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Impact of New ICRP Dose Coefficients on Tourist Caves

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In 1996, the Australian Radiation Laboratory (later ARPANSA) published a study on occupational exposure to radon in tourist caves.

The annual effective dose was calculated for 116 tour guides using the conversion convention recommended by the International Commission on Radiological Protection (ICRP) at the time. The study found that the highest estimated radiation dose was 9 mSv per year, which is less than one half of the occupational limit for radiation exposure (see Figure 1).

In 2018, the ICRP released a revised Dose Conversion Factor (DCF) for Radon Decay Product (RDP) inhalation exposure which is approximately four times the 1993 DCF for Tourist Caves. The ICRP also published information which enables calculation of site-specific DCFs based on the measured aerosol conditions.

During the 1996 study, a multistage wire screen diffusion battery was used to measure radon progeny activity size distributions. The diffusion battery activity size distribution results were used to calculate site-specific radon progeny size-weighted dose conversion factors using the ICRP137 size dependent DCF curve.

The doses received by the tour guides in the study have been re-calculated using the new DCF from ICRP (Figure 2) and site-specific DCFs (Figure 3).

These revised calculations suggest that approximately **10% of guides are receiving doses in excess of 10 mSv and that some may be receiving dose in excess of 20 mSv**.

In Australia, if the dose due to exposure exceeds the reference level of 10 mSv/y, radiation protection should be optimised using the actual parameters of the exposure situation, such as occupancy and other site specific factors.

These calculations are based on average DCF values over the tour path and the in-cave time reported by each guide. However, it was found that the site-specific DCF can be highly variable over time (Figure 4) and location within the cave system (Figure 5).

ARPANSA advises that the DCF recommended by the ICRP be used to calculate dose due to radon decay products for optimisation purposes.

