

Steven E. Lindberg

Environmental Sciences Division
Oak Ridge National Laboratory
P.O. Box 2008, Oak Ridge, TN 37831-6038

email: lindbergse@ornl.gov
Phone: (865)574-7857
Fax: (865)576-8646

Education

Duke University	B.S.	1969	Chemistry
Florida State University	M.S.	1973	Chemical Oceanography
Florida State University	Ph.D.	1979	Geochemistry

Professional Experience

1971-1974 **Graduate Fellow**, Florida State University Department of Oceanography, Tallahassee.
1974-1986 **Research Associate and Staff Member**, Oak Ridge National Laboratory, Oak Ridge, TN.
1987 **Visiting Professor**, Institute of Bioclimatology, University of Göttingen, Germany.
1994 **Visiting Scientist**, Swedish Environmental Research Institute, Göteborg, Sweden.
1995 **Visiting Professor**, University of Stockholm and University of Lund, Sweden
1996-1997 **Visiting Scientist**, Institute of Hydrophysics, GKSS Fed. Laboratory, Geestacht, Germany
1995-*present* **Adjunct Professor**, School of Public Health, University of Michigan, Ann Arbor, MI; Dept. of Ecology and Evolutionary Biology, The University of Tennessee, Knoxville, TN
1987-1999 **Senior Research Staff Member**, and Group Leader for Atmospheric and Biogeochemical Cycling
2000-*present* **ORNL Corporate Research Fellow**, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN.
2002 **Visiting Scientist**, Institute of Ecosystem Studies, NY

Honors and Awards

- Alexander von Humboldt Foundation Fellowship Award, 1986-1987
- Elected Fellow, American Association for the Advancement of Science, 1992
- Lab-wide Publication and Technical Achievement Awards, 1985, 1986, 1997, and 2001
- Nominated for Ernest Orlando Lawrence Award, 1990, and ORNL Scientist of the Year, 2001
- American Men and Woman of Science, Who's Who in Science and Technology
- Environmental Sciences Scientific Achievement Award, 1984
- Oak Ridge National Laboratory Significant Achievement Awards: 1983, 1985, 1992, 1995

Professional Activities

- Associate Editor, Environmental Reviews, Science of the Total Environment, Tellus (Sweden)
- Member, Review Boards: EPA Science Advisory Board for Mercury, Swedish EPA Mercury Panel
- Chairman, International Conference on Mercury as A Global Pollutant, 1995-1996; 1999-2001
- Director for Atmospheric Research, Integrated Forest Study, 1986-1990
- Chairman, United States National Atmospheric Deposition Program, 1988-1989
- Conference Chairman (1986-87) and Member of Conference Honorary Committee (since 1983) for the International Conference on Heavy Metals in the Environment

Publications

Six books edited, and over 200 publications authored in the open literature, with more than 110 in refereed journals in the fields of atmosphere/surface exchange, trace metal chemistry, and biogeochemical cycling. Invited lecturer or plenary speaker on atmospheric deposition, mercury, and canopy interactions at more than 100 institutes and conferences in North America, Europe, South America, and Asia.

Funded Proposals, Contracts, and Grants (with ORNL collaborators unless otherwise noted):

1970-1979

- 1975-1976, "Trace Element Emissions from Coal Fired Power Plants" (with A Andren). US Dept. of Energy (DOE) (\$50,000).
- 1975-1976, "Geochemical Cycling of Hg in a River-Reservoir System" (with R Turner). NSF-RANN (\$90,000).
- 1978, "Mercury Emissions from Mine Spoils" (with D Jackson). NSF-RANN (\$75,000).
- 1977-1980, "Trace Element Deposition, Stream Chemistry, and Cycling in Forest Watersheds" (with R. Turner). US DOE (\$1,000,000).

1980-1989

- 1981-1982, "Dry Deposition to Petri Dish and Foliar Surfaces" (with C Davidson, CMU). US Environmental Protection Agency (EPA) (\$30,000).
- 1981-1983, "Acid Deposition/Forest Canopy Interactions: Mechanisms of Sulfur and Nitrogen Deposition to Forests." Electric Power Research Institute (EPRI) (\$675,000).
- 1981-1984, "Atmosphere/Canopy Interactions: Wet Deposition and Rain Chemistry." US DOE (\$900,000).
- 1985-1989, "Integrated Forest Study (IFS) of the Effects of Atmospheric Deposition on Forest Nutrient Cycles" (with D Johnson) EPRI (total project \$11,600,000).
- 1985-1989, "Atmosphere/Canopy Interactions: Development of Surface Analysis Methods for Dry Deposition." US DOE (\$920,000).
- 1987, "Deposition and Atmospheric Chemistry of Nitrogen Compounds" (with G. Gravenhorst, U. Gottingen). West German Federal Ministry for Technology and Alexander von Humboldt Foundation (\$45,000).
- 1989, "Atmospheric Deposition and Red Spruce Nutrition in the Great Smoky Mountains National Park" (with D Johnson and H Van Miegroet). USDA Forest Service (\$225,000).

1990-1999

- 1990, "A Soft Ionization Mass Spectrometer for the Simultaneous, Real-time Analysis of Biogenic Non-methane Hydrocarbons in the Forest Canopy Airspace" (with M Payne, W Chen, and P Hansen). ORNL Seed Money Committee (\$100,000).
- 1990, "Integrated Forest Study of the Effects of Atmospheric Deposition on Forest Nutrient Cycles: Synthesis of Results." (with D Johnson) EPRI (\$198,000).
- 1990, "Atmospheric Deposition and Red Spruce Nutrition in the Great Smoky Mountains National Park-Testing the AI Hypothesis" (with H Van Miegroet). USDA Forest Service (total project \$235,000).
- 1990-1991, "Development of Methods for Network Sampling of Air Toxics in Precipitation" (with S. Vermette, ISWS) USGS (\$70,000).
- 1991-1994, "Atmosphere/Canopy Interactions: Surface Analysis of Dry Deposition in Complex Terrain". US DOE (\$700,000).
- 1992-1996, "Air/Surface Exchange of Mercury (MASE): Development of Flux Methods and Models". EPRI (\$1,195,000).
- 1993-1995, "Elevational Trends in Deposition in the Smoky Mountains" (with S. Nodvin, USBS). NPS (\$150,000).
- 1994-1995, "Aerosols at the Sea/Land Interface". (with B Wiman, U Lund) Swedish NFR (NSF) (30,000Kr).
- 1996, "Emission of Mercury from Freshwater Lakes". USEPA (\$18,000).
- 1996-1997, "Emission of Mercury from soils in the Elbe River Floodplain". (with R. Ebinghaus, GKSS) German BMFT (15,000DM).
- 1996-1999, "Mercury Emissions from Wetlands in the Florida Everglades". South Florida Water Management District (\$400,000).
- 1997-1998, "Mercury Fluxes and Exposure over Contaminated Industrial Soils". ABB Engineering (\$32,000).

