David H. Minott, QEP, CCM *(RETIRED)*

President and Principal Consultant

david.minott@arc5enviro.com
978.877.7719

David Minott, QEP, CCM has retired following a 44-year career as an environmental consultant to management. While retired, he remains professionally engaged, serving on the Technical Council and Editorial Board of the Air & Waste Management Association (AWMA).

Biomass energy and waste-to-energy (WTE) had been Mr. Minott's professional focus since the early 1980's, including some 60 projects nationally. Experience included all types of traditional technology for WTE and biomass energy (grid-connected, co-generation, co-firing), as well as extensive experience with the emerging, energy conversion technologies such as thermal and plasma gasification, pyrolysis, anaerobic digestion biogas, and waste-to-liquid fuels. He also has significant national experience with thermal drying and other beneficial uses for wastewater biosolids.

Mr. Minott is an air quality specialist and environmental permitting generalist. Notably, Mr. Minott earned a national reputation as an expert specialist in environmental consulting specifically for waste-to-energy facilities, bioenergy plants, and biosolids thermal treatment facilities. He has directed feasibility studies, siting analyses, transactional due diligence, regulatory planning and negotiations, air permitting, dispersion modeling, health risk assessment, general environmental permitting, EIS preparation, lifecycle analyses, and stakeholder engagement. Mr. Minott's capabilities and extensive experience have contributed significantly to the successful development of numerous landmark projects nationally.

More broadly, Mr. Minott has provided strategic advice on environmental planning, permitting, and compliance matters to a wide spectrum of clients – electric power generation, public environmental infrastructure (solid waste, waste water, transportation), institutions, and a variety of industrial manufacturing industries.

Mr. Minott has extensive experience in public communication and expert witness testimony.

Professional Registrations

- Qualified Environmental Professional (QEP)
- Certified Consulting Meteorologist (CCM)

Professional Affiliations

- Air and Waste Management Association (AWMA), Serving on Technical Council and Editorial Board
- American Meteorological Society (AMS)

Fields of Competence

- ***Bioenergy, Waste-to-energy (WTE), conversion technologies, biomass power, CHP, AD biogas, liquid biofuels, biosolids re-use***
- Environmental feasibility studies
- Environmental/Transactional due diligence
- Permitting and compliance strategies
- Direction of environmental consultant teams
- ***Strong Air Permitting*** – PSD and Title-V; Boiler MACT, Area Source, and CISWI Rules; MWC Rules; NHSM Rule; RICE Rule, GHG Tailoring Rule, CPP Rules
- Air-pollutant dispersion meteorology/modeling
- EIS preparation
- Effective report writing
- Public hearings and expert testimony
- Stakeholder engagement

Education

- M.S.B.A., (1) Business Administration,
  (2) Air Quality Science & Technology,
  University of Massachusetts
- B.S., Meteorology, University of Massachusetts

Civic Experience in Community of Residence (Past)

- Elected member of Board of Health
- Founded and directed the recycling program
- Trails Committee member

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Employment History – Environmental Consulting

- Arc5 Environmental Consulting, LLC,
  2013 – Present (Retired in 2018),
  President and Principal Consultant
- Environmental Resources Management (ERM),
  2007 – 2013,
  National Practice Leader - Bioenergy and Waste-to-Energy
- Alternative Resources, Inc. (ARI),
  1984 – 2007,
  Co-Founding Principal, VP Environmental Services
- TRC Companies, Inc.,
  1974 – 1983,
  Senior Air Quality Scientist

Key Projects

Projects are arranged below under the categories:

- **Bioenergy**
- **Waste-to-Energy/Conversion Technologies**
- **Wastewater Biosolids**

Bioenergy

Directed [2000 -2016] the conceptual engineering design, complex air permitting (PSD and Title V), dispersion modeling, and health risk assessment for a 55 MW biomass power plant (stoker boiler) developed in Benson, MN by Fibrowatt LLC, later owned and operated by Benson Power. The $200 million Benson Power Biomass Plant, operating from 2007 to 2018, was unique in that it is fueled principally with turkey litter – up to 1,000 TPD. Notable aspects of permitting were the acid gas control requirements associated with using poultry litter as a fuel (SDA/FF), a unique emissions profile for PM10/2.5, as well as the need for a case-specific MACT determination.

