

Charles N. Haas

Present Position: Betz Chair Professor of Environmental Engineering & Head,
Department of Civil, Architectural and Environmental Engineering
Drexel University
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Date of Birth: December 27, 1951

Place of Birth: Bronx, New York

Citizenship: U.S.A.

Education: B.S. (Biology), Illinois Institute of Technology (IIT), 1973.
M.S. (Environmental Engineering), IIT, 1974.
Ph.D. (Environmental Engineering in Civil Engineering), University of Illinois, Urbana,
Illinois, 1978.

Academic Appointments

2005-- : Head, Department of Civil, Architectural and Environmental Engineering
2003–2005: Interim Head, Department of Civil, Architectural and Environmental Engineering
2003--: Research Professor, Department of Emergency Medicine, Drexel University College of Medicine
2002--:2005 Director of Environmental Engineering and member of Department Executive Committee
1991-- : Betz Chair Professor of Environmental Engineering, Drexel University.
1989-1990: Acting Chairman, Pritzker Department of Environmental Engineering, Illinois Institute of
Technology
1988-1989: Visiting Professor of Environmental Engineering, University of Illinois at Urbana-Champaign
1981-1990: Assistant Professor (1981-83), Associate Professor (1983-87), Professor (1987-90) Illinois
Institute of Technology
1978-1981: Assistant Professor of Environmental Engineering in the Department of Chemical and
Environmental Engineering, (1979-1981), Acting Director of Environmental Engineering
Programs, Rensselaer Polytechnic Institute

Other Affiliations

Director and Vice President, Environmental Science, Policy And Research Institute (ESPRI), 2018 – present.

Professional Memberships

American Chemical Society; American Association for the Advancement of Sciences; American Society for
Engineering Education; American Statistical Association; American Society for Microbiology; American Water
Works Association (Life Member); American Society of Civil Engineers; Association of Environmental
Engineering and Science Professors; International Water Association; Sigma Xi; Society for Risk Analysis; Water
Environment Federation; American Academy of Environmental Engineers

Honors and Awards

Recipient, 1984 AAAS-USEPA Summer Environmental Science and Engineering Fellowship.
Octave Chanute Award (Outstanding Paper), Western Society of Engineers, 1984.
Charles Ellet Award (Outstanding Young Engineer), Western Society of Engineers, 1985.
Listed in American Men and Women of Science (1994)
Listed in Who's Who in Science and Engineering (1996)
Listed in Who's Who in the East (1997)
Listed in Who's Who in Medicine and Healthcare (1997)
Listed in Who's Who in America, 51st edition (1996)

Listed in Who's Who in the World (2001)
 Professional Research Award, Pennsylvania Water Environment Association (1997)
 American Academy of Microbiology, Elected as Fellow (1997)
 Frontiers in Research Award, Association of Environmental Engineering and Science Professors (sponsored by Malcolm Pirnie, Inc) (2002).
 American Association for the Advancement of Science, Elected as Fellow (2002)
 Society for Risk Analysis, Elected as Fellow (2002)
 University of Illinois at Urbana-Champaign, Department of Civil and Environmental Engineering, Distinguished Alumnus Award (2003)
 International Ozone Association, Harvey M. Rosen Memorial Award (best paper in Ozone Science and Engineering for 2001-3) (2003).
 National Academies (National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council): designated as a lifetime National Associate (2004).
 American Water Works Association, advisor to 2nd Place Academic Achievement Award Winner (Christopher Crockett—PhD dissertation) (2005).
 American Water Works Association, Water Science and Research Division, best paper award (“Risk Assessment of Waterborne Coxsackievirus”) (2005).
 American Academy of Environmental Engineers, Board Certified Environmental Engineering Member (BCEEM), elected by eminence (2007)
 American Society of Civil Engineers, elected Fellow (2010)
 International Water Association, elected Fellow (2011)
 Association of Environmental Engineering and Science Professors, elected Fellow (inaugural class) (2013)
 Society for Risk Analysis, Distinguished Achievement Award (2016)
 John Leal Award, American Water Works Association (2017)
 Athalie Richardson Irvine Clarke Prize (administered by the National Water Research Institute) (2017)

Workshops & Continuing Education Attended

American Council on Education workshop for Department/Division Chairs and Deans, February 2006, San Diego.
 Peter Seldin Workshop on Preparing a Leadership Portfolio, March 2007, Philadelphia.