- 1997-2000, "Mercury Emissions from Landfills in Florida". Florida DEP (\$190,000).
- 1997-2000, "Natural Mercury Emission Study (NaMES): Their Role in the Global Cycle". (with M. Gustin, UNR) EPRI (total project \$580,000).
- 1997-2000, "Air/Surface Exchange of Mercury in the Lake Superior Watershed". Lake Superior Trust (\$250,000).
- 1998-1999, "Intercomparison of Speciation Methods for Reactive Gaseous Mercury in Ambient Air". (with W. Stratton, Earlham College) Florida DEP (\$20,000).
- 1998-2000, "Air Mass Trajectories of Mercury Transport in the Arctic Environment" (with T. Meyers, ATDD) NOAA (\$100,000).
- 1998-2003, "Atmospheric Deposition in Mountainous Terrain: Scaling up to the Landscape". (with K Weathers and G Lovett, IES) USEPA and NPS (total project \$580,000).
- 1999, "Pilot Studies with Stable Isotopes to Quantifying Air/surface Exchange Rates of Hg, USDOE (\$280,000).
- 1999-2000, "Dry Deposition of Mercury in the Florida Everglades". (with G. Keeler, UMAQL) Florida DEP (total project \$200,000).
- 1999-2000, "Emission of Mercury from Chlor-alkali Plants". (with J. Kinsey, NERL) USEPA (total project \$200,000).
- 1999-2000, "Chlor-alkali wastes: Assessing their Role as a Mercury Source in the Great Lakes". (with J. Nriagu, UM) Great Lakes Protection Fund (total project \$225,000).
- 1999-2000, "Evaluating a reactive gaseous mercury sampler for the Arctic". USEPA and Florida DEP (\$65,000).

2000-

- 2000-2002, "The role of plants & soils in the biogeochemical cycling of Hg on an ecosystem level, (with UNR/DRI), EPA EPSCOR, (\$60,000).
- 2000-2002, "Mercury transport and fate through a watershed: The role of Hg reduction reactions, (with J. Nriagu), USEPA STAR Grant, (\$260,000).
- 2000-2004, "Applications of Stable Isotopes to Quantifying Air/surface Exchange Rates of Hg in Whole-ecosystem Manipulation Studies at the ELA, Canada, USDOE (\$1,270,000).
- 2000-2004, "Fugitive Mercury Emissions from Non-combustion Sources in the Great Lakes Region, (with Frontier Geosciences), USEPA, GLNPO, (\$200,000).
- 2001-2002, "Methylmercury Production in Florida Landfills". Florida DEP (\$140,000).
- 2001-2003, "Mercury Emissions from Natural Processes: Scaling to the Landscape". (with M. Gustin, UNR) EPRI (\$170,000).
- 2001-2004, "Dynamic Oxidation of Mercury in the Arctic Environment" (with S. Brooks, ATDD) NOAA (\$295,000).
- 2002-2005, "Assessment of Natural Source Mercury Emissions" (with UNR/DRI), EPA STAR, (total project \$891,500).

[grants last updated in Dec, 2002]

Students Supervised:

Advisor to ORNL Student Interns

- S. Henry, B.S., Chemistry, Earlham College (1976)
- S. Kimbrough, B.S., Biology, College of the South (1976)
- W. Petty, B.S., Biology, Grinnell College (1986)
- A. Pendergrass, B.S., Civil Engineering, Auburn University (1993)
- T. Kuiken, B.S., Chemistry, Rochester State (1999)
- J. Ramirez, Chemistry, U. Puerto Rico (2000)

Advisor to Postdoctoral Researchers at ORNL

- Dr. G. Lovett (Ph.D., Ecology, University of New Hampshire), ORAU Postdoctoral Fellow (1982–1984) (currently Sr. Scientist, Institute of Ecosystem Studies, NY)
- Dr. D. Schaefer (Ph.D., Biogeochemistry, University of New Hampshire), ORAU Postdoctoral Fellow (1986–1988, currently Asst. Prof., University of Puerto Rico)
- Dr. K.-H. Kim (Ph.D., Marine Chemistry, University of South Florida), ORNL Postdoctoral Fellow (1992–1994, currently Asst. Prof., University of Seoul, Korea)
- Dr. Hong Zhang (Ph.D., Soil Chemistry, University of Vermont), ORNL Postdoctoral Fellow (1998–2001, currently Assoc. Prof., Tennessee Tech. University, Cookeville)
- Dr. Weijin Dong (Ph.D., Plant Physiology, Tulane University), ORNL Postdoctoral Fellow (2000–2002, currently Assoc. Prof., McNeese State University)

Adjunct Faculty Committee Member for Graduate Students

- C. Potter, Ph.D. in Ecology, Emory University (1983–1985)
- M. Hoyer, Ph.D. in Atmospheric Chemistry, Air Toxics Laboratory, School of Public Health, University of Michigan (1992–1995)
- A. Rea, Ph.D. in Air Quality, Air Quality Measurements Laboratory, School of Public Health, University of Michigan (1994–1998)
- J. Shubzda, M.S. in Forestry, School of Fisheries, Forestry, and Wildlife, The University of Tennessee (1995–1999)
- A. Carpi, Ph.D. in Environmental Toxicology, Cornell University (1994–1996).
- A. Vette, Ph.D. in Air Quality, Air Quality Measurements Laboratory, School of Public Health, University of Michigan (1996–1999).
- M. Goodsite, Ph.D. in Atmospheric Chemistry, Department of Chemistry, University of Copenhagen, Denmark (2000-present).

Invited Faculty Opponent for Ph.D. Defense

- W. Ivens, Ph.D. in Biogeochemistry, University of Utrecht, The Netherlands (1989–1991)
- Z. Xiao, Ph.D. in Inorganic Chemistry, Chalmers University of Technology, Göteborg, Sweden (1994–1995)
- M. Coggin, Ph.D. in Atmospheric Chemistry, University of Galway, Ireland (1999-2000)
- J. Benesch, M.S. in Environmental Science, University of Nevada, Reno (2001-2002)

Expert External Reviewer for Habilitation to Professor

- Dr. D. Godbold, Habilitation candidate, University of Göttingen, Germany (1990)
- Dr. R. Ebinghaus, Habilitation candidate, University of Lüneberg, Germany (2002)

Informal PhD Advisor

- D. Walschlager, Ph.D. in Geochemistry, University of Hamburg, Germany (1995-1996)
- T. Frescholtz, M.S. in Environmental Science, University of Nevada, Reno (2001-2002)
- K. Scott, Ph.D. in Microbiology, University of Manitoba, Winnipeg, Canada (2001-2002)

Publications- (in prep and submitted)

[updated Apr 2003, published list starts below]

Lindberg, S.E., G. Southworth, E.M. Prestbo, D. Wallschläger, M. A. Bogle, J. Price. Gaseous methyl- and inorganic mercury in landfill gas from landfills in Florida, Minnesota, and California. Atmos. Envir. (in prep).

