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Characterization of a High-Sensitivity Radon Emanation System

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Radon is an important background consideration for rare-event searches such as dark matter direct detection and neutrinoless double-beta decay experiments. Materials of construction for these experiments often require screening of ultra-low radon levels, sometimes as few as tens of atoms in equilibrium. Radon emanation is one of the most sensitive and robust ways of making these measurements. A system for low-level measurements has been commissioned at the Pacific Northwest National Laboratory (PNNL) that achieves high sensitivity through use of custom high-efficiency ultra-low-background proportional counters. The system includes small and large radon emanation chambers coupled to a custom-built gas handling system with a cryogenic radon trap. The emanation system and detection method will be described, and characterization of backgrounds and efficiencies using a calibrated radon source will be discussed.

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