Funded Research Projects

Co-principal Investigator “Hazardous Waste Processing and Disposal Practices–Best Technology.” New York State Environmental Facilities Corporation (1979 for \$25,000).
 Co-principal Investigator “The Potential for the Application of Resource Recovery Practices in the Hazardous Waste Processing and Disposal Industry.” New York State Environmental Facilities Corporation (1979 for \$25,000).
 Principal Investigator, “Microbiological Alterations in Water Quality in Distribution Systems and Granular Activated Carbon.” U.S. Environmental Protection Agency (1980-2 for \$113,000).
 Principal Investigator, “Trace Metal Speciation”. U.S. Environmental Protection Agency–Industrial Waste Elimination Research Center (1980-1982 for \$113,000).
 Co-principal Investigator “Evaluation of High-Performance Phosphorus Control POTW’s in the Great Lakes Basin.” U.S. Environmental Protection Agency (1981-1982 for \$88,850).
 Principal Investigator “Preparation of a Chapter on Chlorination–Dechlorination and Miscellaneous Halogens.” U.S.Environmental Protection Agency via a subcontract from Oklahoma State University (1982-1985 for \$82,000).
 Principal Investigator “Metal Speciation and Separation.” U.S. Environmental Protection Agency–Industrial Waste Elimination Research Center (1982-1983 for \$119,000).
 Principal Investigator “Wastewater Treatability Study.” Modine Manufacturing Company (1982-1983 for \$28,000).
 Principal Investigator “Evaluation of Microbial Dynamics in the Calumet River and Downstream Waters.” Metropolitan Sanitary District of Greater Chicago (1983-1985 for \$22,800).
 Co-principal Investigator, “Metal Speciation Kinetics.” U.S.Environmental Protection Agency – Industrial Waste Elimination Research Center (1984 - 1988 for \$500,000).
 Principal Investigator, “Indefinite Delivery Contract for Research Support in Environmental Engineering” – US Army Corps of Engineers, Construction Engineering Research Laboratory (1985 - 1987, \$1,900,000).

Co-Principal Investigator, "Characterization of Diffusion of Solutes Through Compacted Clays" – Milligan Venture Fund Grant (IIT – 1986-1987 for \$10,000).

Principal Investigator, "Wastewater Treatability Study" – Morton Thiokol, Morton Chemical Division (\$25,000 1986-1987).

Co-principal Investigator, "Waste to Energy Recovery of Refuse as an Alternative to Landfill in Illinois", Illinois Department of Energy and Natural Resources (\$139,000, 1987- 1989).

Principal Investigator, "Effects of Changing Disinfection Practices on Receiving Water Quality", Metropolitan Sanitary District of Greater Chicago (\$97,000, 1987-1990).

Principal Investigator, "Beneficial Co-Utilization of Solvents and Plastic Scrap Wastes", Illinois Hazardous Waste Research and Information Center (\$6300, 1987).

Principal Investigator, "Disinfection of Microbial Biofilms", American Water Works Service Co., (\$30,400, 1987-8).

Principal Investigator, "Analysis of Giardia Disinfection Kinetics", USEPA Office of Drinking Water (\$15,000, 1987).

Co-Investigator, "Analysis of Performance of Superfund and SARA", Coalition on Superfund, (1988-89, \$250,000).

Principal Investigator, "Analysis of Proposed Sludge Regulations", Metropolitan Water Reclamation District of Greater Chicago, (1989, \$20,000).

Principal Investigator, "Equilibria of Mixed Metal Precipitates", IWERC (USEPA) (1990, \$55,000).

Principal Investigator, "Statistical Analysis of Waste Generation by Electroplaters and Metal Finishers", Metropolitan Water Reclamation District of Greater Chicago, (1990, \$9500).

Principal Investigator, "Analysis of Disinfection Survey Results", American Water Works Association, (1990, \$15,000).

Principal Investigator, "Development of Novel Models for Describing Multiple Toxicity Effects", Air Force Office of Scientific Research, (1991-94, \$173,925).

Principal Investigator, "Development and Validation of Rational Kinetic Approaches for Predicting Full-Scale Disinfection Performance", American Water Works Association Research Foundation (1991-1994, \$260,000).

Principal Investigator, "Analysis of Groundwater Disinfection Survey Results", American Water Works Association (1991-2, \$5000).

Co-Principal Investigator, "Microbial Risk Assessment", American Water Works Association Research Foundation (1993-1995, subcontract from University of South Florida, \$90,000).

Principal Investigator, "Review of Factors Affecting Metal Fate and Transport in Saline Waters", Dupont Corporation (1992, \$12,500).

