Introduction to Environmental Forensics of Organic Chemicals: Survey of Applications, Approaches, Capabilities, and Limitations

Presented by David M. Mauro (META Environmental, Inc.)

Environmental forensics is the systematic and scientific evaluation of environmental data, using various disciplines, for the purpose of developing defensible scientific and legal conclusions regarding the source, age and history of chemical pollutants released into the environment.

This course will introduce participants to the principles of environmental forensic science and survey the major applications and techniques for organic chemicals. In particular, you will learn about the sources, composition, transport, and fate of selected chemicals in the environment; forensic sampling and analysis techniques; and data analysis and presentation.

These concepts will be illustrated with several mini-case studies which have been prepared from the field of environmental forensic science.
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Course Outline

8:00 – 8:45 AM What is Environmental Forensic Science

- Legal context
- Goals and applications
- General approaches to a site-specific environmental forensic study

8:45 – 9:30 AM Sampling Considerations

- How many samples?
- Where?
- Statistical sampling designs

9:30 – 10:20 Analytical Methods and Quality Control

- GC and GC/MS methods - Comparison of forensic methods to conventional methods
- Isotope methods
- QA/QC issues and their impact on source identification

10:20 – 10:35 Break

10:35 – 12:00 PM Hydrocarbon Forensics

- Petrogenic substances (petroleum products)
- Pyrogenic substances (coal tar, creosote, incomplete combustion)

*Fingerprints, Ratios, and other Data Analysis*

- What can you do with conventional investigation data?
- What is done with typical environmental forensic data?

12:00 – 1:00 Lunch
1:00 – 1:45 PM  Hydrocarbon Forensics (Continued)

- Age-dating
- Urban background
- Quantitative Forensics

1:45 – 2:30 PM  Chlorinated solvents

2:30 – 2:45  Break

2:45 – 3:30 PM  PCBs, PCDDs/PCDFs

3:30 – 4:00 PM  Emerging Methods in Environmental Forensics

4:00 – 5:00 PM  More Case Studies and Q&A
David M. Mauro
President/Senior Scientist
META Environmental, Inc.

Mr. Mauro is an environmental and analytical chemist with more than 30 years of experience in the field. He is co-founder and president of META Environmental, Inc. (META), a nationally-recognized environmental consulting and laboratory services company. Mr. Mauro has served as the project manager or senior technical consultant for dozens of projects involving design and implementation of site characterization studies, source identification and cost allocation studies, treatability studies, environmental fate and transport studies, statistical and quality control studies, and remedial designs under CERCLA, RCRA, and other programs.

Education
Ph.D. Candidate - Boston University - Chemistry

M.S. - 1982 - Florida Institute of Technology - Environmental Science
Thesis Title: "4-(4-Nitrobenzyl)pyridine Tests for Mutagens Following Chemical Oxidative Activation"

B.S. - 1977 - Southampton College of Long Island University - Biology & Env. Science

Project Experience

- Mr. Mauro was the Principal Investigator for an Electric Power Research Institute (EPRI) contract, "MGP Site and Materials Research: Source Characterization, Identification, and Fingerprinting." This contract included a detailed literature, field, and laboratory study of the formation, sources, and chemical composition of wastes, such as tars and oils, found at former MGP sites. In addition, the project objectives include evaluating sampling and analysis methods for discriminating sources of contamination, applying mathematical and display methods for quantifying dissimilarity, and developing bases for cost allocation. The results of this work form the basis for most of the environment forensic assessments and cost allocations involving MGP sites conducted in the U.S. today.
  - In addition, Mr. Mauro has built an environmental forensics services practice that involves consulting and laboratory testing at numerous former MGP and coke plant sites throughout the U.S. He is actively working on many of the largest sediment contamination sites in the country that involve PAHs.

- Mr. Mauro has been the senior chemist and forensic expert for several major industrial and municipal clients managing contaminated sediments; services provided have included: historical research and the evaluation of dozens of industrial/commercial sites including coking plants, foundries, MGP, shipyards, scrap yards, tank farms, wood treating sites, landfills, POTWs, and urban runoff potentially contaminated with PCBs, PCDDs/PCDFs, hydrocarbons, coal tar or creosote, metals, and municipal wastes.
Mr. Mauro has been responsible for soil and sediment sampling; design and implementation of laboratory testing programs using routine and special forensic analyses; evaluation of chemical transport and fate; review and critique of human health and ecological risk assessments; development of source attribution models; evaluation of remediation drivers and potential alternatives and providing independent remediation cost estimates; and assessing Natural Resource Damage (NRD) claims.

Mr. Mauro is a recognized expert on sediment contamination issues near former MGP sites; regulatory criteria; and background levels and sources of PAHs.

Mr. Mauro also specializes in identifying and allocating sources of PCBs and PCDDs/PCDFs to urban sediments.

Mr. Mauro was a Principal Investigator and Project Manager for the multiyear EPRI contract, "Sampling and Analysis of Organic Substances - An Initial Evaluation and Case Studies." The goals of this project were to develop an understanding of the distribution, movement, and fate of organic substances at MGP sites, and to develop sampling and analysis techniques, and remediation methods for use at MGP sites. His responsibilities included conducting soil gas surveys, developing rapid on-site analytical techniques and operating on-site laboratories, managing contract laboratory work, evaluating data quality, evaluating chemical fate and transport, and conducting treatability studies.

Mr. Mauro was the Principal Investigator for a multiyear EPRI contract, "PCB Research and Technical Information." This contract includes a detailed literature, field, and laboratory study of the sources, sampling and analysis methods, transport and fate properties, and regulations associated with PCBs at utility sites. The research evaluated the various approaches for measurement of PCB congeners and their use in risk assessment and source apportionment. The work has been extended with a new EPRI contract, “Investigating PCB Congeners,” that is looking at the regulatory and risk drivers for PCB congener use, the congener-specific transport and fate properties of PCB dielectric fluids, and the use of PCB congeners to identify PCB sources.

Mr. Mauro built a NELAP-certified environmental specialty laboratory at META that specialized in forensic analyses and applied R&D for the electric and gas utility industry across the U.S. META’s laboratory operated for 23 years until it was purchased by Accutest Laboratories in 2013.

Mr. Mauro has been a technical expert on several litigation cases during the past several years that have involved MGP contamination issues, PCB contamination issues, dioxin contamination issues, metals, chemical transport, fate, and source apportionment, urban background sources of PAHs, PCBs, dioxins/furans, and other chemicals, contamination of indoor dust, and sources of petroleum releases. He has provided expert testimony on sediment contamination and chemical transport and fate in sediment.

In addition to these projects, Mr. Mauro has extensive experience in the characterization, fate and transport properties, analytical methods, and quality assurance procedures at sites contaminated with refined petroleum products, wood preservatives (creosote and PCP), PCBs, non-PCB dielectric fluids, metals and solvents. He has been a technical consultant for several projects involving fires and explosions of PCB fluids and PCB-containing materials, including review and assessment of data from the World Trade Center disaster.
Selected Recent Publications and Presentations


