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DEVELOPMENT OF A RADON FLUX DENSITY STANDARD. R. Collé and J.M.R. Hutchinson (National Bureau of Standards, Gaithersburg, MD 20899)

The importance of measurements of radon-222 exhalation rate or radon flux density (i.e., the exhalation rate per unit area) from surfaces has been repeatedly emphasized in many meetings and workshops in the past five years. Very little attention or effort, however, has been directed to the adequacy of calibration procedures or the availability of standards for these measurements.

To address this need NBS has been investigating the feasibility of a radon flux density transfer standard that would provide a constant and known exhalation rate from a sufficiently large surface. A few attempts have been made by other laboratories to obtain a radon flux density calibration facility which are based on the characterization of a fabricated site of either natural or enriched radium-bearing soils, sands, or mill tailings. An alternative approach considered for this study consists of incorporating an aqueous solution of radium into a sealed, shallow, large-surface area container which is covered with a thin, but rigid, polyethylene sheet which is permeable to radon. The use of a radium solution eliminates possible spatial dependencies and minimizes the effects of ambient and meteorological variations. This source configuration may be characterized in terms of a steady-state diffusion model. The model is an extension of the various radon transport cases treated in Collé, et al. (NBS Tech. Note 1139, 1981), and is based on a derivation by Rubin (NBS, unpublished calculations, 1984).

A 40-cm-diameter prototype has been constructed (with partial support from the U.S. Environmental Protection Agency). It consists of a stainless steel right circular cylinder with a radium solution depth of 6 cm which is covered and sealed with a 3.2 mm polyethylene sheet. It was designed for a radon flux density of approximately 5 $pCi \cdot m^{-2} \cdot s^{-1}$ which is about 10 atoms per cm^2 per sec. The prototype is also equipped with an ancillary circulation system which is driven with a seal-less, magnetic-drive pump and contains appropriate valves, inlet port, and drain line. This plumbing system is necessary for loading the radium solution, for possible makeup of water transpiration losses, and for mixing to ensure that the solution remains homogeneous.

The model, design calculations, and characteristics of the proposed standard will be discussed; and results of preliminary measurements for the prototype will be reported.