



POLLUTION PREVENTION
FACULTY AND PROGRAMS:
PHYSICAL SCIENCE



ATMOSPHERIC SCIENCE

386 DR. JOHN R. BARKER

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The Air Quality Master of Engineering program at the University of Michigan trains baccalaureate degree holders in air quality. It features training in both monitoring and computer modeling, and it has a component in policy/regulation issues. It also has close ties with the UM Department of Public Health, where active research is taking place regarding the transport and fates of trace metals, toxic, and other species. Dr. Barker's personal research is the laboratory investigation of rates and mechanisms of atmospheric reactions. His research team is currently studying aqueous phase reactions involving free radical photochemistry. He has recently published a book on Atmospheric Chemistry entitled Problems and Progress in Atmospheric Chemistry (John R. Barker, Editor, Advanced Series in Physical Chemistry, Vol. 3, Series Editor C.Y. Ng, World Scientific, Singapore, 1995).

387 DR. RICHARD P. TURCO

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Involved with the UCLA Institute of the Environment, UCLA Environmental Coalition, UCLA Center for Environmental Risk Reduction, and the UCLA Pollution Prevention Education and Research Center (PPEREC). PPEREC's mission is to reduce or eliminate the use of toxic substances; to conserve resources; and to improve human and environmental health through an interdisciplinary program of education, research and outreach. Activities of PPEREC include classes and lecture series, pollution prevention forums, industry roundtables, training seminars, and operation of a resource center. Dr. Turco's teaching and research is in the area of Atmospheric Chemistry—an area which plays a key role in defining the sources and sinks of emitted chemical compounds, their effects on air quality, the ozone layer, and various elements of the climate system. The atmospheric chemistry modeling program at UCLA includes studies of stratospheric and tropospheric chemistry including photochemical and heterogeneous chemical processes. For more information, visit WWW site at http://www.atmos.ucla.edu:80/brochure/atm_chemistry.html/.



CHEMISTRY

388 DR. THOMAS CARROL

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Introduces general pollution prevention concepts into organic chemistry courses and laboratories. Has worked to reduce waste in all chemistry experiments (e.g. substituted (1) CrO₃ with bleach in the synthesis of

adipic acid from cyclohexane and (2) K_2CrO_4 with non-polluting organics in spectrophotometer demonstration of Beer's Law). He serves as science advisor to the Westchester Environmental Coalition. The Chemistry Department is in the planning stages for an environmental Bachelor's degree at Keuka College.

389 DR. TERRENCE COLLINS

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Teaches undergraduate and graduate courses on benign chemistry—the development of environmentally-conscious chemicals to replace pre-existing toxic chemicals.

390 DR. THOMAS DUNN

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Dr. Dunn is working with NPPC Research Manager Gregory Keoleian (record number 99) and Jon Greene, a UM Master's student, on an introduction and case study to add to the NPPC's *Chemistry Compendium*. The objective is to develop an evaluatory framework for chemical synthesis which incorporates pollution prevention and life cycle design principles. The framework will be demonstrated utilizing a case study to compare specific production and use characteristics of two chemicals. The background section will provide a research overview of the emerging field of green chemistry.

391 DR. GARY HICKERNALL

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Introduces general pollution prevention concepts into organic chemistry courses and laboratories. Has worked to reduce waste in all chemistry experiments (e.g. substituted (1) CrO_3 with bleach in the synthesis of adipic acid from cyclohexane and (2) K_2CrO_4 with non-polluting organics in spectrophotometer demonstration of Beer's Law). He serves as science advisor to the Westchester Environmental Coalition. The Chemistry Department is in the planning stages for an environmental Bachelor's degree at Keuka College.

392 DR. BRUCE R. KOWALSKI

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Founder and Director of the Center for Process Analytical Chemistry (CPAC), a NSF Industry/University Cooperative Research Center at the University of Washington (Seattle). CPAC's mission is to develop on-line, real-time chemical analyzer systems for process optimization and control for both increased industrial competitiveness and pollution prevention. Founded the area of chemometrics, the use of multivariate mathematics to solve chemical problems. Chemometrics is essential for analysis of the complex issues resulting from advanced chemical analysis of industrial processes or environmental contamination sites. CPAC is developing a new type of chemical sensor, a second order sensor, which requires chemometrics to analyze the data produced in response to the analyte of interest in the presence of unknown interferences. CPAC is currently involved in a project for the Westinghouse Hanford Company using spectroscopy and chemometrics to non-invasively measure the moisture content in Hanford waste tanks. Professor Kowalski has trained numerous postdoctoral and visiting scientists in the area of chemometrics. For more information about others involved with CPAC, see record number 102 (McGrath).

