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New Study: Air Pollution Particles Linked to Heart Disease, Other Effects Many Sources and Components May Contribute....

(BOSTON, MA) New comprehensive studies published today by the Health Effects Institute (HEI)¹ at www.healtheffects.org conclude that despite claims that certain sources of fine particle air pollution (PM_{2.5}) may be less toxic than others, the best evidence finds that no source can yet be excluded from adverse health concerns. These nationwide studies – HEI’s *National Particle Components Toxicity* (NPACT) initiative – were conducted by over 50 scientists at leading research institutions across North America, and are the most systematic effort ever undertaken to combine epidemiologic and toxicologic research to investigate whether “all particles are created equal” and therefore deserve the same level of public health and regulatory attention.

The studies found links between health effects – particularly on the cardiovascular system – and sulfate particles (primarily from coal combustion) and, to a somewhat lesser extent, traffic sources. But the HEI NPACT Review Panel, fourteen experts who subjected the studies to intense, independent peer review, cautioned that the results “do not provide compelling evidence that any specific source, component, or size class of PM may be excluded as a possible contributor to PM toxicity.”

The Panel went on to note that we need to know more about exposure and health effects before concluding that “regulations targeting specific sources or components of PM_{2.5} will protect public health more effectively than continuing to follow the current practices of targeting PM_{2.5} mass as a whole.”

The NPACT studies were undertaken by HEI in response to calls from its sponsors at both US EPA and industry for answers to these important questions. Following extensive planning and intense scientific competition, two teams - led by Morton Lippmann from New York University and Sverre Vedal from the University of Washington - were selected to undertake an integrated set of detailed toxicology and epidemiology analyses across the U.S. of air pollution and its effects on cardiovascular disease and other health outcomes:

¹ The Health Effects Institute is an independent, non-profit research institute funded jointly by government and industry to provide credible, high quality science on air pollution and health for air quality decisions. HEI sponsors do not participate in the selection, oversight or review of HEI science, and HEI’s reports do not necessarily represent their views.

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- Lippmann and colleagues conducted four coordinated toxicologic and epidemiologic studies. They analyzed heart rate variability and atherosclerosis as well as markers of inflammation and oxidative stress in animals and human cells exposed to PM samples from five geographic regions in the US. In epidemiologic studies, they examined short-term effects on mortality and hospital admissions associated with PM_{2.5} emissions in 150 U.S. cities; they also evaluated associations between long-term exposure to PM and mortality from cardiovascular and respiratory diseases and lung cancer for participants in the American Cancer Society's Cancer Prevention Study population.
- Vedal and colleagues hypothesized that the cardiovascular health effects associated with long-term exposure to PM_{2.5} are driven in large part by traffic-related sources. They examined associations of exposure to PM and effects in the Multi-Ethnic Study of Atherosclerosis (MESA) and the Women's Health Initiative–Observational Study (WHI-OS) populations. In a parallel toxicologic study, Matthew Campen of the University of New Mexico and Jake McDonald and colleagues at the Lovelace Respiratory Research Institute evaluated the role of mixed vehicular engine emissions and its various constituents in contributing to adverse health effects of PM.

Given the complexity and importance of this research, HEI appointed a special NPACT Oversight Committee of independent scientists to oversee every aspect of the research and statistical analyses; HEI also conducted independent audits for data quality assurance and control throughout the studies.

The investigators submitted comprehensive reports of their results which were subjected to intensive peer review by a Special Review Panel convened by the HEI Review Committee and comprised of fourteen experts who had no involvement with the design, implementation, or oversight of the studies. After the investigators had responded to the Panel's initial review, the Panel also crafted HEI Commentaries to summarize what the studies have shown, the implications for decision making, and what still needs to be learned.

What the NPACT Studies Add

- Lippmann and colleagues conducted studies in mice and in human cell lines exposed to ambient PM and epidemiologic studies of short- and long-term cardiovascular effects. Their study has provided new insights into the toxicity of PM components and source categories, and identified the Coal Combustion, Residual Oil Combustion, Traffic, and Metals source categories as most consistently associated with health effects. However, other components and source categories could not be definitively excluded as having no adverse effects.
- Vedal and colleagues' study of the cardiovascular effects of PM components focused on traffic sources; they evaluated data from the Multi-Ethnic Study of Atherosclerosis and Women's Health Initiative Observational Study cohorts and exposed mice to combinations of mixed vehicular engine emissions and non-vehicular PM. They found strong evidence for associations of PM_{2.5}, organic carbon, and sulfur with subclinical and clinical outcomes in the cohorts, with weaker evidence for elemental carbon. Their toxicologic study provided strong evidence for effects of mixed vehicular engine emissions and to a lesser extent exhaust gases on vascular markers in mice; non-vehicular PM induced few effects.

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- Taken together, the NPACT studies, which are to date the most systematic and comprehensive effort to combine epidemiologic and toxicologic analyses of these questions, found associations of secondary sulfate and, to a somewhat lesser extent, traffic sources with adverse health effects.
- The HEI Review Panel emphasized, however, that the studies do not provide compelling evidence that any specific source, component, or size class of PM may be excluded as a possible contributor to PM toxicity.
- Better understanding of exposure and health effects is needed before it can be concluded that regulations targeting specific sources or components of PM_{2.5} will protect public health more effectively than continuing to follow the current practices of targeting PM_{2.5} mass as a whole.

Next Steps Following release of these reports the HEI Research Committee will be examining the major findings and identifying priorities for research on unresolved issues as it goes forward to develop the next *HEI Strategic Plan for the Health Effects of Air Pollution*.

An Executive Summary of these comprehensive studies, along with the complete studies and online appendices of additional data can be found at www.healtheffects.org. For more information please contact Dan Greenbaum 617 283 5904 dgreenbaum@healtheffects.org or Annemoon van Erp 617 488 2346 avanerp@healtheffects.org

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