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Graded array for the measurements of radioactive aerosol size distribution

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Indoor air pollution caused by various aerosol sources poses significant concerns regarding toxic and radiological hazards, making it a crucial issue in the field of environmental pollution. Knowledge about the size distribution of radioactive aerosols plays a crucial role in evaluating the potential internal exposure resulting from inhalation into the respiratory system. The size range of radioactive aerosols typically spans from 1 nm to 10-20 μm. The measurement of aerosol size distribution across such a broad range cannot be accomplished using a single instrument. This is because the deposition of radioactive aerosols of different sizes involves various physical mechanisms, such as diffusion deposition, inertial deposition, impact, and more. The concept of a single-channel device for obtaining a complete size distribution of aerosols has been developed. The analysis of various methods for obtaining the size distribution of aerosols based on their physical properties has been carried out: cascade impactors, diffusion batteries and aerosol filters. The equipment comprises a diffusion battery with 4 meshes, a cascade impactor with five stages, and a collection of three aerosol filters that possess known permeability functions. The diffusion battery enables the acquisition of aerosol distribution within the range of 1-12 nm, while the cascade impactor covers the range of 0.8-20 μm. Additionally, the multilayer fiber filters are capable of capturing aerosols within the range of 0.01-0.5 μm. The inclusion of a diffusion battery prior to the cascade impactor prevents the diffusion deposition of ultrafine aerosols at the initial stages of the impactor. This precautionary measure helps to avoid misleading indications of the presence of larger aerosols in the atmosphere. The radon equivalent equilibrium activity concentration used to be determined by Kuznets method. This method allows for measurements to be conducted over an extended period of time following sampling and enables the restoration of the original activity concentration. The advantage of this method is the ability to measure a larger number of elements with fewer radiometers without losing dosimetry information. Using this device and inverse problem-solving methods, it is possible to reconstruct the size distribution of radioactive aerosols by performing a single sampling on filtering materials.

Přihlásit do soutěže

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