

Air Pollution and Health Effects Research at EPRI: The ARIES Program

Air pollution, especially particulate matter (PM), has been linked with adverse health effects at levels currently observed in the United States. However, most epidemiological studies have not included sufficiently comprehensive air quality monitoring to allow identification of many of the components that may be associated with a particular health endpoint. This is a critical piece of missing information. Knowledge of the true causative agents would enable us to better protect public health by regulating those sources that produce harmful pollutants. Indeed, health effects drive the regulatory agenda for the proposed multi-pollutant legislation and air quality standards. This underscores the importance of determining the components of air pollution responsible for health effects.



The Aerosol Research and Inhalation Epidemiology Study (ARIES) was designed to address the issue of air pollution components by coupling an extensive air quality monitoring effort with 5 health studies. ARIES is examining mortality, emergency department visits, ambulatory care visits, cardiac arrhythmias in defibrillator patients, and heart rate variability in a subset of compromised individuals. Findings to date, which cover four years of health and air quality data, show statistically significant associations with a number of air pollution parameters, including carbon-containing PM, metals, and criteria gases. There are no consistent associations with sulfates, which are commonly associated with coal combustion.

ARIES-type studies are critical because they add unique information to the existing body of literature regarding the health effects of specific components of air pollution. ARIES has received broad acceptance from regulatory and scientific bodies. The study has been cited by the White House OMB as an archetype of air pollution studies. Dr. John Graham of OMB has asked EPA to conduct similar types of studies. The National Research Council (NRC) Committee on Research Priorities for Airborne Particulate Matter has emphasized the need to understand the toxicological composition of PM.

ARIES has been successful. However, one study alone cannot definitively answer all the questions. It is critical that epidemiological findings be replicated in other geographical areas with different air pollution profiles and different study populations. EPRI is currently overseeing several other ARIES-type studies. These studies focus on a smaller subset of health endpoints, but follow the same general design of including a comprehensive air quality monitoring effort in order to allow assessment of component-specific effects. These studies include.

- *St. Louis ARIES*: Investigates the association between specific air pollutants and emergency department visits for cardiac and upper respiratory illness in the St. Louis Metropolitan area using a retrospective, population-based design.
- *Detroit Cardiovascular Health Study (Detroit ARIES)*: An epidemiological panel study, this project makes use of in-kind detailed exposure data being collected by EPA as part of its DEARS study. The study determines repeated measures of vascular function in 120 DEARS participants during air pollution exposure characterization. Results will indicate those components of air pollution that are associated with vasoconstriction.

- *New York City Exposure/Asthma Panel Study (NYCEPS)*: Like Detroit ARIES, NYCEPS is an epidemiological panel study designed to investigate the associations between air pollution components and asthma exacerbation in individuals living in the South Bronx and East Harlem neighborhoods of New York City.
- *Texas ARIES (planned)*: Will make use of the extensive air quality data being collected under the TexAQS II study as well as data collected by the Texas Commission on Environmental Quality (TCEQ). ARIES Texas will evaluate in time-series analyses the association between air pollution/PM parameters and mortality and hospital admissions in Houston, Dallas, and San Antonio.

EPRI also has a small ARIES-type effort in Baltimore to examine the association between air pollution and acute episodes of heart failure in congestive heart failure (CHF) patients. This study utilizes a less extensive air quality database than other ARIES studies, but still more comprehensive than many epidemiological studies being carried out by other groups.

EPRI's long-term plan is to conduct additional "full-scale" ARIES-type studies in 3-4 other cities across the U.S., evaluating similar health endpoints to allow comparison across studies. There are several basic criteria that must be satisfied for the city selection process. The city must be large enough that there is sufficient statistical power for the health studies to detect effects. The city should also have a moderate level of air pollution, and, importantly, have temporal variation in pollution levels. Finally, to optimize research dollars and avoid replication, it would be better to conduct an ARIES-type study in a city in which an extensive air pollution epidemiology study has not yet been conducted.


The strategic value of the overall ARIES Program is high. Since ARIES-Atlanta is currently the only epidemiology study of this scope and breadth being carried out, the need is great for additional large-scale, comprehensive studies to more fully elucidate the components of air pollution that are responsible for adverse health effects. Replication of findings from Atlanta will increase confidence in the results and facilitate consideration and incorporation of results into regulatory activities. Specifically, on the federal level, findings from the ARIES Program will inform the reissuing of the National Ambient Air Quality Standards (NAAQS) for PM and other pollutants. The NAAQS will be issued in 2005; therefore, there will be reviews of the standards in 2010 and 2015, with possible reissuing of the standards at these times. ARIES Program findings will feed into this process. On a state level, findings for a specific region will help states in the development of SIPs and management strategies for attainment of the standard.

In terms of specific benefits of funding the ARIES Program, these studies will provide input into the federal regulatory process, which is driven by health issues. Findings will inform the development of SIPs and appropriate management strategies. Participating in these kinds of studies demonstrates industry concern over important public health issues, and is an opportunity for a collaborative effort between public and private sectors. Participation in the ARIES study puts the electric power industry clearly on the proactive side, asking questions to which we will need answers to protect public health and welfare.

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