Schroeder, W.H., A. Steffen, K. Scott, T. Bender, E. Prestbo, R. Ebinghaus, J.Y. Lu and S. E. Lindberg. First International Arctic atmospheric mercury research workshop. Atmos. Envir. (submitted).

Amyot, M., G. Southworth, S.E. Lindberg, H. Hintelmann, J.D. Lalonde, C. Gilmour, J.W.M. Rudd, C.A. Kelly, R. Harris, F.M.M. Morel, A. Poulain, Ken Sandilands. Evolution of dissolved gaseous mercury in large lake enclosures amended with $^{200}\text{HgCl}_2$. Can J. Fish Aq Sci (submitted).

Southworth, G. R., S. E. Lindberg, H. Zhang, J. S. Kinsey, F. Anscombe, and F. Schaedlich. Fugitive mercury emissions from a chlor-alkali facility: sources and fluxes to the atmosphere. Atmos. Envir. (submitted).

Kinsey, J. S., Swift, J., Burse, J., Lindberg, SE, and Southworth, G. Characterization of mercury emissions from the cell building at a U. S. chlor-alkali plant. Atmos. Envir. (submitted).

Lindberg, S., G. Southworth, M. Bogle, T. Blasing, H. Zhang, T. Kuiken, D. Wallschlaeger, J. Price, D. Reinhart, H. Sfeir, J. Owens, and K. Roy. Airborne emissions of mercury from municipal solid wasteNew measurements from three landfills in Florida. JAWMA, (submitted).

W. Dong, S.E. Lindberg, T. Meyers, and J. Chanton. A proposed mechanism of gaseous mercury emission mediated via aquatic plant in the Florida Everglades. Atmos. Envir. (in prep.)

Brooks, SB, K. Scott, and SE Lindberg. Surface Mercury Hg(0) Emissions during Annual Snowmelt at Barrow, Alaska. J. Geophys. Res. (in prep. 5/02).

Brooks, SB, M. Goodsite, SE Lindberg, M Landis, and R. Stevens. Aircraft Studies of Atmospheric Mercury Conversion in the Arctic Marine/Coastal Boundary Layer. Nature (in prep. 6/02).

Tate, Scherbatskoy, Donlon, Keeler, Shanley, Lindberg. Dry Deposition of Hg to a Northern Hardwood Forest (in prep 5/02).

Brooks S., and S. E. Lindberg. Estimates of Springtime Atmospheric Mercury Deposition rates at Barrow, Alaska from Stable Boundary Layer Inverse Method. J. Geophys. Res. (in revision).

Books and Whole Journal Issues:

L. Levin, D. S. E. Lindberg, and D. Porcella (Guest Eds.). 2000. Special Issue on Mercury Biogeochemistry. Science of the Total Environment: Vols. 259-260-261, 511 pp. Elsevier Publ., N.Y.

Gustin, M-S., S. E. Lindberg, and M. A. Allan (Guest Eds.). 1999. Special Issue: Nevada STORMS mercury flux intercomparison study: Constraining mercury emissions from naturally enriched surfaces: Assessment of methods and controlling parameters. J. Geophys. Res.: 104, No. D17, pp. 21829-21896. American Geophysical Union Publ., Washington.

Lindberg, S. E. (Sr. Guest Ed.). 1998. Special Issue: Atmospheric Transport, Chemistry and Deposition of Mercury. Atmospheric Environment: 32, No. 5, 134 pp. (807-940). Pergamon Press, U.K.

Johnson, D.W., and S.E Lindberg (Eds.). 1992. Atmospheric Deposition and Forest Nutrient Cycling, Ecological Studies Vol. 91, Springer-Verlag, New York, 707 pp.

Norton, S., S. E. Lindberg, and A. L. Page. (Eds.) 1990. Soils, Aquatic Processes, and Lake Acidification, Advances in Environmental Sciences Series Acidic Precipitation, Vol. 4. Springer Verlag, NY., 293 pp.

Lindberg, S. E., A. L. Page, and S. Norton. (Eds.) 1990. Sources, Deposition, and Canopy Interactions, Advances in Environmental Sciences Series Acidic Precipitation, Vol. 3. Springer Verlag, NY., 332 pp.

Lindberg, S. E. and T. C. Hutchinson (Eds.). 1987. Proceedings of the Sixth International Conference on Heavy Metals in the Environment, New Orleans, LA, September 15-18, 1987, CEP Limited Publishers, Edinburgh, UK.

Shriner, D. S., C. R. Richmond, and S. E. Lindberg (Eds.) 1980. Atmospheric Sulfur Deposition. Ann Arbor Science Publishers, Ann Arbor, MI, 568 pp.

Journal Papers and Book Chapters:

In Press

Gustin, M-S., and S.E. Lindberg. Understanding the role of natural ecosystems in the biogeochemical cycle of Hg. Proc. Air Quality-III (in press).

2000's

Johnson, D.W., Benesch, J.A., Gustin, M.S., Schorran, D.E., Coleman, J., and Lindberg, S.E. 2003. Soil gaseous Hg and CO₂ concentrations response to watering, plants, and evidence against diffusion control of Hg flux, Science of the Total Environment 304: 175-184.

Gustin, M.S, M. Coolbaugh, M. Engle, B. Fitzgerald, R. Keislar, S. Lindberg, D. Nacht, J. Quashnick, J. Rytuba, C. Sladek, H. Zhang, R. Zehner. 2003. Atmospheric Mercury Emissions from Mine Wastes and Surrounding Geologically Enriched Terrain. Envir. Geol. 43:339-351.

J. Ericksen, M.S. Gustin, D. Schorran, D. Johnson, S. Lindberg, and J. Coleman. 2003. Accumulation of atmospheric mercury in forest foliage, Atmos. Envir. 37:1613-1622.

Hintelmann, H., V. St.Louis, K. Scott, J.Rudd, S. E. Lindberg, D. Krabbenhoft, C. Kelly, A. Heyes, R. Harris, and J. Hurley. Reactivity and mobility of newly deposited mercury in a Boreal catchment, 2003. Envir. Sci. & Technol. 36:5034-5040.

Lindberg, S. E., W. Dong, and T. Meyers. 2002. Transpiration of gaseous mercury through vegetation in a subtropical wetland in Florida. Atmos. Envir. 36: 5200-5219.

Zhang, H, Lindberg, S, Gustin, M, and Xu, X. Towards A Better Understanding of Mercury Emissions from Soils. IN Cai, Y, and Braids, O. C. Eds., Biogeochemistry of Environmentally Important Trace Elements, ACS Symposium Series 835, American Chemical Soc, Washington.

Wallschlèger, D., Kock, H.H., Schroeder, W.H., Lindberg, S.E., Ebinghaus, R. and Wilken, R.D. 2002. Estimating gaseous mercury emissions from contaminated floodplain soils to the atmosphere with simplified field measurement techniques. Water, Air, Soil, Pollut. 135: 39-54.

