

RAYMOND G. MERRILL, JR.

Education

Ph.D., Analytical Chemistry, Duke University, Durham, North Carolina, 1977.

B.S., Cum Laude, Chemistry, Stetson University, Deland, Florida, 1972.

Experience

Senior Program Manager, Eastern Research Group, Inc., 1996-Present.

Senior Program Manager, Radian Corporation, 1992-1996.

Program Manager, Radian Corporation, 1990-1992.

Senior Staff Scientist, Group Leader, Radian Corporation, 1987-1990.

Senior Scientist, Radian Corporation, 1986-1987.

Research Chemist, GS-14, U.S. Environmental Protection Agency, 1983-1986.

Chemist, GS-13, U.S. Environmental Protection Agency, 1980-1983.

Chemist, GS-12, U.S. Environmental Protection Agency, 1978-1980.

Research Associate/Research Fellow, Duke University, 1976-1978.

Fields of Experience

Dr. Merrill is an internationally recognized environmental chemist with over 29 years of experience in environmental measurements systems, methods development, method validation, and Quality Management Systems. He is experienced in a broad range of applications chemistry, including routine chemical analysis procedures through high hazard chemical containment. He planned, developed, and managed EPA's in-house multimedia (air, soil, and water) research laboratory during the 12 years he spent with EPA's Office of Research and Development Engineering Laboratory in Research Triangle Park, North Carolina. Dr. Merrill managed and led environmental sampling and analysis business for Radian Corporation and Eastern Research Group since 1987. Dr. Merrill is active in ASTM and ISO standard development and consults internationally on environmental Lab quality issues, good lab practice, and application of ISO 25 to environmental laboratories. He is currently Quality Assurance Site Manager for ERG's Durham laboratory and Morrisville Office. In this role he is responsible for maintaining laboratory quality certification under EPA's National Environmental Laboratory Accreditation Conference (NELAC). He teaches courses on methods application EPA permit writers, provides training internationally on laboratory management, quality systems development, laboratory audit programs, and project management. He is co-chair of AWMA's Air Quality Measurement Methods and Technology Symposium and the Source Emission Society's Stationary Sampling and Analysis for Air Pollutants Conference.

Recent Ambient Air Monitoring Project Experience

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- Project Manager for EPA's Guidance on Site Selection for the Enhanced Ozone Monitoring Program (March through October 1993). Dr Merrill coordinated efforts to develop guidance for Photochemical Air Monitoring Stations that incorporate all EPA existing monitoring requirements plus the additional guidance needed for automated ozone precursor sampling and analysis site selection.
- Contract Manager for EPA's National support contract for NMOC, Urban Air Toxics and PAMS Networks, EPA Contract No. 68-D3-0095. He was a key member of the proposal and technical team that has won repeat awards of this program since 1987. This program represents 12 continuous years of outstanding service to EPA's national ambient air toxics and nonmethane monitoring program.
- Project Manager and Senior Analytical Steering Committee member for volatile and semivolatile sampling and analysis of emissions from propellant, explosive, and pyrotechnic (PEP) detonation and burning at the BangBox experimental test facility at Dugway Proving Grounds, UT, 1990-1996. He developed methods and monitored volatile and semivolatile organic compounds and coordinated the efforts of three prequalified laboratories covering inorganic, volatile organic, and inorganic materials analysis. This program set the basis for all Resource Recovery and Conservation Act (RCRA) Subpart X permits for demilitarization of waste explosives, flares, and propellants.
- Senior Contract Manager and Peer Reviewer for REPA Zone 2 ambient monitoring and model verification program for boilers, industrial furnaces and hazardous waste incinerators (1997-1998). His responsibilities included coordination of network design, sampling and analytical method selection, Test Plan development, QA plan development, Health and Safety program, site support, and analysis support. This program is the first to demonstrate ambient model verification for use of exposure and risk in permits under RCRA omnibus rule for site specific risk assessment of hazardous waste incinerators.

