Report of Project 04, Contract B17-047 of the CEC Radiation Protection Research Programme (1990-1992)

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II. Objectives for the reporting period

The objectives for the reporting period were to further develop the experimental facility for radon/aerosol studies, to develop a multi-orifice impactor which combines a low cut-off diameter with a high flow rate and to perform introductory controlled studies of the interaction between radon daughters and aerosol particles.

III. Progress achieved including publications

During the reporting period the experimental facility has been further developed and partially rebuilt. The previously used radon room, which has been described elsewhere (see "resulting publications" #1 and #3) is no longer in use. Instead, a new room has been designed and built at Lund Institute of Technology. The radon room itself is made of stainless steel and has a volume of 20 m^3. It has an air lock with a volume of 3 m^3 (figure 1). All joints of the room are welded for optimum tightness.

In the walls of the chamber there are seven interchangeable hatches. The hatches are either made of stainless steel (with or without outlets) or glass windows (figure 1). This makes it possible to customize the room without destructing the walls themselves (figure 2). The hatches can also be used for plateout measurements, simply by removing them and placing them on a large-area pulse ionization chamber. A schematic view of the facility is shown in figure 2.

Dry pressurized air is filtered and humidified and then supplied to the room. Whenever there is a need for higher ventilation rates, outdoor air is pushed through a three-stage filter unit and into the room. Various aerosols can be added to the room.

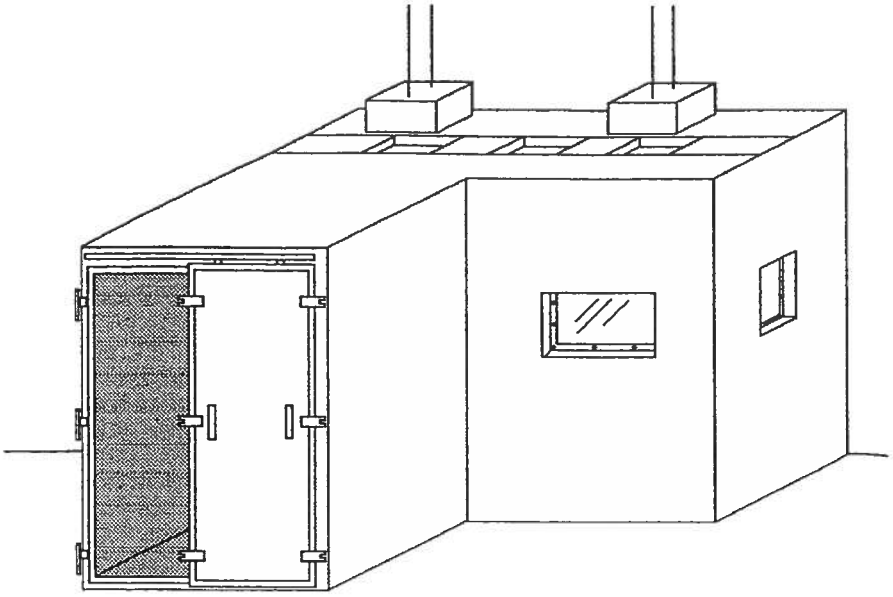

Figure 1. The new radon room at Lund Institute of Technology.