Van Miegroet, H. I.F. Creed, N.S. Nicholas, D.G. Tarboton, K.L. Webster, J. Shubzda, B. Robinson, J. Smoot, D.W. Johnson, S.E. Lindberg, G. Lovett, S. Nodvin, S. Moore. 2001. Is there synchronicity in N input and output fluxes at the Noland Divide Watershed, a small N-saturated forested catchment in the Great Smoky Mountains National Park? In Optimizing Nitrogen Management in Food and Energy Production and Environmental Protection Proceedings of the 2nd International Nitrogen Conference on Science and Policy. TheScientificWorld 1 (S2), 480-492.

Lindberg, S. E., Brooks, S.B., C-J. Lin, K. J. Scott, M. S. Landis, R. K. Stevens, M. Goodsite, and A. Richter. 2002. The Dynamic Oxidation of Gaseous Mercury in the Arctic Atmosphere at Polar Sunrise, Envir. Sci. & Technol. 36: 1245-1256.

Zhang, H, Lindberg, SE, Barnett, MO, Vette, AF, Gustin, MS. 2002. Dynamic flux chamber measurement of gaseous mercury emission fluxes over soils, Part 1 Simulation of gaseous mercury emissions from soils measured with dynamic flux chambers using a two-resistance exchange interface model. Atmospheric Environment 36: 835-846.

Lindberg, SE, Zhang, H, Vette, AF, Gustin, MS, Barnett, MO, and Kuiken, T. 2002. Dynamic flux chamber measurement of gaseous mercury emission fluxes over soils, Part 2 Effect of flushing flow rate and verification of a two-resistance exchange interface simulation model. Atmospheric Environment 36: 847-859.

Zhang, H., and S.E. Lindberg. 2002. Dissolved gaseous mercury in Whitefish bay and the Taquemenon River watershed in the Michigan Upper Peninsula: Distribution and dynamics. Water, Air, Soil, Pollut. 133: 379-389.

Rea, A.W.; Lindberg, S.E.; Scherbatskoy, T. 2002. Mercury accumulation in foliage over time in two northern mixed-hardwood forests. Water, Air, Soil, Pollut. 133: 49-67.

Lindberg, S. E., S. Brooks, C-J Lin, K. Scott, T. Meyers, L. Chambers, M. Landis, and R. Stevens. 2001. Formation of reactive gaseous mercury in the arctic evidence of oxidation of Hg⁰ to gas-phase Hg-II compounds after arctic sunrise Water, Air and Soil Pollution: Focus, 1: 295-302.

Lindberg, S.E., S.B. Brooks, M. Landis, and R. Stevens. 2001. Comments on atmospheric mercury species in the European Arctic: Measurements and modeling, Atmospheric Environment 35:5377-5378.

Levin, L., Lindberg, S. and Gustin, M. 2001. Uncertainties in Mass Balance of U.S. Atmospheric Mercury Emissions. IN *Air-Surface Exchange of Gases and Particles Poster Proceedings* (D. Fowler, C. E. R. Pitcairn, L. Douglas and J-W. Erisman, Eds.). Publ. By Center for Ecology and Hydrology, Edinburgh.

Lindberg S. E. and T. P. Meyers. 2001. Development of an automated micrometeorological method for measuring the emission of mercury vapor from wetland vegetation. Wetland Ecology & Management, 9: 333-347.

St.Louis, VL, JW Rudd, CA. Kelly, BD.Hall, KR. Rolfhus, KJ. Scott, SE. Lindberg, and W Dong. 2001. The importance of the forest canopy to fluxes of methyl mercury and total mercury to boreal ecosystems, Envir. Sci. & Technol. 35: 3089-3098.

Munthe, J., I. Wängberg, N. Pirrone, Å. Iverfeldt, R. Ferrara, P. Costa, R. Ebinghaus, X.Feng, K. Gårdfelt, G. Keeler, E. Lanzillotta, S. E. Lindberg, J. Lu, Y. Mamane, E.Nucaro, E. Prestbo, S. Schmolke, W. H. Schroeder, J. Sommar, F. Sprovieri, R.K.Stevens, W. Stratton, G. Tuncel, A. Urba. 2001. Intercomparison of methods for sampling and analysis of atmospheric mercury species. Atmos. Env. 353007-3017.

Lindberg, S.E., D. Wallschlaeger, E. Prestbo, N. Bloom, J. Price, and D. Reinhart. 2001. Methylated mercury species in municipal waste landfill gas sampled in Florida. Atmospheric Environment 35: 4011-4015.

Lindberg, S. E., Brooks, S., Lin, C-J., Scott, K., Richter, A., Meyers, T., Stevens, R., and Landis, M. 2001. Studies of interactions between reactive gaseous mercury and elemental mercury vapor during polar spring at Point Barrow, Alaska. Proc. of International Symposium on the Measurement of Toxic and Related Air Pollutants Symposium held in Research Triangle Park, North Carolina, September 12-14, 2000.

Rea, A.W., S.E. Lindberg, and G. Keeler. 2001. Dry deposition and foliar leaching of mercury and selected trace elements in deciduous forest throughfall. Atmospheric Environment 35: 1352-2310.

Zhang, H, and S.E. Lindberg. 2001. Sunlight and iron(III)-induced photochemical production of dissolved gaseous elemental mercury in fresh water. Envir. Sci. & Technol. 35: 928-935.

Stratton, W. J., S. E. Lindberg, and C.J. Perry. 2001. Atmospheric Mercury Speciation: Critical evaluation of a mist chamber method for measuring reactive gaseous mercury, Envir. Sci. & Technol. 35: 170-177.

Zhang, H., S. E. Lindberg, F. J. Marsik, and G. J. Keeler. 2001. Mercury air/surface exchange kinetics of background soils of the Taquamenon River watershed in the Michigan Upper Peninsula. Water, Air, Soil, Pollut. 126: 151-169.

Lindberg, S. E., S. Brooks, C-J Lin, K. Scott. 2001. Recent research on missing sources and sinks in the global mercury cycle: The role of the Arctic. Proc. NIMD Forum-01, publ. by the National Institute of Minamata Disease Press, pp. 53-58.

Gustin, M..S. and S. E. Lindberg. 2000. Assessing the contribution of natural sources to the global mercury cycle: The importance of intercomparing dynamic flux measurements. Invited paper for Fresenius Journal of Analytical Chemistry, 366: 417-422.

Zhang H., and S. E. Lindberg. 2000. Air/water exchange of mercury in the Everglades I: The behavior of dissolved gaseous mercury (DGM). Science of the Total Environment 259: 123-134.

Lindberg, S. E., and Zhang H. 2000. Air/water exchange of mercury in the Everglades II: Measuring and modeling evasion of mercury from surface waters. Science of the Total Environment 259: 135-144.

Gustin, M..S. and S. E. Lindberg, K. Austin, M. Coolbaugh, A. Vette, and H. Zhang. 2000. Assessing the contribution of natural sources to regional atmospheric mercury budgets. Science of the Total Environment 259: 61-72.

Rea, A.W., S.E. Lindberg, and G. Keeler. 2000. Development of a washing technique for measuring dry deposition of mercury to foliage and surrogate surfaces, Envir. Sci. & Technol. 34: 2418-2425.

