

AbstractID: 10551 Title: The Radiological Physics Center's Annual TLD Machine Calibration Audit and its Impact on Clinical Trials

Purpose: Demonstrate the importance of the annual TLD machine calibration audit for clinical trial patient dosimetry.

Material and Methods: The RPC TLD postal audit program, begun in 1977, currently monitors ~14,000 megavoltage beams at ~1700 institutions that participate in NCI sponsored cooperative group clinical trials. This TLD audit uses capsules containing LiF powder and mini-phantoms that are shipped to institutions annually. The TLD are irradiated, returned to and read by the RPC. The TLD dose is compared to the institution's stated dose. The RPC's acceptance criterion is $\pm 5\%$ and results falling outside the $\pm 5\%$ criterion are investigated to resolve potential dosimetry errors.

Results: At the 770 institutions that contribute the majority of the clinical trial patients, ~5% of the beams audited fall outside the 5% criterion. Correspondingly, 15-20% of the institutions have one or more beams with a potential calibration error. The standard deviation of the RPC/Inst. TLD results is 2.1% about a mean of 0.999. Most institutions rarely have dosimetry errors in two consecutive years. If the frequency of the audit were to occur biennially then the number of potential errors detected would nearly double during that time period (700 vs. 1200 beams) to include ~33% of the institutions. As the number of uncorrected calibration errors increases, the uncertainty in dose delivered to trial patients also increases. An increase in clinical trial patient dose uncertainty, even at the 2-3% level, can reduce a trial's ability to show differences between experimental arms.

Conclusions: Megavoltage beam calibration is the one dosimetry parameter that is unique to each machine and highly dependent on personnel. An independent TLD annual audit serves to detect potential calibration errors. These errors can be resolved, reducing the uncertainty in the doses delivered to clinical trial patients.

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