correction factors account for the loss of signal (fading) between the irradiation and read dates, supralinearity of the dose response and energy differences as compared to the 60Co irradiated standards.

Results: More than 15 batches of TLD were commissioned to determine correction factors for the calculation of dose. The correction for fading, a characteristic of the LiF crystal, varied by ±1% between the multiple batches. The linearity correction, between 25 and 600cGy, normalized to 300cGy, showed a maximum variation of ±3% between batches. The energy correction factors, as defined for the RPC beam output audit system varied within ±1.7% (one std dev.) for the 15 batches. The system sensitivity is highly dependent on the LiF crystal grown for each batch, specific TLD reader and reading session conditions. The system sensitivity, while keeping the readers and reading sessions constant, varied by as much as 20% between batches.

Conclusions: Each batch of LiF-100 TLD powder showed variability in their powder characteristics such that calculation of dose accurately, with minimal uncertainty, requires a new commissioning.

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