For the Benson Power Biomass Plant in MN above, provided [2015-2016] compliance planning services with regard to the new boiler air rules issued by EPA in 2013 (Boiler MACT, CISWI). Prepared a petition to US EPA under the new NHSM Rule for EPA to reclassify poultry litter from a waste material when combusted to a non-waste fuel material. EPA granted the petition in 2015, the first such determination made nationally by EPA. The successful outcome enables the plant to be regulated under the Boiler MACT rule, rather than under the CISWI Rule, avoiding a significant compliance risk.

Performed [2014] state-level solid-waste permitting and evaluated the applicability of the EPA CISWI Rule for fluid-bed gasification of carpet remnants, scrap plastics, C&D wood, and other opportunity fuels for the 340 MMBtu/hr steam & power boiler at the Pratt Paper Mill in Conyers, GA.

Furnished [2012] expert technical and strategic guidance for the successful air permitting of the Hu Honua 24-MW Bioenergy Facility (wood fueled) under development in Hawaii, including analysis of Best Available Control Technology (BACT) and strategic assessment of the implications for the project of new EPA air regulations (Boiler MACT, GHG Tailoring Rule for PSD).

Provided specialized technical and air-regulatory guidance for the permitting of the MultiTrade 28-MW Rabun Gap biomass power plant (wood fueled) in Georgia [2009].

For a global petroleum company [2011], evaluated the carbon lifecyle profile for the company's plan for a large fleet of anaerobic digestion (AD) biogas facilities across the country at large dairies and cattle feedlots. The concept is being considered as a means for reducing the overall carbon emissions profile associated with the company's oil extraction and refining operations in the U.S.

For a global petroleum company, advised [2010] on the environmental aspects of siting and permitting non-grain cellulosic ethanol plants planned for development in the U.S.

Completed an expert, independent review of the environmental impacts of a 50 MW wood biomass power plant planned for development in Russell, MA. The engagement entailed meeting with officials and residents of the host community to ascertain issues of local concern, followed by a detailed technical review of the permit application documents and Environmental Impact Report that had been prepared by consultants to the project developer. Issues assessed independently included truck traffic safety and truck diesel emissions impacts; options for boiler technology (stoker vs. fluid bed); permissible types of wood fuel; air emissions and their control; health risk assessment; cooling tower

impacts; and impacts on the local river from water draw and waste water/stormwater discharge. Presented findings at a public meeting and delivered expert testimony at a formal State DPU hearing on the project.

Directed (2012) the permitting of two, 45-60 MW poultry-litter biomass power plants planned in North Carolina, addressing all required permits and approvals, as well as site evaluations (wetlands, cultural resources), EIS preparation, stakeholder engagement, and environmental justice concerns. Performed strategic assessment of the implications for the project of new EPA air regulations (Boiler MACT, CISWI Rule, GHG Tailoring Rule for PSD).

Developed [2012] a strategic environmental permitting plan, stakeholder engagement strategy, and performed a fuel availability study for an energy project at a recycling paper mill on the East Coast that would entail installation of a fluid-bed gasifier at the mill to convert the mill's solid residues as well as MSW to electricity and steam for use by the mill.

For the Maryland Environmental Service (MES), prepared an analysis of air pollutant emissions to be expected from a 40-MW biomass power plant to be fueled with poultry litter, and planned for development in Maryland.

Waste-to-Energy and Conversion Technologies

Performed transactional due-diligence [2015) for United Airlines in support of their investment in Fulcrum Bioenergy, a company that will manufacture jet fuel from municipal solid waste (MSW). The process entails thermal gasification of MSW and syngas catalysis.

Furnished [2013] expert technical and strategic environmental consulting services for the 4,000 TPD RDF-based WTE facility planned by Energy Answers in Baltimore, MD. Assessed regulatory applicability; PSD permitting requirements; BACT/LAER emission limits and technology; BACT for non-biogenic/biogenic GHG and compliance demonstration methods; continuous emissions monitoring requirements; EPA requirements for a Siting Analysis and Materials Separation Plan. Addressed comments on the draft PSD permit posed by EPA Region III and presented expert testimony on the draft permit at a regulatory hearing.

Performed transactional due-diligence [2014] on behalf of a [confidential] lending institution to fund the growth of a leading international developer of cellulosic biofuels and green chemicals.