Lindberg, S.E., S. Brooks, C-J Lin, T. Meyers, and L. Chambers. 2000. **BAMS- the Barrow Arctic Mercury Study: a preliminary description of recent measurements of mercury depletion events at Point Barrow, Alaska.** CD-ROM Proceedings, 25th International Conference on Heavy Metals in the Environment, Ann Arbor, MI (6-10 August, 2000).

Marsik, F.J., G. Keeler, E. G. Malcolm, J. T. Dvonch, J. A. Barres, S. E. Lindberg, H. Zhang, R. K. Stevens and M. S. Landis. 2000. **FEDDS: The Florida Everglades Dry-Deposition Study.** CD-ROM Proceedings, 25th International Conference on Heavy Metals in the Environment, Ann Arbor, MI (6-10 August, 2000).

Lindberg, S. E., P. J. Hanson, W. Stratton, T. Meyers, K. Kim, A. Carpi, H. Zhang, J. Owens, M. Gustin, R. Turner, J. Munthe, F. Schaedlich, J Price, M. Barnett, and D. Wallschlèger. 2000. **The Role of Mercury Air/surface Exchange Processes in the Global Biogeochemical Cycle: a Brief Summary of Research by the ORNL Mercury Group,** Proc. NIMD Forum-99, publ. by the National Institute of Minamata Disease Press.

Lindberg, SE, A. Vette, C. Miles, and F. Schaedlich. 2000. Application of an automated mercury analyzer to field speciation measurements: Results for dissolved gaseous mercury in natural waters. Biogeochemistry, 48(2), 237-259.

Lindberg, S. E., W. J. Stratton, P. Pai, and M. Allan. 2000. Measuring and modeling concentrations of a water-soluble gas-phase mercury species in ambient air. Fuel Proc. Technol. 1288: 65, 143-156.

Wallschlèger, D., Kock, H.H., Schroeder, W.H., Lindberg, S.E., Ebinghaus, R. and Wilken, R.D. 2000. Mechanism and significance of mercury volatilization from contaminated floodplains of the German river Elbe. Atmos. Environ 34:3745-3755.

1990's

Weathers, K.C., G.M. Lovett, S.E. Lindberg, S.M. Simkin, D.N. Lewis and M.L. Chambers. 1999. Atmospheric deposition in mountainous terrain: Scaling up to the landscape. EOS, Trans. American Geophysical Union: 80, 390.

Lindberg, S. E., D. Reinhart, P. McCreanor, and J. Price. 1999. Pathways of mercury release in municipal solid waste disposal: A preliminary data report. Proceedings Sardinia 99, Seventh International Waste Management and Landfill Symposium, 4-8 October, 1999, pp. 225-232. CISA, Environmental Sanitary Engineering Centre, Cagliari, Italy.

Gustin, M-S., S. E. Lindberg, and M. A. Allan. 1999. Preface to the Nevada StoRMS mercury emissions project special issue. J. Geophys. Res. 104, 21829-21830.

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Turner, R. R., J. W. Elwood, C. Feldman, and S. E. Lindberg. 1978. Chemical speciation in fly ash leachates: Importance and determination with specific reference to arsenic. Project Completion Report to the Electric Power Research Institute, Palo Alto, CA.

Turner, R. R. and S. E. Lindberg. 1976. Interlaboratory comparison of trace metal analyses by graphite furnace atomic absorption spectroscopy. ORNL/TM-5422. Oak Ridge National Laboratory, Oak Ridge, TN. 21 pp.

Andren, A. W., S. E. Lindberg, and L. C. Bate. 1975. Atmospheric input and geochemical cycling of selected trace elements in Walker Branch Watershed. ORNL/NSF/EATC-13. Oak Ridge National Laboratory, Oak Ridge, TN. 68 pp.

Turner, R. R., S. E. Lindberg, and A. W. Andren. 1974. Concentrations of C, N, ¹³⁷Cs, and selected heavy metals in a sediment core from Lake Jackson, Florida. IN Job Completion Report for the State of Florida Game and Freshwater Fish Commission, Study VI, Lake Jackson Investigations.

Invited Lectures, Seminars, and Presentations

“Pondering Heretical Notions about the Mercury Cycle,” Invited presentation at the Gordon Research Conference on Environmental Sciences: Water. Holderness School, NH, June, 2002.

“Recent Studies of Hg Re-emission over Arctic Snow,” Invited seminar at Frontier Geosciences, Seattle, June, 2002.

“Biogeochemistry of Hg in Wetlands,” Invited seminar at the University of Nevada-Reno, Apr., 2002.

“Measuring Mercury Emissions at Municipal Landfill Facilities,” Invited presentation at the National Solid Waste Mgmt. Assoc. Annual Conference, Coral Springs, FL, Feb. 2002.

“Is Polar Sunrise A Short-Circuit in the Global Mercury Cycle?,” Invited seminar at the Water Chemistry Laboratory, Department of Environmental Engineering, University of Wisconsin, Feb. 2002.

“Mercury beyond Oak Ridge: the Polar sunrise phenomenon,” Invited lecture to the UT Science Forum, University of Tennessee, January 2002.

“Polar Sunrise: a Short-Circuit in the Global Mercury Cycle,” Invited Plenary Luncheon Address at the Joint Policy Meeting of the Commission on Environmental Cooperation and International Joint Commission, Raleigh, Dec. 2001.

“Opening Address and Closing Summary,” Invited presentations at the Sixth International Conference on Mercury as a Global Pollutant, Minamata, Japan, October 15-19, 2001.

“Oxidation of elemental mercury vapor by reactive halogens in the Arctic troposphere,” Invited presentation at the Annual Meeting of the American Chemical Society, Chicago, Aug. 2001.

“The BAMS-2001 Campaign: An update on mercury at Barrow, AK,” Invited presentation at the Arctic Monitoring and Assessment Program (AMAP) workshop on trends and effects of heavy metals, McLean, VA, June, 2001.

“Mercury and Polar Sunrise: Dynamic reactions in the Arctic,” Invited plenary at the USEPA Conference on Mercury Cycling in Aquatic Systems, West Palm Beach, FL, May, 2001.

“Mercury dynamics in the Arctic: the BAMS project” Invited lecture at the National Institute of Minamata Disease, Japan, March, 2001.

“Polar sunrise and the Arctic biogeochemical cycle of mercury,” Invited seminar at the Institute of Ecosystems Studies, New York, Feb. 2001.

“The global mercury cycle and issues on the use of Hg in the ORNL SNS,” Invited seminar, University of Tennessee Dept. of Nuclear Engineering, January, 2001.

“Mercury cycling in the Arctic, new data from Barrow Alaska,” Invited seminar, Duke University School of the Environment, January, 2001.

“Recent research on the mystery of mercury depletions in the Arctic,” Invited seminar, New Mexico State University, Dec. 2000.

“Natural sources and sinks in the global Mercury cycle,” Invited seminar, University of Nevada, Dec. 2000.