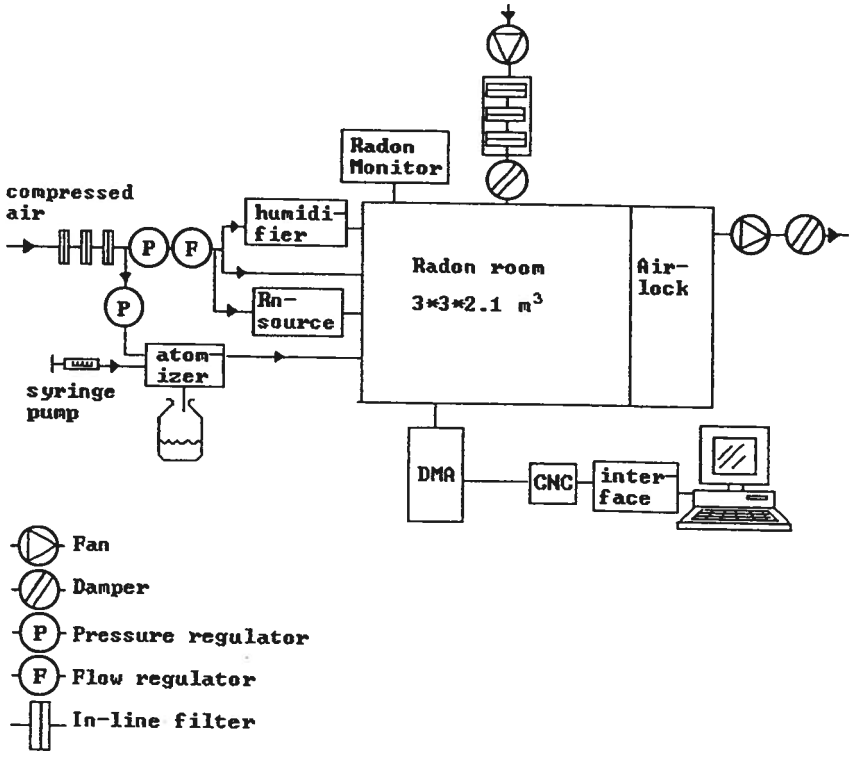

Figure 2. Schematic view of the radon progeny exposure system.

The experimental facility is also used for plate-out studies connected to the "glass method" for retrospective assessment of radon exposure (CEC project B17-CT90-0013).

Multi-jet impactor

The first stage of a multi-orifice impactor has been constructed and calibrated. In order to optimize the impactor design, the collection efficiency characteristics have been studied as a function of nozzle-to-plate distance, and of the Reynolds number of the jet. The nozzle plate of the current stage has 2704 laser-drilled orifices. The diameter of the nozzle plate is 26 mm and the orifice diameters are 50 um. A cut-off diameter down to about 100 nm can be achieved. An example of a cut-off characteristic, as a function of the square root of the Stokes' number, is given in figure 3 (Air flow: 24 l/min., pressure drop over the impaction stage: 13 kPa).

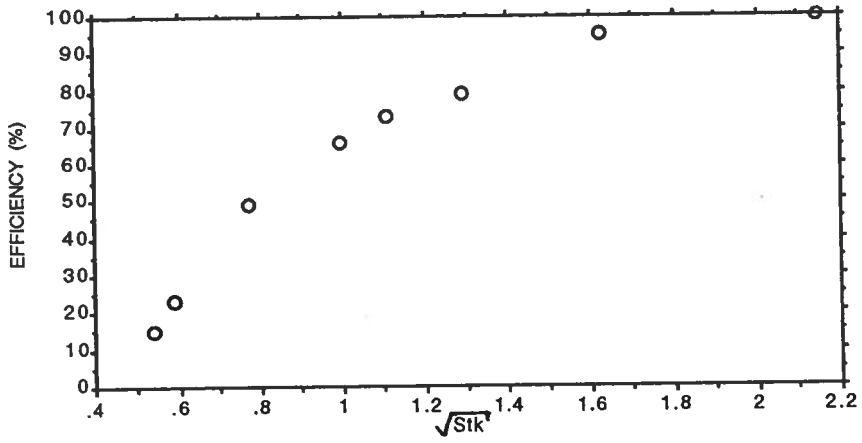

Figure 3. Cut-off characteristic of the impactor stage at a flow rate of 24 l/min.. The 50% cut-off corresponds to a particle diameter of 150 nm. A sharper cut-off can be achieved by increasing the flow rate and decreasing the nozzle-to-plate distance.

Resulting publications

#1 An Experimental Facility to Simulate Radon Progeny Behavior in Dwellings, Proceedings of the 29th Hanford Symposium on Health and the Environment. Richland, USA, October 1990.
(Eklund P., Bohgard M.)

#2 Multi-Jet Impactor with 50 Micrometer Diameter Nozzles for Uniform Deposition of Submicron Particles. Proceedings of the Symposium of the Nordic Society for Aerosol Research, Gothenburg , Sweden, November 1990.
(Gudmundsson A., Bohgard M., Hansson H-C)

#3 A Full-Scale Experimental Set-Up for Determining Relevant Parameters for Radon Daughter Behaviour in Dwellings. Proceedings of the Symposium of the Nordic Society for Aerosol Research, Gothenburg, Sweden, November 1990.
(Eklund P., Bohgard M.)

#4 A Large-Scale Experimental Facility for Studying the Interaction Between Radon Daughters and Airborne Particles in Dwellings. Abstract, European Aerosol Conference, Karlsruhe, September 1991.
(Eklund P., Bohgard M.)