

Investigation into the Variability of Dose Measurement using a Selection of Approved Dosimetry Services

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1. Introduction

In the medical sector large numbers of staff are monitored, many of whom do not receive any significant radiation dose. There are often instances of unexplained spurious doses above the minimum reporting level reported by Approved Dosimetry Services (ADS). Following a sudden increase in these spurious doses an investigation was carried out to determine if they could be genuine. As part of this the accuracy of dosimeters was assessed at their lower limit of detection and for a range of doses normally expected for hospital workers.

2. Objectives

To compare five different ADS whole body dosimeters sensitivity and precision when exposed to known radiation doses in the range encountered in the medical sector.

To determine appropriate minimum reporting levels to avoid unreliable doses being recorded in dose records.

3. Method

Dosimeters

- Each ADS provided fifty dosimeters.
- Dosimeters tested were of two types: Thermoluminescent (TLD) (supplied by four ADS) and Optically Stimulated Luminescence (OSL) (supplied by one ADS).
- Lower limits of detection were between 0.01 mSv - 0.1 mSv.

Experimental setup

- Batches of dosimeters were exposed to Hp(10) doses of 0.014 mSv, 0.054 mSv, 0.113 mSv, 0.216 mSv and 0.493 mSv.
- Exposures were made using 140keV gamma ray photons from a Tc-99m source.
- Dosimeters were attached to water filled containers to provide realistic backscatter.

4. Results

Accuracy

- For doses less than 0.1mSv the maximum difference observed between calculated and reported dose was $\pm 100\%$. The minimum difference observed was +7% (figure 1).
- For doses greater than 0.1mSv the maximum difference observed between calculated and reported doses was -43% . The minimum difference observed was 3% (figure 1).

Precision

- For doses less than 0.1mSv coefficient of variation (CoV(%)) measurements showed a high level of variability (40% - 50%) (figure 2).
- At doses greater than 0.1mSv CoV measurements were generally lower (2-30%) (figure 2).

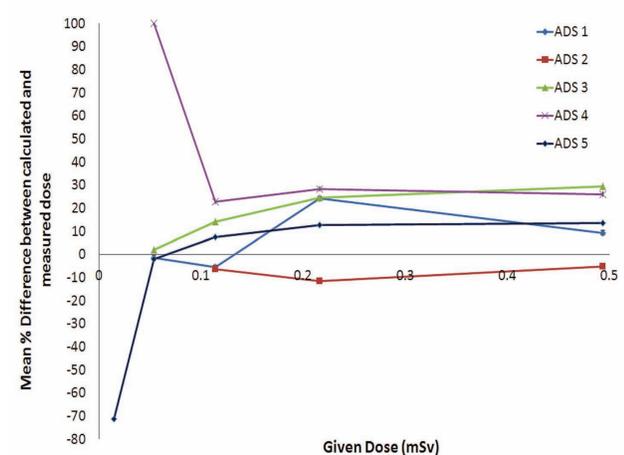


Figure 1: Mean Difference (%) between calculated and measured dose for all dosimeters tested.

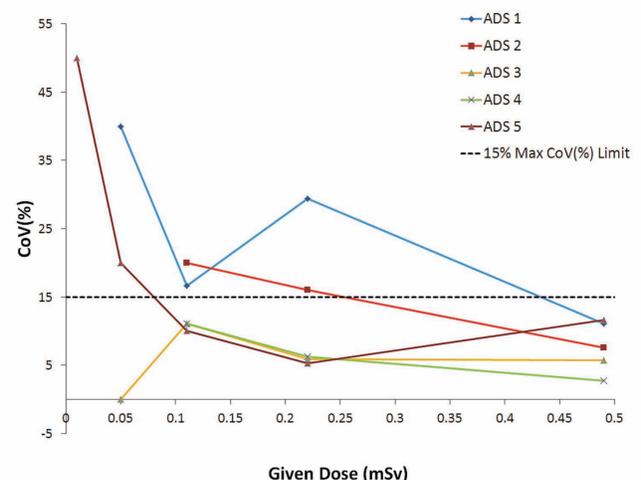


Figure 2: CoV(%) for all dosimeters tested.

5. Conclusion

Care should be taken when using a lower limit of detection less than 0.1 mSv as reported doses may be unreliable.

Accuracy of reported doses varied between ADS for all doses tested.

Precision of reported doses at each ADS lower limit of detection was generally poor.

Precision improved for doses greater than 0.1 mSv and was consistent between ADS at this level.

6. Acknowledgements

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