“Mercury emission and re-emission from diffuse area sources: The dilemma of small emissions from large surfaces, the “inert” nature of elemental mercury vapor, and missing sinks in the global mercury cycle,” Invited presentation at the EPA Workshop on Mercury in mining, San Francisco, Nov. 2000.

“Interactions between reactive halogens and elemental Mercury vapor in the Arctic: the cause of depletion events,” Invited seminar, University of Virginia, Nov. 2000.

“The dynamics of Mercury behavior in the Arctic snowpack,” Invited presentation at the Annual Meeting of the National Atmospheric Deposition Program, Saratoga Springs, NY, Oct. 2000.

“Photochemical production of reactive gaseous mercury in the Arctic,” Invited presentation at the EPA Conference on Air Toxics, USEPA National Environmental Research Laboratory, Research Triangle Park, NC, Sept 2000.

“Missing sinks in the global mercury cycle,” Invited Plenary lecture at the 25th Anniversary of the International Conference on Heavy Metals in the Environment, University of Michigan, Aug 2000.

“The role of Arctic ecosystems in the global mercury cycle,” Invited seminar at the USEPA Office of International Programs, Washington, DC, May 2000.

“The Arctic as a sink in the global mercury cycle,” Invited seminar at the University of Illinois, State Water Survey, April 2000.

“The role of natural sources in the global mercury cycle,” Invited seminar at the EPRI Annual Board Meeting, Palo Alto, March 2000.

“New sources and sinks in the global mercury cycle,” Invited seminar, University of Michigan Air Quality program, March, 2000.

“Pathways of mercury release from municipal solid waste disposal,” and “New measurements in the global mercury cycle,” Invited seminars at the USEPA National Environmental Research Laboratory, Research Triangle Park, NC, Dec. 1999.

“The Arctic as a sink for atmospheric mercury,” Invited seminar at the NOAA Air Resources Laboratory, Silver Springs, MD, Dec. 1999.

“Developing atmospheric measurement methods to study the global air/surface exchange cycle for mercury,” Invited presentation at the National Institute of Minamata Disease Forum ‘99, Minamata Institute, Japan, Oct., 1999.

“Understanding the role of vegetation in the global mercury cycle,” Invited seminar at the University of Nevada- Las Vegas, Sept., 1999.

“Advances in measuring natural soil emissions and their role in the global mercury cycle,”
Invited seminar at the University of Nevada- Reno, Sept., 1999.

“Highlights of recent measurement campaigns from the ORNL Mercury Group: Emission sources and the global cycle,” Invited seminar at Frontier Geosciences, Seattle, Sept., 1999.

“The role of wetlands in the emission of Mercury to the atmosphere,” Invited seminar at the Experimental Lakes Area, July, 1999.

“The role of air/surface exchange processes in the global mercury cycle.” Invited Plenary Speaker, Opening Day Session, V World’s Congress on Mercury as a Global Pollutant, Rio de Janeiro, Brazil, May 23-27, 1999.

“The behavior and sources of reactive gaseous mercury in air.” Invited paper at National Conference on Air Quality Beyond 2000, Washington, DC, Dec., 1998.

“Emissions from natural surfaces, the problem of re-emission, and the role of dry deposition in global cycling.” Invited presentation at the Science Experts Workshop on Mercury, NAFTA Commission for Environmental Cooperation, Las Vegas, NV, Oct., 1998.

“Tests of a method for sampling reactive gaseous mercury in air.” Invited paper at EPA Analytical Chemistry Conference, Research Triangle Park, NC, Sept., 1998.

"The re-emission of mercury from natural surfaces: Scaling field data to provide a critical link in the global mercury cycle," and "Uncertainties in measuring atmospheric fluxes over environmental surfaces" Invited presentations at the Workshop on Natural Sources of Mercury: Field Intercomparison of Flux Methods, University of Guelph, Canada, May, 1998.

"Processes of mercury emission from terrestrial and wetland ecosystems." Invited seminar, TVA, Chattanooga, April, 1998.

“Methods for measuring mercury fluxes over natural landscapes: application to large-scale growth chambers.” Invited seminar at the Desert Research Institute, Reno, NV, April, 1998.

“Concentrations of a water-soluble gas-phase mercury species in ambient air: Results from measurements and modeling”. Invited paper at Conference on Managing Hazardous Air Pollutants, Washington, DC, Nov. 1997.

"The role of natural surface emissions in the global mercury cycle”, Invited speaker at Laboratory Kolloquium Series, Geestacht Research Center (GKSS), Germany, October, 1997.

"Recent measurements of mercury fluxes over the continents”, Invited seminar in the Meteorological Institute of Stockholm University, Stockholm, Sweden, September, 1997.

"Micrometeorological methods for mercury air/surface exchange studies over forests and waters", Invited seminar at the Department of Environmental Physics, Chalmers' Technical University, Goteborg, Sweden, September, 1997.

"Uncertainties in measuring atmospheric deposition to forests: Do we always know which way is up?" Invited plenary speaker, Gordon Research Conference On Hydrobiogeochemistry, New Haven, Aug. 1997.

"The application of micrometeorological and flux chamber methods to measurements of mercury emission from soils." Invited presentation at the Desert StoRMS Workshop on Scaling Natural Mercury Fluxes, University of Nevada- Reno, Sept., 1997.

"The re-emission of mercury from natural surfaces: A critical link in the global mercury cycle." Invited presentation at Mercury Elimination and Reduction Symposium, Toronto, May, 1997.

"Multiple talks on the application of Tekran automated analyzers to mercury studies." Invited presentations at First Tekran Workshop, Toronto, May, 1997.

"The Role of a Center for the Environment on a University Campus." Invited seminar, Cornell University, March, 1997.

"Processes of mercury emission from terrestrial and wetland ecosystems." Invited seminar, Dept. of Soil, Crop, and Atmospheric Sciences, Cornell University, March, 1997.

"Thoughts on the re-emission of mercury from coal combustion solid wastes." Invited presentation at the Clean Air Advisory Board workshop on mercury emission controls (given in absentia by D. Porcella), Chicago, January, 1997.

"Micrometeorological measurements of mercury evasion over a subtropical wetland and a boreal forest lake." Invited presentation, Environmental Toxics Seminar, Cornell University, Nov., 1996.

"The application of surface analysis methods to quantification of coarse particle dry deposition of phosphorus in the Florida Everglades, Invited presentation, Nutrient Loading Working Group, South Florida Water Management District, West Palm Beach, November, 1996.

"The influence of solar radiation on mercury emission from soils and waters." Invited presentation at the University of Nevada- Reno, Sept., 1996.

"The biogeochemical cycle of mercury in forests." Invited presentation at the Desert Research Institute, Reno, NV, Sept., 1996.

"The mobility of mercury in contaminated and background soils: Is emission the dominant pathway over subsurface transport?" Invited presentation at the USEPA/DOE Workshop on Mercury Speciation, Denver, CO, Sept., 1996.