Recent Source Sampling and Analysis Project Experience

- Project Manager and provided sampling and analytical support to Indian Head Division (IHDIV) of the Naval Surface Warfare Center for chamber testing of biological agent defeat (January - July 2003). The Vulcan Agent Defeat unit is a thermal device designed to decontaminate an area suspected to contain biological agents. Sampling support included the development of a sampling system to measure metals, chlorine, and soluble metal anions (fluoride, chloride, nitrate). Analytical support included selecting analytical methods that meet state-of-the-science quality control requirements reportable for both research investigations and regulatory reporting. Analyses were performed in quick response (24-hour turnaround times) to allow formulation and experimental design changes to meet the IHDIV project schedule and development requirements for agent

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defeat. Analyses were performed following National Environmental Laboratory Accreditation Council certification and quality requirements.

- Senior Program Manager and Contract Manager on “Development and Validation of Source Emission Methodology in Support of Clean Air Act Title III Air Toxics”, EPA AREAL Contract No. 68-D4-0022, 68-D0-0011, (1991-1998). Dr. Merrill managed more than 20 simultaneous work assignments and over \$8 million in contract research. The technical effort on these contracts required the development of methods to measure emissions of toxic and hazardous air pollutants from stationary sources. Coordinated efforts with multiple specialty subcontract laboratories for critical high profile chemical analysis. Work involved using ERG’s high hazard containment laboratory to develop sampling and analytical methods for acutely toxic materials such as phosgene, hydrogen cyanide, volatile organic compounds, semivolatile organic compounds, pesticides, chlorinated dioxins and isocyanates. He coordinated round robin evaluation of analysis methods for indoor air pollutants. The methods developed and validated on this contract are currently EPA’s required techniques for inorganic and organic regulatory compliance demonstration from stationary sources of air pollution. In addition to his management, was Principal Investigator/Senior Peer Reviewer on projects dealing with developing procedures and guidelines for new monitoring methods for Clean Air Act Amendment Title III organic compounds.
- Dr. Merrill was Program Manager for “Source Testing and Method Evaluation For Stationary Source Organic Emissions” in support of EPA OAQPS, 1990-1994. This contract was EPA’s regulatory application of stationary source methods developed by Radian and EPA. Dr. Merrill was responsible for oversight, client interface, budget control, report delivery and quality on over \$5 million in stationary source emissions testing and regulatory support. He coordinated more than 25 active work assignments simultaneously, working with senior field project leads and multiple EPA Work Assignment Managers. Coordinated efforts with multiple specialty subcontract laboratories for critical high profile chemical analysis including chlorinated dioxin/furan and toxic metals. Maintained a monthly schedule with the EPA Technical Project Officer to insure that budget and deliverable targets were met during a time of high intensity and changing objectives for EPA.
- Program Manager for Jet Engine Emissions Testing for US DoD, Air Force, 1995-1996. Dr. Merrill designed the technical approach, negotiated technical issues with EPA for the Air Force, presented program approaches and objectives to senior military staff, and executed an innovative test program. Managed and coordinated a highly successful test program for criteria and Clean Air Act Amendment Title III compounds emitted from military jet fighter engines operated across a full range of thrust conditions from idle to zone 5 (full afterburner). Data and emission factors from this program were used to

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demonstrate compliance with engine test facility (Hush House) emissions requirements under Title 5 of the Clean Air Act Amendment of 1990.

- Contract Manager on the “National Technical Services Master Service Agreement” with BASF corporation. This contract involved field testing at BASF sites in the United States. Specific projects required Field Test Plans, Quality Assurance Plans, and Health & Safety Plans. Work was primarily directed toward process evaluation and permit compliance testing 1994-1996.
- Dr. Merrill was responsible for the EPA's original field manual for Modified Method 5 sampling and the early research on collection sorbents which became the fundamental building block for persistent, toxic, and bioaccumulatable semivolatile and nonvolatile organic sampling and analysis. This method is the basis for current EPA methods including: RCRA SW-846 Method 0010, Method 0023A, and EPA OAQPS Modified Method 5 and Method 23.