393 DR. KENT MANN

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Has upgraded several chemistry laboratory experiments with P2 in mind. In general chemistry courses he relates the chemistry of the environment to real issues such as acid rain, ozone depletion, etc. Chemistry, as a discipline, is not a significant waste generator; however, waste reduction and P2 work has been spurred recently by high disposal costs. The Department commitment to P2 is strong and future plans include development of a comprehensive P2 curriculum.

394 DR. MARIO MOLINA

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Research and teaching focus on the chemistry of the global atmosphere and the way it is affected by humans. Emphasizes the need to understand how the atmosphere functions in order to prevent damage to the environment. Global atmospheric pollution can be prevented by reducing harmful emissions. Past work focused on the chemistry of ozone depletion in the stratosphere. Laboratory research involves investigations of elementary gas phase chemical and photochemical reactions, and of heterogeneous processes occurring on cloud particles.

395 DR. SAMUEL P. SAWAN

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Studying the interaction of supercritical carbon dioxide with polymers and adhesives for applications such as cleaning or disassembly of manufactured goods. These studies are driven by the need to find replacements for CFCs for cleaning and other industrial applications. Additionally, such studies may allow for the facile disassembly and recycling of products that have been manufactured using adhesives.

396 DR. ALEC SCRANTON

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Conducts research on the development of high-performance coatings and inks which emit no volatile organic components during cure. While most of his work in the area is focused on research rather than education, he has discussed this topic in several courses he teaches, and in public presentations on P2. The emission of volatile organic components (VOCs) from curing inks and coatings is a leading cause of atmospheric pollution. Numerous studies have shown that when these VOCs enter the atmosphere they result in the formation of smog and air pollution. Researches the use of pollution-free, high performance coatings.

397 DR. SANFORD SILLMAN

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Research on the chemistry of urban smog (ozone), including models for ozone formation in urban areas; also models for regional and global chemical balances associated with air pollution. Although Dr. Sillman does not hold a teaching position, he regularly works with graduate students, gives seminars and guest lectures for undergraduate courses. He also works with state regulatory groups and environmental groups that are concerned with urban smog. Has also done research on solar energy development, and taught a university course on energy and environment. Published a general interest article, "Tropospheric Ozone: The Debate Over Control Strategies" (*Annual Review of Energy and Environment*, 1993, vol. 18, p. 31-56).

398 DR. MONO M. SINGH

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The Microscale Chemistry Laboratory Program is the ideal ethical approach to how science should be conducted in the laboratory at the turn of the millennium. Microscale Chemistry is a means of reducing chemical waste at the source, by reducing the quantity of chemicals used in research, development and testing laboratories. Workers who are trained in microscale techniques are better able to see possibilities for waste reduction on the production line, so the possibilities of reducing volumes of waste streams are quite substantial. It is also pedagogically positive, as it shortens reaction times, reduces the laboratory fear factor, and allows the student to perform a much wider variety of experiments. The program offers four three-day workshops for high school teachers, two workshops for elementary teachers and three workshops for college and university teachers. Additionally, workshops are conducted at different sites upon invitation. For more information on people involved with the National Microscale Chemistry Center, see record numbers 77 (Pike) and 79 (Szafran).

399 DR. T. SPIRO

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Research interests are in mass flows and exposure to toxic chemicals (dioxin, lead, cadmium) and in chemical mechanisms of pollutant mobilization in soils. Teaching focuses on environmental chemistry and chemistry for non-science students via environmental issues. Dr. Spiro has published a book on this subject.

400 DR. ERIC M. SUUBERG

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Has conducted research in energy conversion, fire safety, nitrous oxide mitigation, automotive tire recycling, and plastics recycling. Also involved in many aspects of coal chemistry and combustion. Has taught courses on environmental aspects of energy conversion and on chemical and phase equilibria of environmental systems.

401 DR. SCOT WHERLAND

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Is working on introducing P2 ideas into a general chemistry course and laboratory experiments. Has gradually substituted toxic and heavy metals in the unknowns of laboratory assignments with non-toxic elements. Dr. Wherland is actively looking down the P2 road for the development of strong chemistry education curricula.

402 DR. LUCIAN ZELAZNY

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Teaches *Soil Chemistry* and *Soil, Physical and Colloidal Chemistry* to graduate students. Conducts research on waste management; acid rain; metal adsorption, mobilization, speciation and toxicity; mine-land reclamation; and colloid facilitated transport.