Portable Monitor for Aerolson-Based Heavy Metal Exposure

Morbidity and mortality from occupational respiratory disease are estimated to cost ten billion dollars each year in the U.S. alone. World-wide, such diseases are associated with approximately 425,000 annual occupationally-related mortalities. Yet, despite the high incidence and prevalence of occupational respiratory diseases, the paradigm for assessing exposure to occupational aerosol hazards has remained largely unchanged over the last 25 years. A critical need therefore exists to improve the sensitivity and timeliness of aerosol exposure assessment methods in occupational settings. The proposed research addresses these issues in developing new technology to measure species-specific metal concentrations collected on personal sampling filters in-situ. The new technology is based on microfluidic paper analytical devices (μPADS). A μPAD consists of a capillary circuit printed on filter paper and allows for precise analytical chemistry to be conducted directly on the sample. In our approach, a μPAD for in-situ metals analysis will be printed onto the 25 mm filter substrate located in a standard personal aerosol sampler. Particles will be sampled onto the 25 mm filter substrate located in a standard personal aerosol sampler. Particles will be sampled onto a defined collection spot (~60 min sampling time) and then the sample analyzed by digestion followed by colorimetric reaction specific for Pb. The intensity of the color will indicate concentration. It is our central hypothesis is that μPADs can be integrated into personal aerosol samplers for quantification of exposure of airborne metals with sampling and analysis times of less than one hour. Successful completion of the project will generate the first step towards a novel tool for industrial hygienists with a sensitive, in-situ technique to assess airborne metal hazards in the workplace. Such technology represents a paradigm shift in the field of exposure assessment and contributes to the National Occupational Research Agenda (NORA) by developing a new and inexpensive instrumentation (a cross-sector theme) for assessing worker exposure (a cross-sector theme) to airborne metals (affecting the transportation/utilities, manufacturing, and construction sectors.