Quality Assurance & Quality Control Experience

- Contract Manager and Senior Peer Reviewer for ERG's Stationary Source Audit Program, EPA Contract.. This contract provides EPA with Quality Assurance and Performance evaluation samples as well as training and method development support for compliance audit materials (1996 -2005).
- Program Manager for preparation of the Technical Assistance Document for Enhanced Ozone Monitoring sponsored by EPA/OAQPS on EPA ORD/AREAL, 1993. Dr. Merrill coordinated the activities of senior corporate measurements experts in field sampling and chemical analysis and client interface with an extremely demanding client to document state of the art guidance for ambient air quality measurement techniques that were still under development by EPA.
- Dr. Merrill was Senior Contract Manager and Field Auditor for REPA Zone 2 Trial Burn support under RCRA Subpart B permitting. Responsibilities included coordination of guidance document sections for laboratory audit procedures, performance of audits, cost estimates, and management of budget and schedule for audits.
- Consultant and trainer to the Philippine Industrial Initiative for a Sustainable Environment (IISE). Dr Merrill was the quality trainer and consultant to Chemonics/ECODIT and Madecore Environmental Management Systems for Laboratory Bench marking and Market Demand studies in the Philippines. In this effort, Dr. Merrill developed a laboratory evaluation system to ensure data of known quality were generated for environmental monitoring and assessment programs.

Monitoring System Design and Development

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- Program Manager for the Ambient Air Monitoring Program for Eastman Kodak in Rochester, NY. This effort involves coordination with Kodak, the New York Department of Environmental Conservation, and associate contract laboratories to formulate site design, sampling and analysis approaches, and implementation of the monitoring program, 1989-1995.

Other Relevant Experience

- He was senior peer reviewer for EPA's National Peer Review of Draft Guidance Document on Sampling and Analysis Methodology for Site Specific Risk Assessment related to EPA's combined RCRA/Clean Air Act MACT Rule for Hazardous Waste Incinerators.
- Dr. Merrill is project manager and lead technical advisor for the development of Performance Based Measurements Systems Training and Guidance PBMS, under EPA/ORD contract 68-D7-0001 (January 1999- September 2000). Dr. Merrill developed guidance documents, as well as training and briefing materials in modules for the EMMC PBMS Training Work Group. He developed guidance manuals with an associated training and briefing package and literature publications on application of PBMS concepts to regulation writing, permit preparation, and facility compliance audits.
- Dr. Merrill was also the project manager for development of Performance Based Measurements Implementation Planning for EPA's Office of Air and Radiation. This guidance document development included liaison between the EPA Office of Air and Radiation (OAR) representatives. The resulting implementation plan included a catalogue of EPA air standards that require analytical measurements, recommendations for PBMS applicability, and a ranking of current OAR methods to modify for PBMS.
- Dr. Merrill teaches the Sampling, Analytical, and Quality Assurance portions of EPA's training seminar on Resource Recovery and Reclamation Act (RCRA), Hazardous Incinerator Permit Writer Course. Dr. Merrill developed and revised training material to include instruction on new methods used to comply with the combined Maximum Achievable Control Technology (MACT) Clean Air Act Amendments (CAAA), RCRA revised rule issued in July of 1999.
- He was Contract Manager for "Environmental and Industrial Hygiene Support" with GlaxoWellcome Corporation. The program included development of new or modified analysis procedures for industrial hygiene sampling and analysis approaches for research and new production pharmaceuticals. Dr. Merrill was responsible for cost estimates, planning, schedule and deliverables, coordination of standard operating procedure (SOP) development, and HPLC methods consulting. The client used SOPs developed in this program as the procedure for its international program for IH sample analysis of new

pharmaceuticals.