For the World Bank [2011-2015], prepared a comprehensive technical, economic, and environmental feasibility assessment for implementation of alternative solid waste management technologies in Latin America including anaerobic digestion of food waste, composting and vermiculture, traditional recycling, engineered landfills, traditional waste-to-energy, gasification, waste-to-liquid fuels, and mechanical-biological treatment. The assessment also included evaluation of the GHG emissions intensity for the waste management technologies.

For Ontario County, New York, performed (2010) a comprehensive independent review of the technical and environmental viability of technology which thermally gasifies municipal solid waste and wood chips, and converts the syngas to liquid fuel (e.g., methanol, biodiesel) via the Fischer-Tropsch process.

Performed the key analyses (2007) for the permitting of a new 250 TPD waste-to-energy unit at the Olmsted County Waste-to-Energy facility in Rochester, Minnesota, including quantification of air pollutant emissions, BACT analysis, the required "Siting Analysis," and the Materials Separation Plan. Successfully negotiated BACT for control of NOx emissions that avoided unduly expensive control technology (SCR) and avoided aggressive, risky emission limits for NOx that had been suggested by the US EPA's regional office. The new combustion unit is currently in operation.

In a confidential engagement, performed an environmental due-diligence and financial risk assessment of a company's rail-haul/landfill operation, entailing rail transshipment of municipal solid waste from New Jersey for disposal in a 5,000 TPD landfill in Ohio. Performed an independent review of the environmental, technical, and economic feasibility of the project, including both the rail-haul and landfill aspects.

Performed comprehensive, environmental due diligence for the re-financing by John Hancock of the 1,500 mass-burn, waste-to-energy facility operating in Millbury, Massachusetts.

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Directed EIS preparation, all permitting, health risk assessment, and public interface for two large waste-to-energy facilities planned by the Solid Waste Management Authority of Puerto Rico. Both traditional waste-to-energy and alternative gasification technology were assessed at the 1,800 TPD scale. Participated extensively in siting and feasibility studies for both, planned facilities.

Prepared the air permit application and air impact assessment for a 250 TPD pyrolysis waste-to-energy plant planned for private development by Power Recovery Systems in Derry, New Hampshire. This 1980's project was the first *pyrolysis* waste-to-energy facility proposed for development in the U.S.

Directed the permitting of a 1,575-TPD mass-burn, waste- to-energy facility planned by Covanta in Clark County, Ohio, including preparation of the PSD air permit application, the air quality impact assessment, the required air-toxics assessment and the required permit applications for solid waste, storm water, and wastewater discharge. The air permit application was prepared in "record time," enabling it to be deemed a complete application by the regulatory agency before the deadline for a change in federal regulations that would significantly ratchet down the minor/major source threshold for NOx in the local ozone nonattainment area.

Provided feasibility-assessment, permitting, and EIS services for the first MSW "conversion technology" project ever proposed in the U.S. This was an innovative gasifier facility planned in Orange County, New York during the 1980's, which would convert 750 TPD of municipal waste and sewage sludge to fuel ethanol. The lignin byproduct of the process would be gasified onsite to produce electric and thermal energy needed by the ethanol plant.

For the City of New York, assessed and compared the environmental attributes of eight, commercially-available, emerging technologies for converting municipal solid waste to energy, including thermal and plasma gasifers, food waste anaerobic digesters, and waste-to-ethanol. The technologies were assessed for air emissions, water use, wastewater discharge, solid residue generation, and carbon footprint. The City had intended to select and procure one of these innovative conversion technologies and implement a 500 TPD commercial demonstration project.

For a law firm representing Exelon, performed an expert independent assessment of the 250 TPD tires-to-energy facility operating in Ford Heights, IL. The assessment focused on whether the plant could or could not achieve a high annual capacity factor, while still meeting permit limits on air pollutant emissions. Delivered expert testimony regarding findings and opinions.

Prepared the EIS, air permit application, air dispersion modeling analysis, and health risk assessment for a 1,500 TPD mass-burn, waste-to-energy facility planned for private development in Lowell, Massachusetts.

Prepared the air permit application and multi-pathway health risk assessment for an 870 TPD multiple fuel (RDF, tires, wood chips) fluidized-bed waste-to-energy system planned in Collier County, Florida.

