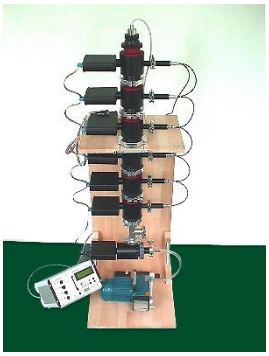
SARAD ASDA 02
Cascade Impactor



Technical Data

The health risk of exposure to radon and thoron progeny is influenced by activity-size distribution of the carrier aerosol particles. Therefore, to enable practical measurements of the activity-size distribution to be made under field conditions, SARAD NUCLEAR INSTRUMENTS, in collaboration with the University of Göttingen, the Australian Radiation Laboratory and A.C. James/SARAD Technologies, Inc. (in the USA) has developed highly portable measurement system.

This system consists of:

- a four stage graded screen array (featuring in-situ alpha counting of the first screen and back-up filters)
- a six (eight) stage, low pressure impactor (featuring in-situ alpha counting of impaction stages)
- an open filter (also counted in situ)
- fully automatic spectroscopic analysis and deconvolution software

The combination of a graded screen array (to measure the ultrafine components of the radon/thoron progeny aerosol) and a low-pressure impactor enables the activity- size distribution to be fully over the very wide range of particle size (from 0.6 nm to several µm equivalent particle diameter).

1. Graded Screen Array

This consist of a four wire-mesh stages operated in parallel, together with an open filter (to measure the total airborne activity concentration of the radon/thoron progeny). One stage is a single wire-mesh, which collects the classical "unattached" progeny (of equivalent particle diameter in the range 0.6 - 1 nm). The collected activity is counted directly on the front face of this screen. The other three stages consist of increasing numbers of fine wire meshes mounted in front of a filter. In these stages, the activity collected on the filter is counted in situ by state alpha detector. Graded increases in the number an fineness of the wire meshes (stainless steel) enables the various stages to collect progressively lager particles in the sub- micron size-range (by the mechanism of Brownian diffusion).

2. Low-Pressure cascade Impactor

The impactor consist of a cascade of 6 (8) stages through which the sampled air flows at progressively increased velocity. Thus, particles are separated at each stage according to their aerodynamic diameter: The first stage collecting the smallest particles (of about 0.3 µm diameter). At each impaction stage, particles are deposited onto a thin foil. The deposited radon/thoron progeny activity is analysed in situ by a solid stage alpha detector. A special feature of this impactor design is that each collecting surface rotates - to avoid the build up of a thick deposit beneath the impaction jet, which would degrade the alpha energy resolution

All foils can be removed or replaced by others for separate chemical analysis of non-radioactive aerosol particles (fungi spores, combustion soot, lacquer smog, abrading-welding dust or abrasives)

3. Electronics and Software

The detector signals are processed by a combination of SARAD MOD 01/03 detector (400 mm²) / amplifier unit and a multi-channel spectroscopy analysis system based on our spectrometer 50xx series. The whole unit is connected to a PC notebook computer via the parallel port interface.

The accessory software includes a nine-channel MCA control program which enables samples to be taken automatically. After completing a sample, the analysis software automatically applies deconvolution algorithms (SIMPLEX) to calculate the aerosol activity-size distribution according to radon progeny potential alpha energy. Each stage of the acquisition and analysis processes, and the final activity-size distributions, are displayed on the computer screen, in the real time.

We also offer a software accessory to compute the effective dose to the respiratory to the recommendations of the ICRP Publication 66 Lung Model (ICRP, 1994). This software incorporates the dose conversion coefficients as a function of particle size that were provided to the U.S. National Academy of Sciences BEIR VI Committee which is re-assessing the health risks from exposure to radon progeny.

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