"The E-MASE project: Mercury evasion in the Florida Everglades Nutrient Removal project", and "Recent developments in the EPRI MASE project." Invited presentations at the All-Florida Investigators Workshop, Orlando, FL, April, 1996.

"Strategies for development of a mercury wet deposition network in Central and South America", invited presentation at the Americas-MDN Workshop, Montreal, Canada, Feb., 1996.

"An overview of the global cycling of atmospheric mercury", Invited presentation to the NAFTA Commission for Environmental Cooperation, North American Working Group on the Sound Management of Chemicals, Montreal, Canada, Feb., 1996.

"Emissions of mercury from natural surfaces in the environment." Invited seminar, Departmental Colloquium, Department of Geology, Florida State University, Tallahassee, November, 1995.

"Atmospheric speciation and air/surface exchange of mercury vapor." Invited seminar, Atmospheric Environment Service, Environment Canada, Toronto, Canada, October, 1995.

"The role of air/surface exchange in the biogeochemical cycle of mercury." Invited presentation at the Atmospheric Sciences Department, University of Michigan, Ann Arbor, September, 1995.

"Dry and wet deposition mechanisms for mercury." Invited presentation at the Canadian Mercury Network Symposium, Toronto, Canada, September, 1995.

"Forests and the global biogeochemical cycling of mercury." Invited plenary paper at the NATO Advanced Science Institute Expert Workshop on Regional and Global Mercury Cycles, Novosibirsk, Siberia, July, 1995.

"Methods to measure the lake surface evasion of Mercury." Invited seminar at the South Florida Water Management District, West Palm Beach, March, 1995.

"Air/surface exchange and atmospheric speciation of Mercury." Invited seminar at Frontier Geosciences, Seattle, February, 1995.

"Evasion of Mercury at Lake Gardsjön, Sweden: The EPRI G-MASE Project." Invited seminar at the Swedish Environmental Research Institute, Goteborg, Sweden, February, 1995.

"A review of recent research on mercury at Oak Ridge National Laboratory." Invited plenary lecture at the International Review of Mercury Research at GKSS, Geesthacht Physics Research Center (GKSS), Hamburg, Germany, May, 1994.

"The role of surface re-emission in the global Mercury cycle", Invited seminar in the Meteorological Institute of Stockholm University Seminar Series, Stockholm, Sweden, May, 1994.

"Development of micrometeorological methods to quantify air/surface exchange of mercury over forest soils and canopies." Invited seminar at the Department of Inorganic Chemistry at Chalmers' Technical University, Goteborg, Sweden, May, 1994.

"Micrometeorological and chamber measurements of the air/surface exchange of mercury." Invited seminar at the Air Toxics Lab, School of Public Health, University of Michigan, Ann Arbor, MI, Jan. 1994.

"Mercury emissions from trees: Results of field and chamber studies." Invited keynote presentation at the Annual Meeting of the National Atmospheric Deposition Program, Nashville, TN, October, 1993.

"New measurements of soil fluxes of mercury vapor from contaminated and background sites." Invited seminar at the Desert Research Institute, September, 1993.

"Development of micrometeorological methods to determine dry deposition of mercury vapor in forests." Invited seminar at the Institute of Ecosystem Studies, Cary Arboretum, NY, Sept. 1993.

"Application of micrometeorological methods to measurements of mercury emissions over contaminated soils." Invited presentation at the Ninth International Conference on Heavy Metals in the Environment, Toronto, Canada, September 12-16, 1993.

"Recent data on air/surface exchange of mercury." Invited presentation to the UNECE Commission on Long-Range Transboundary Air Pollution Workshop on Emissions and Modeling of Atmospheric Transport of Persistent Organics and Heavy Metals, Durham, NC, May, 1993.

"Results of micrometeorological and chamber measurements of the air/surface exchange of mercury." Invited seminar at the Air Toxics Lab, School of Public Health, University of Michigan, Ann Arbor, March, 1993.

"Atmosphere/surface exchange of Mercury: preliminary results from micrometeorological, plant chamber, and throughfall methods." Invited seminar at the Swedish Environmental Research Institute, Goteborg, Sweden, November, 1992.

"A network for measurement of Mercury deposition: What do we know and where do we go?" Invited presentation at the Annual Technical Meeting of the National Atmospheric Deposition Program, Cocoa Beach, FL, October, 1992.

"Wet and dry deposition of mercury to forests." Invited seminar at the University of Illinois, Champaign, December, 1991.

"Air/surface exchange of mercury: modeling dry deposition." Invited seminar at the Complex Systems research Center, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, November, 1991.

"A synthesis of results from the Integrated Forest Study." Invited lecture at the Sukachev Institute of Forest and Timber Research, Siberian Division of the U.S.S.R. Academy of Sciences, Krasnoyarsk, U.S.S.R., July, 1991.

"The role of fossil fuel emissions and atmospheric deposition in Mercury cycling". Invited presentation to the New York Power Authority, New York, April, 1991.

"Studies of deposition gradients during the Integrated Forest Study". Invited presentation at the U.S. - Poland Gradient Workshop, Miami, March, 1991.

"Atmospheric chemical inputs to small catchments". Invited presentation at the SCOPE Workshop on Biogeochemical Processes in Small Catchments, Most, Czechoslovakia, November, 1990 (presented in absentia by H. Ross).

"Atmospheric deposition and canopy interactions of metals and nitrogen in forest ecosystems: The influence of global change". Invited plenary lecture at the 110th Anniversary Celebration of the Free University of Amsterdam, Amsterdam, The Netherlands, September, 1990.

"A changing climate for atmosphere/forest interactions: Atmospheric deposition and the role of climate change on aerosol sources and sinks." Invited seminar at the Department of Environmental and Energy Systems Studies, Lund Institute of Science and Technology, Lund, Sweden, June, 1990.

"The role of dry deposition in the atmosphere/forest transfer of Mercury." Invited plenary paper at the International Conference on Mercury as an Environmental Pollutant, Gävle, Sweden, June, 1990.

"Canopy assimilation of deposited atmospheric nitrogen compounds: Results from the Integrated Forest Study." Invited lecture at the National Institute of Public Health and Environmental Protection, Utrecht, The Netherlands, June, 1990.

"The behavior of airborne sulfur in forest canopies: A synthesis of results on throughfall studies in the Integrated Forest Study." Invited lecture at the Department of Geography, University of Utrecht, Utrecht, The Netherlands, May, 1990.

"Atmospheric emissions and aquatic losses of mercury from an abandoned chlorine plant." Invited seminar at the Illinois State Water Survey, University of Illinois, Champaign, March, 1990.

"Atmospheric deposition in North American forests." Invited plenary presentation at the International Congress on Forest Decline Research: State of Knowledge and Perspectives, Friedrichshafen, FRG, October, 1989.

"Deposition and canopy interactions studies in the Integrated Forest Study," Invited seminar at the Institute of Radioagronomy, Julich Nuclear Center, Julich, FRG, September, 1989.

