

Exponent®
Engineering & Scientific Consulting

Lloyd Schulman, Ph.D., CCM

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Professional Profile

Dr. Schulman is a Certified Consulting Meteorologist with over 40 years of experience in the development, evaluation, and application of air quality models. He co-developed the building downwash algorithm currently recommended by the U.S. EPA for regulatory use.

Dr. Schulman has conducted air quality analyses for a wide range of sources and industries including power plants, steel mills, oil refineries, chemical plants, offshore platforms, smelters, asphalt plants, landfills, incinerators, natural gas pipelines and paper mills and involving emissions such as toxic chemicals, odors, and dense gases. Other work has involved the design and siting of data measurement systems and forensic meteorological studies.

Dr. Schulman was also a co-developer of the Buoyant Line and Point Source model for aluminum reduction plants and managed the development of the Offshore and Coastal Dispersion model, which is applied to pollutant releases over water. These models have also been recommended by the EPA for regulatory use.

As part of his interest in micro-scale and urban-scale air flow, Dr. Schulman has been involved in applying the computational fluid dynamics models FLUENT and STAR-CCM+. Some of the applications have included wind forces on buildings during a hurricane, design of wind fences to mitigate wind-blown fugitive dust, two-phase accidental releases of dense gases from railcars or vents, fogging and recirculation of exhausts from mechanical draft cooling towers, plume rise from air-cooled condensers, the effect of structures on wind turbines, and the contamination of fresh-air intakes by rooftop vent emissions.

Academic Credentials & Professional Honors

Ph.D., Meteorology, Massachusetts Institute of Technology (MIT), 1974

M.S., Meteorology, Massachusetts Institute of Technology (MIT), 1972

B.S., Meteorology and Oceanography, University of Michigan, Ann Arbor, 1970

Licenses and Certifications

Certified Construction Manager (CCM)

Prior Experience

Vice President, TRC Environmental, 2006-2011

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Principal Scientist, Earth Tech, 1993-2006

Principal Scientist, Sigma Research Corporation, 1986-1993

ERT (later ENSR and AECOM), 1974-1986

Professional Affiliations

American Meteorological Society - Certified Consulting Meteorologist #240

Air & Waste Management Association

Publications

Schulman LL, DesAutels CG, Kolts B. Effectiveness of wind fences to reduce fugitive particulate emissions from material piles: A computational fluid dynamics study. Air & Waste Management Association 106th Annual Meeting, Chicago, IL, June 2013.

Schulman LL, DesAutels CG. Comparing AERMOD and CFD downwash predictions for GEP stacks. Guideline on Air Quality Models: The Path Forward Conference, Raleigh, NC, March 2013.

Schulman LL, Scire JS. Building downwash modeling with AERMOD. 10th EPA Conference on Air Quality Modeling, Research Triangle Park, NC, March 2012.

Schulman LL, Strimaitis DG, Scire JS. Development and evaluation of the PRIME plume rise and building downwash model. Journal of the Air & Waste Management Association 2000; 50:378-390.

Schulman LL, Scire JS. Building downwash screening modeling for the downwind recirculation cavity. Journal of the Air & Waste Management Association 1993; 43:1122-1127.

Schulman LL, Hanna SR. A decision system for selecting a site-specific air quality dispersion model. Ecological Modelling 1992; 64:205-219.

Schulman LL, Scire JS. The effect of stack height, exhaust speed, and wind direction on concentrations from a rooftop stack. ASHRAE Transactions 1991; 97(2):573-582.

Schulman LL, Hanna SR. Evaluation of downwash modifications to the Industrial Source Complex model. Journal of the Air Pollution Control Association 1986; 36:258-264.

Hanna SR, Schulman LL, Paine RJ, Pleim JE, Baer M. Development and evaluation of the Offshore and Coastal Dispersion Model. Journal of the Air Pollution Control Association 1985; 35:1039-1047.

Hanna SR, Paine RJ, Schulman LL. Overwater dispersion in coastal regions. Boundary-Layer Meteorology 1984; 30:389-411.

Benkley CW, Schulman LL. Estimating hourly mixing depths from historical meteorological data. Journal of Applied Meteorology 1979; 18:772-780.

Schulman LL. A theoretical study of the efficiency of the general circulation. Journal of the Atmospheric Sciences 1977; 34:559-580.

Murphy BL, Schulman LL, Mahoney JR. Potential use of applied meteorology in energy conservation programs. Bulletin of the American Meteorological Society 1977; 58:304-317.

Schulman LL. On the summer hemisphere Hadley Cell. Quarterly Journal of the Royal Meteorological Society 1973; 99:197-201.

Presentations

Schulman LL, DesAutels CG, Viti V. CFD simulations to predict wind induced damage to a steel building during Hurricane Katrina. 5th International Symposium on Computational Wind Engineering, Chapel Hill, NC, May 2010.

DesAutels CG, Schulman LL. Evaluation of the Desert Tortoise ammonia field tests with the FLUENT CFD model using unsteady RANS. 5th International Symposium on Computational Wind Engineering, Chapel Hill, NC, May 2010.

Schulman LL, DesAutels CG. Estimating the effect of building wakes on wind power generation using the CFD model FLUENT. EUEC Energy and Environment Conference, Phoenix, AZ, February 2009.

Schulman LL, DesAutels CG. CFD simulation of building downwash in the EPA wind tunnel. Air & Waste Management Association 101st Annual Meeting, Portland, OR, June 2008.