Prepared a feasibility analysis of innovative waste-to-energy technologies (2004) for the Charleston County Solid Waste Department in South Carolina, as part of a formal long-term plan for potential alternatives to the County's aging, 644 TPD waste-to-energy facility. Alternative conversion technologies evaluated were gasification or pyrolysis, digestion, and waste-to-ethanol.

Conducted a comprehensive, independent technical review of air emissions controls, air impact assessment, and health risk assessment, in connection with the upgrade of a 1,500 TPD waste-to-energy facility operating in North Andover, Massachusetts. Delivered formal testimony at a public hearing and presented findings effectively at a contentious public meeting. Successfully debated Jill Stein (the recent Green Party candidate for U. S. President) over the merits of this project.

Directed a formal feasibility study for a new, 500-TPD waste-to-energy facility being considered to serve the St. Cloud region of Minnesota. The study assessed waste availability, technology options, site suitability, energy sales options, and environmental permitting requirements. Projected capital costs, operating costs, and tip-fee requirements were modeled.

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Prepared the Independent Engineer's Report for the planned $9 million financing of a small, commercial-scale facility that would convert municipal solid waste, animal manure and sewage sludge to fuel ethanol. The feasibility study paid particular attention to the risks associated with the use of innovative technology: (1) use of solid waste as the source of cellulosic feedstock had never been attempted before, and (2) the source of heat for the acid hydrolysis process (a gravity pressure vessel) had never been applied before to ethanol production.

Directed a formal feasibility study for a new, 200 TPD waste-to-energy facility planned by Redwood County, Minnesota. The comprehensive study, prepared for the County Commissioners, assessed the technical, economic, and environmental feasibility of the planned waste-to-energy facility.

Quantified air pollutant emissions from the world's largest landfill, the 13,500-TPD Fresh Kills Landfill in New York City, performed detailed air-quality impact modeling, and assessed associated health risks. Evaluated the expected performance of the landfill gas collection and flaring systems planned in association with landfill closure. Quantified air emissions for the planned flares, and evaluated emission levels and controls for a planned electric power plant to be fueled with the landfill gas.

Prepared a comprehensive study of materials separation as a BACT alternative under PSD permitting for a 1,450 TPD, mass-burn, waste-to-energy facility planned for Mercer/Atlantic Counties, New Jersey.

For a law firm representing the Onondaga County Resource Recovery Authority in New York, prepared a legal affidavit comparing landfills and waste-to-energy facilities with regard to environmental impacts – air pollutant emissions, leachate, as well as odors, scavengers, and vectors.

Prepared EIS sections on air quality and a multi-pathway health risk assessment for four, 2000-3000 tons per day (TPD) waste-to-energy facilities planned in New York City.

Prepared the EIS, air permit application, air quality impact assessment, multi-pathway health risk assessment, and solid waste permit application for a 1,500 TPD mass-burn waste-to-energy facility planned in Boston, Massachusetts.

Performed PSD air quality permitting for a 250 TPD mass-burn co-disposal facility (MSW and sewage sludge) that operated in Glen Cove, New York.

For AES LLC, Bronx, New York City secured [2011] the State and City solid waste approvals needed to construct and operate a metals/plastics buy-back recycling center.

For Routhier, Inc., Ayer, MA, secured the necessary Solid Waste Facility Site Assignment for a 200 TPD facility that processes used tires into tire-derived fuel (TDF).

Glass Recycling Company (CA, MN, WA, NY) – Due Diligence Assessment. Directed a comprehensive due diligence assessment [2011] on a (confidential) glass recycling company with operations in several states across the U.S. Due diligence was performed for both environmental and health & safety compliance on behalf of an investor in the company's growth plans.

As a component of developing the Solid Waste Management Plan for West Cook County, Illinois, prepared comprehensive assessments of the environmental impacts and benefits for the alternatives of waste-to-energy and composting.

For the investment banker, Tucker Anthony, prepared the Independent Engineer's Report for the $50 million financing of a planned, new paper-recycling mill that would use innovative paper-repulping technology. Inspected the operating reference plant in Mexico. Made a number of recommendations for lessening the project risks, for example, establishing a well-funded equipment replacement fund and beefing up the debt service reserve fund, in recognition of the significant reliability risk presented by the innovative pulping technology.