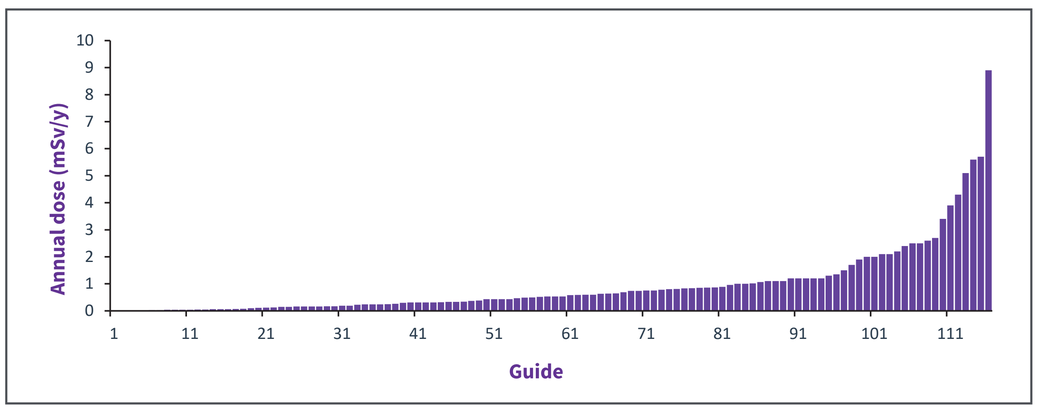

Figure 1: *Guide dose asssessed using 1993 DCF*

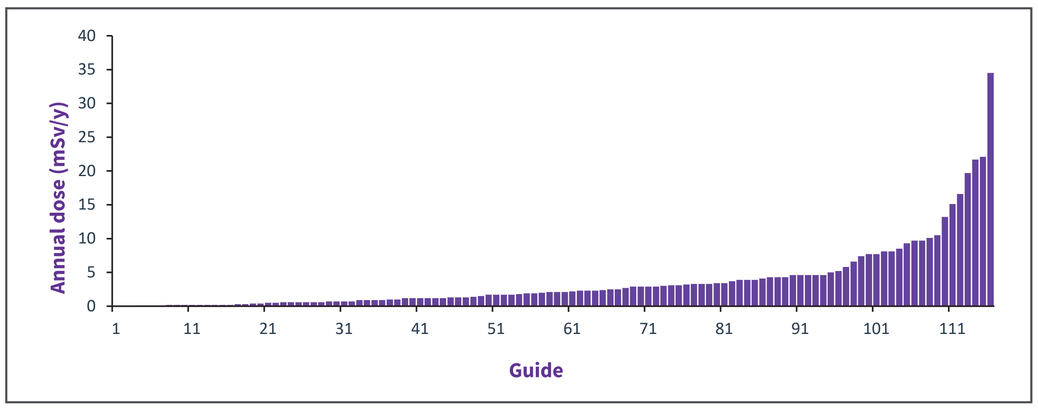

Figure 2: *Guide dose asssessed using default 2018 DCF*

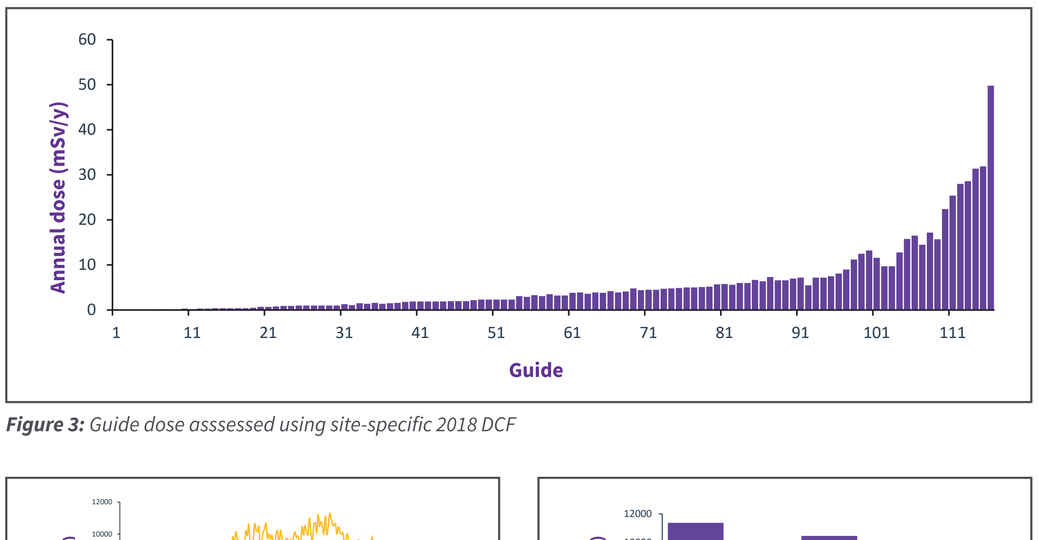

Figure 3: *Guide dose asssessed using site-specific 2018 DCF*

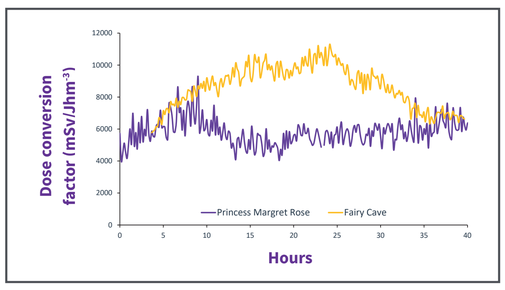

Figure 4: *Variation of DCF with time*

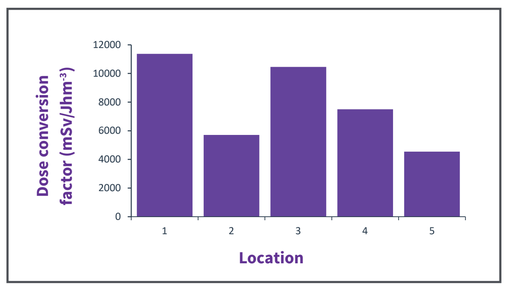

Figure 5: *Variation of DCF with location*