Moore G, Schulman LL, Phadnis M. Development and application of the CALGRID (version 2) photochemical grid model. Air & Waste Management Association 98th Annual Meeting, Minneapolis, MN, June 2005.

de Foy B, Schulman LL. Near-field concentration predictions of a rooftop vent in an urban environment using CFD. Air & Waste Management Association 94th Annual Meeting, Orlando, FL, June 2001.

de Foy B, Schulman LL. Comparison of CFD simulations of building downwash with wind-tunnel observations. Air & Waste Management Association 93rd Annual Meeting, Salt Lake City, UT, June 2000.

Schulman LL, Moore GE. Photochemical grid modeling of four high ozone episodes in the New England Domain. 10th Joint Conference on the Applications of Air Pollution Meteorology with the AWMA, Phoenix, AZ. January 11-16, 1998.

Schulman LL, Scire JS. The development of the Plume Rise Model Enhancement (PRIME): The EPRI plume rise and downwash modeling project. 9thJoint Conference on the Applications of Air Pollution Meteorology with the AWMA, Atlanta, GA. January 28-February 2, 1996.

Moore GE, Fernau ME, Yamartino RJ, Schulman LL, Mayes P. Recent improvements in ozone modeling in New England during the July 7-8, 1988 ozone episode. 9th Joint Conference on the Applications of Air Pollution Meteorology with the AWMA, Atlanta, GA. January 28-February 2, 1996.

Schulman LL, Haga CM, Caiazza R. A comparison of turbulence classification schemes in a lakeshore environment. 7th Joint Conference on Applications of Air Pollution Meteorology, with AWMA, New Orleans, LA, January 14-18, 1991.

Schulman LL, Scire JS, Strimaitis DG, Caiazza R. Mesoscale numerical modeling of the eastern Lake Ontario lake breeze. 7th Joint Conference on applications of Air Pollution Meteorology, with AWMA, New Orleans, LA, January 14-18, 1991.

Scire, J.S., Schulman LL and Caiazza R. Application of a hybrid wind field model to lake breeze circulations in the eastern Lake Ontario region. 7th Joint Conference on Applications of Air Pollution Meteorology, with AWMA, New Orleans, LA, January 14-18, 1991.

Schulman LL. Design of meteorological monitoring systems for emergency planning. Proceedings, AIChE Summer National Meeting, Philadelphia, PA, August 20-23, 1989.

Hoydysh WG, Schulman LL. Fluid modeling study of the contamination of fresh air intakes from rooftop emissions. Proceedings, 80th Annual Meeting of APCA, Paper 87-82A.9, New York, NY, June 21-26,

1987.

Schulman LL, Hanna SR, Paine RJ. Development of the OCD dispersion model for offshore sources. Proceedings, 4th Joint Conference on Applications of Air Pollution Meteorology, Portland, OR, October 16-19, 1984.

Schulman LL, Scire JS, Bass A. Evaluation of the ISCST and RAM models at an industrial complex. AMS/APCA 3rd Joint Conference on Applications of Air Pollution Meteorology, San Antonio, TX, January 12-15, 1982.

Scire JS, Schulman LL. Evaluation of the BLP and ISC models with SF6 tracer data and SO2 measurements at aluminum reduction plants. APCA Specialty Conference on Dispersion Modeling from Complex Sources, St. Louis, MO, April 7-9, 1981.

Schulman LL, Scire JS (Invited Paper). Development of the BLP dispersion model for aluminum reduction plants. APCA Specialty Conference on Dispersion Modeling from Complex Sources, St. Louis, MO, April 7-9, 1981.

Schulman LL, Scire JS (Invited Paper). Development of the BLP dispersion model for aluminum reduction plants. Symposium on Environmental Control in Nonferrous Metals Industries, San Diego, CA, April 26-30, 1981.

Schulman LL, Scire JS (Invited Paper). Development of the BLP dispersion model for aluminum reduction plants. 74th APCA Annual Meeting, Paper 81-44.3, Philadelphia, PA, June 21-26, 1981.

Hoydysh WG, Schulman LL. Wind tunnel modeling of the dispersion of effluents from aluminum reduction plant. 5th Symposium on Turbulence, Diffusion and Air Pollution, Atlanta, GA, March 9-13, 1981.

Scire JS, Schulman LL. Plume rise enhancement from multiple sources. 5th Symposium on Turbulence, Diffusion and Air Pollution, Atlanta, GA, March 9-13, 1981.

Schulman LL, Scire JS. Development of an air quality dispersion model for aluminum reduction plants. 5th Symposium on Turbulence, Diffusion and Air Pollution, Atlanta, GA, March 9-13, 1981.

Schulman LL, Vickers D. Incorporating the sulfur variability of coal in air quality modeling. AMS/APCA Second Joint Conference on Applications of Air Pollution Meteorology, New Orleans, LA, March 24-27, 1980.

Scire JS, Schulman LL. Modeling plume rise from low-level buoyant line and point sources. AMS/APCA 2nd Joint Conference on Applications of Air Pollution Meteorology, New Orleans, LA, March 24-27, 1980.

Lavery TF, Schulman LL. The validity of a Gaussian plume point source diffusion model for predicting short-term SO2 levels in the vicinity of electric generating plants in New York State. AMS/APCA Joint Conference on Applications of Air Pollution Meteorology, Salt Lake City, UT, November 29-December 2, 1977.

Schulman LL, Lavery TF, Penansky SG. The validation of a Gaussian plume point source diffusion model in a lakeshore environment. 7th NATO/CCMS International Technical Meeting on Air Pollution Modeling, Airlie, VA, September 7-10, 1976.