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Wastewater Biosolids

Performed [2013] the environmental due diligence required for the $ ½ Billion acquisition by EQT Infrastructure II of Synagro Technologies, the leading national company in the business of managing municipal wastewater residuals (biosolids), including land application, thermal drying, and composting.

Directed the design-build procurement and environmental permit planning for the 20 DTPD biosolids indirect thermal dryer that now operates at the Stamford, Connecticut wastewater treatment facility [2006].

Performed environmental due diligence for the financing of EnerTech, a biosolids conversion company. Technical and economic feasibility assessment was performed by others. EnerTech developed a facility in Rialto, California that thermally converted municipal biosolids to 200 TPD of biomass fuel to be marketed to cement kilns as a coal substitute. Subsequently to the financing, directed preparation of a comprehensive, greenhouse gas lifecycle assessment for the EnerTech Facility, compared with alternative "baseline" dispositions for biosolids (landfill, compost, incineration, thermal drying, land application). Due to economic challenges, the facility was later converted to another type of organics processing.

Directed the air-permitting and air dispersion modeling for two of the world's largest facilities for thermal drying of municipal biosolids to fertilizer pellets. These facilities have operated in New York City (300 DTPD) and Boston, Massachusetts (164 DTPD). Directed dispersion modeling to assess the locations and severity of odor impacts in the neighborhood surrounding the biosolids thermal drying/pelletizing facility in New York City.

Performed the state-required Environmental Assessment and solid-waste facility permitting for a 1,300 WTPD biosolids transshipment facility in Brooklyn, New York City, for transport of the biosolids for land application out of state. When the plant became operational, directed olfactometry measurements and dispersion modeling to diagnose causes of odor complaints from abutting residents. Recommended operating measures that successfully abated the odor complaints to the satisfaction of state regulators.

Directed the air permitting and dispersion modeling (2005) for a new, 75 DTPD fluid-bed biosolids incinerator for the Borough of Naugatuck, Connecticut's waste water treatment plant.

Directed the air permitting for the major, emissions-control retrofit (wet ESP, RTO) and Title-V operating permit for the Upper Blackstone Water Pollution Abatement District's 150 DTPD sewage sludge incinerator in Millbury, Massachusetts. Directed the CWA Part-503 re-permitting of the incinerators.

Directed the air permitting for the emissions-control retrofit (wet ESP, RTO), and Federal permitting (CWA Part 503) for the 48 DTPD sewage sludge incinerator operating at the East Fitchburg (MA) Wastewater Treatment Facilities.

Directed dispersion modeling and BACT evaluation for permitting of a 40 DTPD, indirect, belt biosolids-drying facility planned for the wastewater treatment plant in Fairhaven, MA. The dryer would be heated with a wood-fueled boiler. Performed odor impact modeling for the dryer and the wastewater treatment plant.

Performed the air permitting, dispersion modeling, and emissions-testing oversight for the emissions control upgrades of two, 60 DTPD multiple hearth biosolids incinerators at the Metropolitan District's wastewater plant in Hartford, Connecticut.

Performed PSD air quality permitting for a 250 TPD mass-burn co-disposal facility (MSW and biosolids) that operated in Glen Cove, New York, into the 1980's.

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Publications (Selected from over 50)

Minott, D., 2016 "EPA's First Case-Specific Non-Waste Determination for a Boiler Opportunity Fuel." Presented at A&WMA 109th Annual Conference and Exhibition, New Orleans, LA, June 20-23, 2016.

Minott, D., 2016 "A National First, EPA Decides: Biomass-Boiler Opportunity Fuel is *Not* Waste Incineration." Presented at the International Biomass Conference, Charlotte, NC, April 14-16, 2016.

Minott, D. and C. Amaechi, 2013. "The New EPA Boiler Air Rules – Not All Biomass Is Created Equal." Feature article in *EM – Environmental Manager*, May 2013, published by the Air & Waste Management Association (AWMA).

Minott, D., "The New Biomass Boiler Rules – What Now?" presented at the International Biomass Conference, Minneapolis, MN, April 8-10, 2013.

Minott, D. et al., "Major New Waste-to-Energy Facility in Maryland — A Permitting Process with National Implications," Annual Conference of the Air & Waste Management Association (AWMA), San Antonio, TX, June 19-22, 2012.