Laboratory Management

- At EPA, managed research and development performed in AEERL's central analytical laboratory supporting AEERL's engineering program. Efforts in this laboratory involve the development and application of methods for the identification of key indicators of process or control performance. New techniques for the analysis of volatile-water soluble hazardous materials were developed in this laboratory under Dr. Merrill's direction. Hybrid analytical techniques were one of Dr. Merrill's major research interests. These techniques allow survey of environmental samples for major inorganic and organic components while simultaneously allowing identification of compounds or elements of EPA hazardous materials lists.
- At EPA, planned and managed the development of a centralized analytical laboratory staffed by eight chemists and technicians. Managed operation and planning aspects for facilities, equipment, sample analysis, and quality control. Method development in this laboratory included new and improved techniques for: inorganic element and compound identification, survey techniques for hazardous organic compounds, and indicator tests for specific classes of hazardous materials. Dr. Merrill's organic materials research at EPA involved the application of GC/MS, HPLC, GC, infrared and Fourier transform infrared spectroscopy (IR and FTIR), and ultraviolet spectroscopy (UV). His efforts in inorganic methods development involved the use and application of X-ray fluorescence (XRF) and atomic absorption spectrometry (AA) and inductively coupled argon plasma spectroscopy (ICAP) for elemental analysis; and ion chromatography (IC), UV spectrometry, and IR spectrometry for anion, cation, and inorganic compound identification.

Interdisciplinary Liaison

- Proposed, planned, and managed major contract research programs for development of sampling, analysis, and application of short term bioassays to complex mixtures. Planned, equipped, and managed central analytical laboratory responsible for research and method development at ERG, Radian, and U.S. EPA.
- At Duke University, participated in an interagency personnel agreement with the EPA where he acted as liaison between EPA/ORD biological laboratories and the engineering research in the AEERL.
- Dr. Merrill's success in merging the application of engineering, chemical, and biological disciplines to evaluate and interpret environmentally relevant pollution problems has brought him national and international recognition. Participated in a NATO conference and workshop, instructed an Environmental Mutagen Society training session, presented

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papers and chaired numerous scientific meetings including: Application of Biological Testing to Complex Environmental Mixtures, International Symposium on Polynuclear Aromatic Hydrocarbons, International Symposium on Measurement of Toxic and Related Air Pollutants, and the International Symposium on In-Vitro Toxicity Testing of Environmental Agents.

- At EPA, he managed support contracts to develop, implement, and trouble-shoot chemical and biological testing for environmental assessment and survey sampling and analysis programs. These contracts were used to support problem solving and method development needs of EPA programs in the Office of Water Programs, Office of Environmental Programs and Effects Research, and the Office of Health Research. A number of high quality research reports have resulted from this program and have proven useful to the scientific community in general.
- At EPA, he was responsible for developing and recommending analytical procedures for identification of toxic and genotoxic components from point sources in the EPA Integrated Air Cancer Program. Completed a major contribution to the field of integrated data interpretation while he was with the EPA. This work involved a technique for the combined ranking of engineering, chemical, and biological test results to direct Agency R&D efforts in control and treatment of stationary source emissions.

Consulting and Support

- At EPA, he was responsible for providing the chemical and comparison biological methods to Corvallis Research Laboratory to evaluate the effect of hazardous waste landfills. In response to a request from EPA's Kerr Laboratory in Ada, Oklahoma, acted as advisor, consultant, and Agency reviewer for a combined screening and bioassay protocol for hazardous waste land farm applications.
- While at the EPA, represented four Research Triangle Park ORD laboratories on a national committee convened to develop procedures for the preparation of environmental and waste samples for chemical and biological testing. He is one of five EPA experts chosen to work with academic, industrial, and other federal agencies to prepare procedures for this quickly developing area of environmental testing.
- Served as the EPA's representative and was secretary of ASTM E-6.54 Committee on methods to evaluate efficiency and emissions of Solid Fuel Burning Appliances. As a member of this committee he represented the EPA in matters of policy, coordination, and sampling and analytical measurement technology. He part of the EPA's Woodstove New Source Performance Standard and Regulatory Negotiation team and represented the EPA's ORD in matters involving the technical basis for sampling and analysis for this regulation.

