RESEARCH IDENTIFYING SOURCES OF AIR POLLUTANTS TO IMPROVE CONTROL STRATEGIES

Issue:

Humans are exposed to a number of air pollution sources. Major sources include motor vehicle exhaust, both large and small industries, power plants, agricultural and forest fires, and domestic activities (e.g., lawn mowing).

Numerous health studies have demonstrated an association between air pollution sources and adverse health and environmental effects. Therefore, it is important to know all we can about the sources we are exposed to and the characteristics and concentration of those sources.

For example, if we know which specific sources contribute to air pollution in a given area, and where people are most likely to be exposed, strategies such as changing fuels or installing air pollution control equipment can

be used to reduce the impact of those sources.

Source-related research informs the air pollution control strategies of EPA, state, and local governments for specific sources or categories of sources.

Science Objective:

Scientists and engineers in EPA's Clean Air Research Program in the Office of Research and Development (ORD) are identifying and quantifying more clearly the various sources of air pollution to improve EPA's understanding of the links between sources and health effects.

The focus of this "source–apportionment" research is on several sources of air pollutants: fine particulate matter (PM2.5), coarse PM, regulated gaseous pollutants, volatile organic

compounds, and mercury. Research is being conducted across the country and in EPA laboratories to evaluate source emissions, determine where they travel, and learn how people and ecosystems are exposed.

Efforts are underway to advance the sampling and analytical methods to measure specific pollutants in air. The routine measurements collected in areas that are not meeting air quality regulations are typically not sufficient to identify local source contributions.

Work is also underway to improve modeling tools that can be used to identify and quantify the local, urban, and regional sources. The modeling tools are publically available and are used by EPA, state and local governments, as well as academic

U.S. Environmental Protection Agency
Office of Research and Development

and international environmental researchers. These models are:

- EPA PMF 3.0 model: http://www.epa.gov/heasd/products/pmf/pmf.htm.

- EPA Unmix 6.0 model: http://www.epa.gov/heasd/products/unmix/unmix.htm.

Application and Impact:

The science developed by the Clean Air Research Program provides information and tools to EPA, states, and local agencies for developing effective air pollution regulations.

Recent advances in the understanding of source contributions to air pollution include:

- Studies in Tampa, Fla., showed a reduction in mercury impact when a major power plant changed its fuel from coal to natural gas. In addition, Steubenville, Ohio research demonstrated the large impact of regional domestic coal combustion on the deposition of mercury in rain water.

- A study in Baltimore, Md., found that 30 percent of particulate matter (PM) from motor vehicles infiltrated inside a retirement home. The indoor level reflected the PM pollution from local coal fire power plants (sulfate). Another study in Research Triangle Park, N.C., found around 50 percent of PM from motor vehicle exhaust was present inside homes and that cooking was a major contributor to PM personal exposure.

- World Trade Center research results showed differences in air pollution sources during the different stages of the recovery effort after 9/11.

- In St. Louis, studies at a major steel facility helped quantify the impact of various industrial sources on local areas.

This research underlines the importance of tracking specific sources in exposure assessments and using the results to improve control strategies.

REFERENCES

"Chemical Characterization of Ambient Particulate Matter near the World Trade Center: Source Apportionment using Organic and Inorganic Source Markers," Atmos. Environ., in press.

Olson, David A.; Norris, Gary A.; Seila, Robert L.; Landis, Matthew S.; and Vette, Alan F. (2007) "Chemical Characterization of Volatile Organic Compounds near the World Trade Center: Ambient Concentrations and Source Apportionment," Atmos. Environ., 41(27) 5673-5683.

Keeler, G.J.; Landis, M.S.; Norris, G.A.; Christianson, E. M.; Dvonch, J.T. (2006) Sources of Mercury Wet Deposition in Eastern Ohio, USA, Environ. Sci. Technol., 40(19) 5874-5881.

Zhao, W.; Hopke, P.K.; Norris, G.; Williams, R.; Paatero, P. (2006) Source apportionment and analysis on ambient and personal exposure samples with a combined receptor model and an adaptive blank estimation strategy. Atmos. Environ. 40 (20) 3788-3801.

Hopke, P.K.; Ramadan, Z.; Paatero, P.; Norris, G.A.; Landis, M.S.; Williams, R.W.; Lewis, C.W. (2003) Receptor modeling of ambient and personal exposure samples: 1998 Baltimore Epidemiology-Exposure Study Atmos. Environ. 37: 3289 – 3302.

U.S. Environmental Protection Agency
Office of Research and Development