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The presence and dosimetry of radon and thoron in a historical, underground metalliferous mine

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2 **underground metalliferous mine.**

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13 **ABSTRACT**

14 A combination of long term passive, and short term active radon-222, radon-220 and
15 respective progeny measurements were conducted in both traverse and longitudinal
16 axes of an historical metalliferous underground mine in North Queensland, Australia.
17 While the passive monitor results provided average radon and thoron air
18 concentrations over periods of 70 to 90 days, active measurements over a four day
19 period provided significantly more detail into the dynamics of radon and progeny
20 concentrations in the naturally ventilated mine environment. Passive monitor
21 concentrations for radon and thoron ranged between 60 and 390 Bq m⁻³ (mean:
22 140 ±55 Bq m⁻³) and 140 and 2600 Bq m⁻³ (mean: 1070 ±510 Bq m⁻³) respectively,
23 with passive thoron progeny monitors providing a mean concentration of
24 9 ±5 Bq m⁻³EEC. Active measurement mean concentrations for radon, thoron, radon
25 progeny and thoron progeny in the centre of the mine drive were 130 ±90 Bq m⁻³,
26 300 ±100 Bq m⁻³, 20 ±20 Bq m⁻³EEC and 10 ±10 Bq m⁻³EEC respectively.

27 It was identified that thoron passive detector placement is critical in establishing
28 reliable monitoring data, and is the reason for the discrepancy between the active
29 and passive thoron results in this study. Site specific progeny measurements are
30 required for the accurate estimation of dose to persons entering the mine. Based on
31 short term active measurements and passive thoron progeny monitor results, the
32 dose contribution from thoron and progeny in the mine was observed to contribute up
33 to 80% of the total radon / thoron inhalation dose, and therefore should not be
34 underestimated in monitoring programs under similar conditions.

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