Minott, D., "The New Biomass Boiler Rules – Can EPA Get It Right?" presented at the International Biomass Conference, Denver, CO, April 16-19, 2012.

Minott, D. "MACT Update – Boiler MACT and Commercial & Industrial Solid Waste Incinerator NSPS," presented at the New England Conference of the Air & Waste Management Association (AWMA), November 6, 2009.

Minott D. and J. Miller, "EnerTech's Process for Conversion of Biosolids to a Renewable Energy Biomass Fuel: A Life-Cycle Analysis of Carbon Emissions Reductions," to be presented at 2009 International Biomass Conference, Portland, OR, 28-30 April, 2009.

Minott D., with A. Jarvis and M. Chemweno, "Renewable Power from Biomass Fuels," presented at 12th Annual EUEC Energy & Environmental Conference, Phoenix, Arizona, February 2-4, 2009.

Minott D. and T. Walmsley, "Environmental Design Issues for Regional-Scale Poultry Litter Power Plants," presented at 99th Annual Conference of the Air & Waste Management Association, New Orleans, LA, June 20-23, 2006.

Minott, D. "Engineering and Environmental Aspects of Managing Municipal Solid Waste Via Waste-to-Energy," presented at the Annual Conference of the Puerto Rico College (association) of Engineers, at Polytechnic University, San Juan, Puerto Rico, February 24, 2000.

Minott, D. "Sustainable Technologies: Experience and Perspective," Presented at 90th Annual Meeting of the Air & Waste Management Association, June 8-13, 1997, Toronto, Ontario.

Licata, A. and D. Minott, "Comparison of Air Emissions from Solid Waste Management Facilities," Proceedings of 17th Biennial Waste Processing Conference, American Society of Mechanical Engineers, Atlantic City, NJ, March 31, 1996.

Minott, D. "Air Pollutant Emissions from MSW Landfills – The 'Sleeper' Issue for Landfill Design and Regulation," in Proceedings of the Tenth Conference on Solid Waste Management & Materials Policy, sponsored by the New York State Legislative Commission on Solid Waste Management, New York City, February 19 - 22, 1995.

Minott, D., "Efficient Combustion with Fluid Bed Furnaces," *Solid Waste & Power*, Vol. IV, N5, October, 1990.

Minott, D H. "Fluid-Bed Energy Recovery Facilities: Operating Principles and Environmental Performance," Proceedings of the International Conference on Municipal Waste Combustion, Hollywood, FL, April 11-14, 1989.

Minott, D. H. "Health Risks and the Alternatives of Resource Recovery Versus Landfills for Municipal Solid Waste," Presented at the 82nd Annual Meeting of the Air & Waste Management Association, Anaheim, CA, June 25-30, 1989.

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Minott, D., "Quantitative Comparison of Health Risks for Energy Recovery Facilities Versus Municipal Landfills," Proceedings of Conference on Municipal Solid Waste Disposal, University of Massachusetts at Amherst, MA, Cosponsored by U.S. EPA Region 1 and the New England Waste Management Officers Association, April, 1988.

Minott, D., "An Overview of Alternative Technologies for Control of Air Pollutant Emissions from Waste-to-Energy Facilities," Proceedings of Conference on Acid Gas and Dioxin Control for Waste-to-Energy Facilities, Washington D.C., Nov. 1985.

Wackter, D. and D. Minott, "Evaluation of Six Urban Air Quality Simulation Models," Preprint of the Fourth Joint Conference on Applications of Air Pollution Meteorology (American Meteorological Society), Portland, OR, Oct. 1984.

Minott, D. and R. Londergan, "Comparative Performance Evaluation of MPTER and Alternative Rural Dispersion Models," Technical Paper 82-3.4: 75th Annual Meeting of the Air Pollution Control Association, New Orleans, LA, June 1982.

Minott, D.H., et al., "EPRI Plume Model Validation Project: Intensive Measurements Program," Fifth symposium on Turbulence, Diffusion, and Air Pollution. American Meteorological Society, Boston, MA, March 1981.

Shearer, D. and D. Minott, "Development of Vertical Dispersion Coefficients for Rolling Terrain Environments," Preprints of the Joint Conference on Applications of Air Pollution Environments, Preprints of the Joint Conference on Applications of Air Pollution Meteorology, American Meteorological Society, Boston, MA, December 1977.