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Project Title: **Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting**

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Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Settings

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Research Objective:

Improvement in understanding the deposition of ambient dust particles on ECAM (environmental continuous air monitor) filters, reduction of the alpha-particle interference of radon progeny and other radioactive aerosols in different particle size ranges on filters, and development of ECAMs with increased sensitivity under dusty outdoor conditions.

Research Progress and Implications:

As of 15 May 1999 we have completed testing the pulsed ionization chamber (PIC) in a prototype operational state as an ECAM. The PIC was modified to have an entrance window of active diameter 19.0 cm with a window material of B10HH metalized film (0.29 mg cm^{-2} proprietary polymer). A 3.0 micrometer pore diameter fluoropore filter (FSLW) with an active collection diameter of 13.0 cm was mounted in front of the window with a gap distance of 0.3 to 0.6 cm. Operated at a flow rate of 310 liters per minute, this configuration achieved an alpha particle resolution of 246 " 26 keV fwhm for airborne Pb214 (7.7 MeV). These results indicated that this PIC configuration can be superior to conventional CAMs (with have much smaller diameter collection filters) for detecting low concentrations of airborne radioactivity. The

essential factor is the higher flow rates possible with much larger filters while comparable energy resolution is maintained. In addition, for a given volume of air processed, this PIC configuration is more resistant to dust loading because the dust is spread over a larger surface area resulting in a thinner layer of energy-dispersing material. However, it is not clear that the present prototype PIC configuration is sufficiently convenient and cost-effective to replace conventional CAMs for routine monitoring situations. The present system is fairly bulky and requires a continuous supply of P-10 gas (>30 cm^3/min) from a compressed gas cylinder. Efforts to design a pre-amp and amplifier that could work with the PIC using common air as the detecting gas have so far been unsuccessful.

Using electrostatic deposition, we have successfully developed a protocol that can produce radioactive aerosol of controlled diameter by depositing radon decay products on inert aerosol particles. We have produced aerosol particles with diameters from a fraction of a micrometer to many micrometers that have sufficient activity to give strong (many becquerels) alpha particle decay signals with very thin (< 0.1 mg/cm^2) layers on filters. Since the effective half-life of these radioactive aerosol particles in well under an hour, they provide a new and convenient way to safely simulate deposition of more hazardous plutonium aerosol particles. For early-warning ECAM applications, we are currently studying energy resolution for very thin layers of radioactive aerosol particles on filters which have an initial non-radioactive layer of dust of varying thickness.

Planned Activities:

Our first priority will be to continue collecting data on energy resolution for a quick burst of radioactive aerosol arriving on a dust-loaded filter. Previous work has studied energy resolution for an increasing single thickness of radioactive aerosol particles on a filter, but not for a thin layer of radioactive aerosol on top of an underlying non-radioactive aerosol layer. We will collect data as a function of radioactive aerosol diameter, thickness and composition of the non-radioactive dust layer, and filter type. These data should aid in selection of filter types and measurement protocols for early-warning ECAMS under outdoor conditions when significant dust loading is a factor.

Suilou Huang, who is receiving her Ph. D. with the Center for Atmospheric Chemistry Studies, University of Rhode Island, will be joining our project in June. Her dissertation work involves measurement and analysis of atmospheric aerosols. She will help with the measurements discussed above and other goals mentioned in the original proposal. In addition, she may initiate studies aimed at characterizing the size and composition of the dust used to load the filters. We are considering collection of dust on filters at field sites near the Waste Isolation Pilot Plant (WIPP) and Los Alamos National Laboratory to better characterize the dust that might be encountered under operational conditions with ECAMs.

Information Access:

Rodgers, J. C., Wasiolek, P. T., Schery, S. D., and Alcantara, R. E., High Resolution Real-Time Optical studies of Radiological Air Sample Processes in an Environmental Continuous Air Monitor, 1998 SPIA Symposium on Industrial and Environmental Monitors and Biosensors, November 1-6, 1998, Boston, MA, LA-UR-98-1684.