Professional Societies/Honors

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American Society for Testing and Materials (Current)
Air and Waste Management Association (Current)
Gamma Sigma Epsilon - Chemistry Honorary
Phi Lambda Upsilon - Chemistry Honorary
Delta Phi Alpha - National German Honorary
American Enka Department Research Fellow, 1976
National Science Foundation Research Assistant, 1971
American Chemical Society Alan T. Waterman Award, EPA Nomination, 1983

Publications

General Chairman and Planning Counsel for the AWMA Symposium on Air Quality Measurements and Monitoring Technology 2002 - 2006.

International Symposium on Measurement of Toxic and Related Air Pollutants, Co-Chair Source Sampling Methodology Session, Research Triangle Park, NC, 1995, 1996, 1997 and 1998.

Bursey, J.T., J.F. McGaughey, R.F. Martz, R.G. Merrill, C.M. Morris, and J.C. Suggs. "Evaluation of Candidate Procedures for the Preparation of Audit Materials for Analysis of Semivolatile Organic Compounds." Intern. J. Environ. Anal. Chem., Vol. 71(1), pp 57-71, 1998.

Steger, Joette L., Bursey, Joan T., Merrill, Raymond G., Epperson, David, Coppedge, Easter, Johnson, Larry, and Jackson, Merrill D. Research and Development of a Field Ready Protocol for Phosgene. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

Steger, Joette L., Merrill, Raymond G., Fuerst, Robert G., Johnson, Larry D., Jackson, Merrill D., and Parrish, Charles R., Development and Evaluation of a Source Sampling and Analysis Method for Hydrogen Cyanide. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

Jackson, Merrill., Bursey, Joan T., McGaughey, James F., and Merrill, Raymond G., An Evaluation of the VOST method for Non-Halogenated Compounds at an Agricultural Chemical Manufacturing Facility. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

Jackson, Merrill D., Bursey, Joan T., McGaughey, James F., and Merrill, Raymond G., An Evaluation of the SemiVOST Method for Non-Halogenated Compounds at an Agricultural Chemical Manufacturing Facility. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

Bursey, Joan T., McGaughey, James F., Merrill, Raymond G., Knoll, Joseph E., Ward, Thomas E.,

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and Jackson, Merrill D., Field Testing to Complete Validation of a Manual Method for High Levels of Phenolic Compounds. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

McGaughey, James F., Bursey, Joan T., Merrill, Raymond G., Fuerst, Robert G., and Jackson, Merrill D. Field Evaluation of EPA Proposed Method 0040 (Sampling and analysis of volatile Organic compounds Using Tedlar Bags. Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, April 29 - May-1, 1997.

Jackson, Merrill D., J. T. Bursey, J. F. McGaughey, and R. G. Merrill. "An Evaluation of the SemiVOST Method for Halogenated Compounds at a Chemical Manufacturing Facility." Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, May-16-18, 1995.

Jackson, Merrill D., J. T. Bursey, J. F. McGaughey, and R. G. Merrill. "Application of VOST and SemiVOST to Nonhalogenated CAAA Compounds." Presented at International Symposium on Measurement of Toxic and Related Air Pollutants. Research Triangle Park, NC, May-16-18, 1995.

McGaughey, J. F., J. T. Bursey, J. Rice, R. G. Merrill, and M. D. Jackson. "Field Test of a Generic Method for Halogenated Hydrocarbons from the Clean Air Act List." Presented at the 13th International Incineration Conference, May 9-14, 1994. Houston, Texas.

