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Development and Application of Advanced Techniques for Inhalation Dose Assessment in Ambient and Occupational Environments

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Radon (222Rn), Thoron (220Rn) and their decay products (radio-isotopes of Pololnium, Bismuth and Lead in particulate form) originating from the Uranium and Thorium series, contribute to the inhalation dose to humans. These are relevant not only in the occupational environments of Uranium mines and Thorium plants, but also in High Background Radiation Areas (HBRAs) where enhanced levels of natural radioactivity are observed. Almost 50% of the total annual effective dose is contributed due to inhalation of Radon, Thoron to a minor extent and their decay products majorly. Thus, it is important to measure directly the decay product concentrations rather than computing them through the measurement of the parent gases which is the conventional methodology. In this regard, recent development of Deposition based decay product sensors at our institute, which can be used both for area as well as personnel monitoring, is a remarkable achievement, which has now been widely accepted, promoted and extensively used in various environments world-wide. In the present work, we elaborate the highlights of the work carried out using these detector systems in different occupational and indoor environments as follows:
a) Direct measurement of decay products in High background radiation areas (HBRAs) and Normal background radiation areas (NBRAs) of India confirmed that, even though the gamma dose rate in HBRAs is around 10 times higher than that measured in NBRAs, the inhalation doses in both the areas are comparable.
b) Direct measurements of decay products in Thorium handling facilities and uranium mines have provided an assessment of presonnel inhalation doses.
c) These measurements aid in building up of a national database of indoor and outdoor deposition velocity parameters which is important for long-term characterization of these sensors.

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