"Atmospheric chemistry and deposition of cloud water in mountain forests," Invited seminar at the North Carolina State Dept. of Meteorology and Earth Sciences, Raleigh, April, 1989.

"The link between air pollution and forest health in the Smoky Mountains," Invited seminar at the ORNL Physics Division, April, 1989.

"An approach for quantifying dry deposition of trace and major atmospheric constituents using surface analysis methods," Invited presentation at the DOE MAP3S/RAINE Planning Workshop, Bethesda, April, 1989.

"A comparison of results of deposition and cloudwater chemistry measurements in the IFS and MCCP projects," Invited presentation at the TVA Annual Acid Rain Conference, Gatlinburg, November, 1988.

"Understanding aerosol dry deposition processes in forests from the analysis of throughfall." 1988. Invited keynote presentation at the European Aerosol Conference Workshop on Particle Deposition to Forests, Lund, Sweden, September, 1988.

"Can total atmospheric deposition of sulfur be estimated from analysis of throughfall: Results of Integrated Forest Study measurements and ³⁵S experiments." 1988. Invited seminar to the Meteorological Institute of the University of Stockholm, Stockholm, Sweden, September, 1988.

"Dry deposition of trace metals associated with coarse aerosols." 1988. Invited presentation at the NATO Advanced Workshop on Atmospheric Trace Metals, Oslo, Norway, September, 1988.

"Field measurements of the atmospheric deposition and plant uptake of airborne nitrogen in the Integrated Forest Study." Invited seminar at the Swedish Environmental Research Institute, Goteborg, Sweden, September, 1988.

"Deposition and canopy scavenging of aerosols," Invited seminar at the Illinois Institute of Technology, April 1988.

"A summary of recent research results on atmospheric wet and dry deposition in the United States," Invited seminar at the Center for Ecosystem Research, University of Göttingen, West Germany, May 1987.

"Atmospheric deposition and meteorologic conditions at low and high elevation sites in the Southern Appalachian Mountains," Invited presentation at the NATO Advanced Workshop on Deposition in Mountainous Terrain, Edinburgh, Scotland, September 1986.

"Development of surface analysis methods for dry deposition to forests," Invited presentation at the NAPAP Workshop on Dry Deposition Methodology, Harpers Ferry, WV, March 1986.

"Trace metals in rain at forested sites in the southeastern US," invited presentation at the Workshop on Methods for Analysis of Trace Metals in Rain, Toronto, Canada, January 1986.

"Deposition and canopy interactions of airborne nitrate in forests," Invited presentation at the United Nations Advanced Workshop on Atmospheric Deposition Effects, Toronto, Canada, May 1985.

"Atmosphere/Plant interactions of trace metals," Invited presentation to the United Nations Scientific Committee on Problems in the Environment, Toronto, Canada, August, 1984.

"The role of atmospheric nitrogen and Pb deposition in the forest decline in Germany," Invited seminar at the General Motors Research Laboratory, Warren, Michigan, July, 1984.

"A review of atmospheric deposition research in southeastern U.S. forests," Invited presentation to the Joint U.S./German Research Group on the Study of Forest Decline Phenomena, Asheville, North Carolina, June, 1984.

"The use of foliar analyses for estimating dry deposition rates," Invited presentation to the State of California Air Resources Board, San Francisco, California, February, 1984.

"Some observations on the German forest decline," Invited presentation to the National Atmospheric Deposition Program Annual Meeting, Knoxville, TN, November 1983.

"Recent research on atmospheric deposition," Invited seminar at the Atomic Energy Research Establishment, Harwell, UK, September, 1983.

"Metals in atmospheric deposition: A review." 1983. Invited keynote presentation at the International Conference on Heavy Metals in the Environment, Heidelberg, FRG, September 1983.

"Vegetation canopies as reaction surfaces for tropospheric constituents." 1983. Invited presentation at the Gordon Research Conference on Environmental Sciences: Air, Biogeochemical Cycles and the Atmosphere. New Hampton, NH, June, 1983.

"Mechanisms of the flux of acids and heavy metals to receptors in the environment." 1983. Invited presentation at the VDI (German Society of Engineers) Colloquium on Acid Precipitation; Lindau, Germany, June, 1983.

"Interactions between airborne heavy metals and acid precipitation." 1982. Invited paper presented at the Annual Meeting of the Air Pollution Control Association, New Orleans, LA, June, 1982.

"Interaction of wet and dry deposition components of acid precipitation with the forest canopy." 1981. Invited presentation at Conference on Effects of Acid Precipitation on Ecological Systems in the Great Lakes Region, Michigan State University, East Lansing, MI, April, 1981.

"Deposition of particles to inert and foliar surfaces in a forest canopy." 1981. Invited seminar, Center for Energy and Environmental Studies seminar series, Carnegie-Mellon University, Pittsburg, PA, March, 1981.

"Processes of deposition to forest vegetation." 1981. Invited seminar, Department of Environmental Sciences, University of Virginia, Charlottesville, VA, March, 1981.

"The forest canopy: A source or sink for trace elements in the atmosphere?" 1980. Invited presentation at the Gordon Research Conference on Aerobiology, Meridan, NH, July, 1980.

"Research needs in the effects of atmospheric deposition on vegetation." 1980. Invited presentation at the International Conference on Current Status and Future needs of Research on Effects and Technology of Air Pollution, Banff, Alberta, Canada, May, 1980.

"Use of surrogate surfaces to measure dry deposited aerosol flux to forest systems." 1979. Invited presentation at the EPA Workshop on Dry Deposition Methodology, Argonne, IL, December, 1979.

"Precipitation chemistry research at Walker Branch Watershed: Relationship to Meteorological Effects of Thermal Energy Releases (METER) studies around plant Bowen." 1978. Invited presentation at the METER-ORNL Workshop, Cartersville, GA, June, 1978.

"The role of wet and dry deposition in air pollution effects studies." 1978. Invited presentation at the Tenth Air Pollution Workshop, Air Pollution Control Association, Minneapolis, MN, April, 1978.

"Geochemical aspects of atmospheric deposition," Invited seminar, Scripps Institution of Oceanography, LaJolla, California, April 1979.

"Atmospheric emission of mercury from abandoned solid waste ponds," Invited seminar, Department of Civil Engineering, University of Tennessee, Knoxville, December 1978.

"The role of wet and dry deposition in trace element cycling at Walker Branch Watershed," Invited seminar at Atmospheric Sciences Group, Brookhaven National Laboratory, Upton, Long Island, New York, June 1978.

"Precipitation chemistry research at Walker Branch Watershed," Invited Presentation at the MAP3S Precipitation Chemistry Program Annual Meeting, University of Virginia, Charlottesville, Virginia, April 1977.

"Aerosol geochemistry in Walker Branch Watershed," Invited seminar at Department of Oceanography, Florida State University, Tallahassee, Florida, October 1976.

"Geochemistry of mercury in the estuarine environment." 1973. Invited presentation at the Second International Estuarine Research Conference, Myrtle Beach, SC. October, 1973.