Steger, J. L., D. E. Wagoner, J. T. Bursey, R. G. Merrill, R. G. Fuerst, and L. D. Johnson. "Laboratory Evaluation of Method 0050 for Hydrogen Chloride." Presented at the 13th International Incineration Conference, May 9-14, 1994. Houston, Texas.

McGaughey, J. F., R. G. Merrill, J. T. Bursey, D. E. Wagoner, M. D. Jackson, and L. D. Johnson. "Preparation of the Components of the Modified Method 5 (Method 0010) Sampling Train for Analysis by SW-846 Method 8270. Presented at the 13th International Incineration Conference, May 9-14, 1994. Houston, Texas.

McGaughey, J. F., J. T. Bursey, R. G. Merrill, Jr., M. D. Jackson, L. D. Johnson, and R. G. Fuerst. "Comparison of a Modified VOST Sampling Method to Method 0030." Presented at the 13th International Incineration Conference, May 9-14, 1994. Houston, Texas.

Jackson, M. D., L. D. Johnson, J. F. McGaughey, D. E. Wagoner, R. G. Merrill, and J. T. Bursey. "Improvements in Preparation of Samples Generated by SW-846 Method 0010." Presented at the International Symposium on Measurement of Toxic and Related Air Pollutants, May 3-6, 1994. Durham, North Carolina.

Philipp, S. B., D. P. Dayton, R. G. Merrill, and M. D. Jackson. "Evaluation of GC Detectors for

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Total Gaseous NonMethane Organic Compounds.” Presented at the International Symposium on Measurement of Toxic and Related Air Pollutants, May 3-6, 1994. Durham, North Carolina.

Kanniganti, R., R. L. Moreno, J. T. Bursey, R. G. Merrill, R. G. Fuerst, and L. D. Johnson. “Sampling of Volatile Organic Compounds from Combustion Sources Using Tedlar Bags and Analysis Using GC/MS.” Presented at the International Symposium on Measurement of Toxic and Related Air Pollutants, May 3-6, 1994. Durham, North Carolina.

Jackson, M. D., L. D. Johnson, R. G. Fuerst, J. F. McCaughey, J. T. Bursey, and R. G. Merrill. “Field Evaluation of a Modified VOST Sampling Method.” Presented at the International Symposium on Measurement of Toxic and Related Air Pollutants, May 3-6, 1994. Durham, North Carolina.

Merrill, R.G. Jr., D.P. Dayton, P.L. O'Hara, and R.F. Jongleux. “Effects of Ozone Removal on the Measurement of Carbonyl Compounds in Ambient Air.” Presented at the National Air and Waste Management Symposium, Vancouver, British Columbia, June 1991.

Kosusko, M., J.T. Bursey, R.G. Merrill, Jr., T.P. Heil, and F. Demartin. “Test Methods for the Determination of Volatile Organic Compounds in Consumer Products.” Presented at the National Air and Waste Management Symposium, Vancouver, British Columbia, June 1991.

Merrill, R.G., J. Rice, and M.A. Zapkin. “Application of Canister Technology to the Measurement of Polar Organic Compounds.” Presented at the EPA/AWMA Symposium on the Measurement of Air Toxics in Durham, North Carolina, May 1991.

Bursey, J.T., R.G. Merrill, D.L. Jones, T.K. Moody, C.R. Blackley, and S.K. Lynch, Radian, and W.B. Kuykendal, EPA. “Measurement Protocol for Air Toxics in Stationary Sources.” Presented at the EPA/AWMA Symposium on the Measurement of Air Toxics in Durham, North Carolina, May 1991.

Sokash, J.A., J.T. Bursey, T. Pauling, R.A. McAllister, F. Sowers, R.G. Merrill, Jr., Radian, and K.W. Grimley, EPA. “An Evaluation of the Responses of Selected Portable Analyzers for Method 21.” Presented at the EPA/AWMA Symposium on the Measurement of Air Toxics in Durham, North Carolina, May 1991.

