EXPOSURE CHARACTERIZATION CORE ABSTRACT

EPA Grant #: RD83479701 **EPA Project Officer:** Mel Peffers/Sherri Hunt

Title: Exposure Characterization Core

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Project Period: 12/1/2010 – 11/30/2015 **Core Costs:** $1,660,814

RFA: Clean Air Research Centers **Research Category:** Air Quality

Description: The Exposure Characterization Core (ECC) is an integral part of all three Projects of the Great Lakes Air Center for Integrative Environmental Research (GLACIER).

Objectives/Hypothesis: In coordination with and support of the GLACIER Research Projects, the ECC will provide measurements of multi-pollutant exposures for both human subject (Project 1) and animal toxicology (Projects 2 and 3) studies. The overall objectives of the ECC are to 1) determine the mass, size, and chemical composition of pollutants for each exposure period, 2) determine the atmospheric emission sources responsible for the observed exposure concentrations, and 3) provide a detailed assessment of the differences in air pollution composition, sources, and chemistry between each of the exposure sites across each of the Projects.

Approach: The ECC is highly innovative in design by the use of ambient particle concentrators coupled with mobile toxicological laboratories to evaluate the acute health effects of multi-pollutant atmospheres dominated by different chemical components and emission sources. These mobile labs will be stationed in three communities in Michigan (Detroit, Dearborn, and Dexter) for short-term exposure studies conducted in Projects 1 and 2, as well as two locations in Columbus, OH, for longer-term exposure studies in Project 3. The ECC will specifically utilize these exposure sites in Michigan and Ohio primarily impacted by (1) near-roadway motor vehicle emissions (two sites), (2) industrial point sources (one site), and (3) regionally transported air pollution (no local emission sources, two sites). Concurrent with the animal inhalation and human exposure studies, intensive characterization of the particles that are concentrated (CAP) for the exposure studies will be conducted using state-of-the-art high temporal resolution monitoring methods. An important and innovative part of the ECC is the use of the Semi-continuous Elements in Aerosol Sampler (SEAS), combined with high-resolution inductively coupled plama-mass spectroscopy (HR-ICP-MS) analysis, to perform sub-hourly multi-elemental analysis of PM2.5 samples. Many previous CAP studies have not included extensive exposure characterization and thus did not allow evaluation of the contribution of specific PM components to observed health responses. Similarly, source apportionment in the context of CAP studies has been extremely limited, with only few studies using factor analytical techniques to assess the impact of particle sources on toxicological responses. The ECC will incorporate extensive PM characterization and source apportionment in order to determine which PM components, as well as PM emission sources, are associated with toxicological responses.

Expected Results: The GLACIER will provide one of the most comprehensive experiments designed to address the toxicity of components and sources of PM2.5 from several different source types prominent across the Great Lakes region and also, by use of the mobile exposure laboratories, at “real-world” exposure locations. We will provide substantial new information regarding the character and sources of PM2.5 in several settings by use of the novel high-time resolution exposure characterization methods.

Supplemental Keywords: air toxics, metals exposure, SEAS