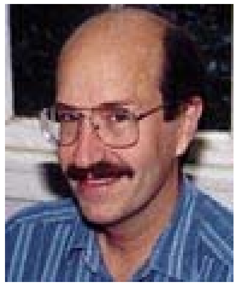
Department of Environmental Sciences & Engineerg

Interdisciplinary Program in Air Quality and Atmospheric Processes

The quality of the air we breathe outdoors, at work and in the home can affect our health and quality of life. Atmospheric processes have a major influence on air quality, as well as on long-term global processes such as climate change. Over the past 30 years, major research contributions of our faculty and students include the generation of an experimental database used to develop and test photochemical mechanisms in the atmosphere that contribute to air pollution; elucidation of the importance of atmospheric reaction products in the formation and composition of particulate matter; development of methods to measure and monitor airborne contaminants; and the development and application of occupational exposure models. Major research activities are ongoing in the following areas:

- **Unraveling and modeling the role of atmospherically generated secondary organic gas- and particle-phase products in human health effects.**
- **The link between air pollution and climate change, with respect to both the underlying science and the policy implications.**
- **Use of air-quality modeling to evaluate alternative strategies to control air pollution.**
- **Modeling and spatiotemporal mapping of contaminants generated in outdoor air and in the workplace to assess human exposure and corresponding health risks.**
- **Quantifying ecosystem-specific trace gas fluxes in natural and anthropogenically altered environments, and interpreting their implications for climate change.**

Individual faculty members with air-related interests include:



Michael Flynn

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Professor Flynn is interested in the development and application of mathematical models of human exposure to airborne contaminants in occupational environments. Current efforts focus on welding exposures and their relationship to neurodegenerative diseases.

Harvey Jeffries

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Professor Jeffries is a gas-phase atmospheric chemist specializing in volatile organic compound photo-oxidation with oxides of nitrogen to produce ozone (ie, "smog"). In addition, he is a mathematical modeler, creating numerical simulation models of photochemistry that become components of large scale Eulerian models incorporating meteorological and emissions sub-models. He has been active in using these models to plan public policy for air pollution control, and his research also focuses on the effectiveness of alternative fuels to reduce ozone and the atmospheric chemistry leading to global change.

Richard Kamens

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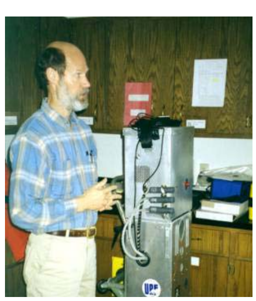
Professor Kamen's research interest focuses on the development of kinetics models to predict secondary organic aerosol formation. SOA formation is an important phenomenon that can influence urban haze formation, global temperature forcing calculations, and potentially may have human health effects. His models use large outdoor smog chamber data, integrate gas and particle phase chemistry and equilibrium partitioning thermodynamics and have been successfully used to predict secondary aerosol formation from organics emitted from vegetation. Most recently this has been expanded to aromatics, which are primarily emitted from anthropogenic sources. In the future his research will try to quantify processes that are involved in particle nucleation. Initially the focus will be the oxidation of sulfur dioxide to sulfuric acid and organic aerosol nucleation. He also directs a study abroad program in Thailand which focuses on feasibility of bio-fuels in South East Asia and their potential environmental and economic impacts.



David Leith

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Professor Leith is interested in aerosol physics and in the engineering control of airborne pollutants. This work is concerned with: (1) factors that affect the generation and release of air contaminants, (2) methods to measure the concentration and properties of contaminants in outdoor air and in the workplace, and (3) engineered methods to remove these contaminants from waste gas streams.

Marc Serre

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Assistant Professor Serre is interested in the development of space/time statistical methods to model the distribution of environmental and health processes, and their application in exposure mapping, disease mapping, environmental epidemiology and risk assessment. His interests in the application of these methods to study problems of air pollution and their health effects include the use of active and passive samplers to monitor air pollution at the community level, the development of land use regression models for air quality, the integration of monitoring data with air quality model predictions, and the use of spatial regression techniques to measure the strength of associations between air pollutants and health endpoints such as cardiovascular mortality, asthma, malodor, and quality of life .

Ken Sexton

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Research Associate Sexton is interested in atmospheric chemistry of urban air pollution systems of nitrogen oxides and hydrocarbons, such as produced from motor vehicle and industrial emissions, with the focus on understanding the reactive chemistry producing ozone and other air toxics, using smog chambers. Research includes producing data suitable for simulating the experiments for the purposes of evaluating chemical mechanisms for use in air quality models for ozone and air toxics, used in estimating control requirements and estimates of human exposure and health effects. In the last six years, he has focused on developing and demonstrating new technological systems to interface smog chambers and *in vitro* toxicological exposure systems for evaluating the effects of photochemistry on urban air mixtures and the resulting toxic potential for health effects. The results of these studies have helped explain the differences in findings between classical human clinical studies of ozone exposures and epidemiological studies showing associations of hospital emissions with much lower concentrations of ozone, and suggest that the health effects of urban "smog" are underestimated. These new toxicological systems include a new *in vitro* exposure apparatus for particulate matter, and a new laboratory and outdoor chamber suitable for aerosol research, including both toxicology and analytical capabilities.

William Vizuete

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Assistant Professor Vizuete uses high performance computers and three-dimensional simulations to model the atmosphere with a focus on understanding the chemistry of pollution formation. These computer models provide insight into the complex interaction of chemistry and physical processes that ultimately produce air pollution. A significant part of Dr. Vizuete's work focuses on providing technical expertise to state and federal policymakers who are developing pollution reduction strategies. Through this work, he is able to provide objective scientific analysis for policies that will affect the health of millions of people. Dr. Vizuete is also interested in the chemistry of aerosols and linking atmospheric chemistry to health effects

Jason West

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Assistant Professor West is interested broadly in the problems of air pollution and climate change, and researches the science and policy links between these problems. He uses global models of air pollutant transport and quantitative methods of policy analysis to consider interrelated problems: the effects of air pollutants on climate change, the inter-continental transport of ozone and particulate matter, the effects of air pollution on human health, and the effects of energy technologies on future air pollution and climate change. His research aims at building the tools to analyze mitigation of air pollution and climate change in an integrated manner, considering both industrialized and developing nations.