Merrill, R.G. Jr., D.P. Dayton, J. Rice, R.A. McAllister, D.E. Wagoner, R.F. Jongleux, J.T. Bursey, L.D. Ogle, W.L. Crow, S.L. Sleva, V.L. Thompson, L. Purdue, and F.F. McElroy. “Practical Experience in Analysis of Organic Compounds in Ambient Air Using Canisters and Sorbents.” Presented at the National Air and Waste Management Symposium, Pittsburgh, Pennsylvania, June 1990.

Merrill, R.G. Jr. “Evaluation of VOST Sampling and Analytical Method at a Coal-Fired Cement

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Kiln." Proceedings of Waste Combustion in Boilers and Industrial Furnaces, an AWMA International Specialty Conference, April 1990.

Burse, J.T., J. Rice, R.A. McAllister, D.P. Dayton, R.F. Jongleux, W.H. Moore, and R.G. Merrill, Jr. "Urban Air Toxics Monitoring Program: Determination of Detection Limits For GC/MD and GC/MS and Establishing Comparability Between the Analytical Systems." Proceedings of Measurement of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1989.

Jongleux, R.F., R.G. Merrill, Jr., R.A. McAllister, and D.P. Dayton. "Ambient Aldehyde Sampling and Analysis in Conjunction with the NMOC and UATMP Programs." Proceedings of Measurement of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1989.

McAllister, R.A., P.L. O'Hara, D.P. Dayton, and R.G. Merrill, Jr. "Nonmethane Organic Compound Sampling and Analysis Program." Proceedings of Measurement of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1989.

Highsmith, V.R., R.B. Zweidinger, and R.G. Merrill, Jr. "Characterization of Indoor and Outdoor Air Associated with Residences using Woodstoves: A Pilot Study." Environment International, Vol. 14, pp 213, 1988.

McAllister, R.A., P.L. O'Hara, W.H. Moore, D.P. Dayton, J. Rice, R.F. Jongleux, R.G. Merrill, Jr., and J.T. Bursey. "1988 Nonmethane Organic Compound and Urban Air Toxics Monitoring Programs." Final Report, Volume I and II, Nonmethane Organic Compound and Three-Hour Air Toxics Monitoring Program. Radian Corporation, DCN No. 88-262-045-25, prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, December 1988.

Merrill, R.G. Jr., J.B. Homolya, D.H. Doerle, and L. Cooper, "Integrating Sampler for Hazardous Pollutants in Liquid Streams." Proceedings of Measurement of Toxic and Related Air Pollutants. Raleigh, North Carolina, May 1988.

Merrill, R.G., R.B. Zweidinger, R.F. Martz, and T.X. Koinis. "Semivolatile and Condensable Organic Compound Distribution in Ambient and Woodstove Emissions." Proceedings of Measurement of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1988.

Merrill, R.G. Jr., D.E. Wagoner, J.B. Homolya, J.L. Steger, B.B. Bagnal, J.H. Margeson, J.E. Knoll, and M.R. Midgett. "Particulate Matter - Organic Compound Interactions on Municipal Incinerator Flyash." Proceedings of Measurement of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1988.

Merrill, R.G. and Harris, D. Bruce. "Field and Laboratory Evaluation of a Woodstove Dilution

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Sampling System." Presented at the National APCA Meeting, New York, New York, June 1987.
Merrill, R.G., R. Zweidinger, R.R. Watts, and S. Rasor. "Progress Toward Identifying Source Specific Tracers." Presented at the EPA/APCA Symposium on Measurements of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1987.

Highsmith, R., R. Baumgardner, B. Harris, T. Lumpkin, R. Drago, R. Zweidinger, and R. Merrill, Jr. "The Collection of Wood Combustion Samples in Raleigh, North Carolina and Albuquerque, New Mexico." Presented at the EPA/APCA Symposium on Measurements of Toxic and Related Air Pollutants, Raleigh, North Carolina, May 1987.

Klouda, G.A., L.A. Currie, A.E. Sheffield, S.A. Wise, B.A. Benner, R.K. Stevens, and R.G. Merrill, Jr. "The Source Apportionment of Carbonaceous Combustion Products By Micro-Radiocarbon Measurements For the Integrated Air Cancer Project (IACP)." Presented at the EPA/APCA Symposium on Air Toxics, May 1987.

Watts, R.R., J. Lewtas, R.J. Drago, R.W. Williams, E. Perry, and R.G. Merrill, Jr. "Woodsmoke Impacted Air: Mutagenicity and Chemical Analysis of Ambient Air in a Residential Area of Juneau, Alaska." 1987.

McCrillis, R.C., R.G. Merrill, Jr., P.L. Westlin, G.E. Weant, and D.E. Wagoner. "Comparisons Between MM5, OM7, and ASTM Measurements of Wood Stove Emissions." Presented at the National APCA Meeting, New York City, New York, May 1986. Paper subsequently submitted for publication in the APCA Journal, June 1986.

Tichenor, B.A., M.D. Jackson, and R.G. Merrill, Jr. "Measurement of Organic Emissions From Indoor Materials - Small Chamber Studies." Presented at EPA/APCA Symposium on Measurement of Toxic Air Pollutants, Raleigh, North Carolina, April 28, 1986.

Nolen, S.L., R.G. Merrill, Jr., and L. Hamel. "Development of Process Monitors for Hazardous Waste Incineration." Poster session presented at the 4th annual Hazardous Waste Symposium, Cincinnati, Ohio, April 1986.

Mumford, J.L., R.H. Hall, and R.G. Merrill, Jr. "Toxicity of Particles Emitted from Combustion of Waste Crankcase Oil: Invitro and Invivo Studies." In Fundamental and Applied Toxicology, March 1986.

Brasch, J., R. Barnes, K. Schafer, and R. Merrill, Jr. "A Comparison of GC/FT-IR and GC/MS in Characterizing Oxygenated and Nitrogenated Species in Combustion Emissions." Presented at the Fourth Annual National Symposium on Recent Advances in the Measurements of Pollutants from Ambient Air and Stationary Sources, Raleigh, North Carolina, 1984.

Walsh, G. and R.G. Merrill, Jr. "Algal Bioassays of Industrial and Energy Process Effluents:

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Algae as Ecological Indicators." Academic Press, Inc., London, England, L. Elliot Shubert Ed., 1984.

Merrill, R.G., Jr., W.W. McFee, and N. Jaworski. "Bioassays of Effluents from Stationary Sources: An Overview." Second Symposium on Application of Short-Term Bioassays in the Fractionation and Analysis of Complex Environmental Mixtures, M.D. Waters Ed., Plenum Press, New York, 1984.

Merrill, R.G., Jr., R.E. Hall, and J. Lewtas. "SASS Versus Dilution Tunnel Sampling of Residential Distillate Oil Combustion Emissions." Third Symposium on Application of Short-Term Bioassays in the Fractionation and Analysis of Complex Environmental Mixtures, M.D. Waters, Ed., Plenum Press, New York, 1984.

Merrill, R., Jr., D. Brusick, R. Young, K. Duke, and S. Coons. "Integrated Data Interpretation: A Case Study." Presented at the Proceedings of Short-Term Bioassay in the Analysis of Complex Environmental Mixtures IV, Raleigh, North Carolina, 1984.

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Johnson, L.D. and R.G. Merrill, Jr. "Stack Sampling for Organic Emissions." In: Toxicology and Environmental Chemistry. Gordon and Breach Science Publishers, Inc., Great Britain, Vol. 6, pp. 109, 1983.

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