Principal Investigator, "Effect of Level of Response on Toxicity of Mixtures", Air Force Office of Scientific Research (AASERT Program) (1993-1994, \$51,000).

Principal Investigator, "Review of Models for Chemical Fate and Transport", Betz Laboratories Inc. (1993-94, \$39,000)

Principal Investigator, "Disinfection of Water Mains", American Water Works Association Research Foundation (1993-1996, \$250,000).

Principal Investigator, "Monitoring for Giardia and Cryptosporidium", Philadelphia Water Department (1994-95, \$45,000).

Principal Investigator, "Models for Chemical Fate and Transport in Waste Treatment", Betz Laboratories Inc. (1995, \$45,000).

Principal Investigator, "Inactivation of Giardia by Ozone and Combined Chlorine", Montgomery-Watson Americas (1995, \$50,000).

Principal Investigator, "Risk Assessment from Sewage Discharges in Mamala Bay, HI", Subcontract from University of Arizona (Mamala Bay Commission), 1995, \$35,000.

Principal Investigator, "Risk Assessment of Heterotrophic Organisms in Point of Use Devices", Subcontract from University of South Florida (Water Quality Association), 1995-1996, \$15,000.

Principal Investigator, "Electroporation and Electroporation Aided Disinfection of Cryptosporidium and Giardia", National Science Foundation, 1995-1998, \$190,000.

Principal Investigator, "Estimation of Disinfection Efficiency of Philadelphia Water Department Plants for Protozoa", Philadelphia Water Department, 1996-1997, \$46,000.

Principal Investigator, "Review of Health, Environmental Effects, and Efficacy of Chlorination for Wastewater Disinfection and Cooling Water", Chlorine Institute, Inc., 1996, \$45,000.

Principal Investigator, "Development of Integrated Program for Chemical Fate and Transport in Waste Treatment", Betz Laboratories Inc. (1996-1997, \$45,000).

Co-Principal Investigator, "Literature Review on Cryptosporidium Removal in Water Treatment", Chlorine Chemistry Council, 1996, \$16,000 (with Gordon Finch).

Co-Principal Investigator, "Extension of Quantitative Microbial Risk Assessment Methods to Foodborne Pathogens", International Life Sciences Institute, 1997-1998, \$85,000 (with Joan Rose and Charles Gerba).

Principal Investigator, "Disinfection of Protozoa", Philadelphia Water Department, 1997-8, \$50,000.

Co-Principal Investigator, "Critical Review Of Existing Data On Physical And Chemical Removal Of Cryptosporidium In Drinking Water", AWWA Research Foundation, 1997-2000 (with Gordon Finch), \$150,000.

Co-Principal Investigator, Update The AWWARF Report On Experimental Methodologies For The Determination Of Disinfection Effectiveness To Include Cryptosporidium Disinfection Protocols", 1997-8 (with Gordon Finch), \$25,000.

Co-Investigator, "Protocol for Cryptosporidium Risk Communication to Drinking Water Utilities", AWWA Research Foundation, 1998-1999 (with Mitchell Small, Baruch Fiscoff et al., total contract \$195,843).

Co-Investigator, "Disinfection of Emerging Pathogens", AWWA Research Foundation, 1998-2000 (with J. Jacangelo, C.P. Gerba), \$250,000.

Co-Investigator, "Microbial Benefits from Laundry Sanitizers", Procter & Gamble Company, 1998, \$25,000.

Co-Principal Investigator, "Compilation and Kinetic Analysis of Data for Ozone Inactivation of Cryptosporidium", International Ozone Association, 1998-1999 (with G. Finch, J. Jacangelo), \$23,000 (Drexel share).

Principal Investigator, "Is Disinfection a Function of Initial Microorganism Concentration?", AWWA Research Foundation, 1999-2001, \$127,000.

Principal Investigator, "Survey on Drinking Water Disinfection", American Water Works Association, 1998-1999, \$25,000.

Co-Investigator, "Synergistic Inactivation of Cryptosporidium Oocysts in Natural Waters", AWWA Research Foundation, 1999-2001 (with Gordon Finch, Mike Belosevic), \$77,000 (Drexel share).

Principal Investigator, Peer Review of Class A Sludge Designation Petition, Metropolitan Water Reclamation District of Greater Chicago, 1999-2000, \$20,000.

Principal Investigator, Assessment of EPA Pathogen Equivalency Committee, US EPA, 2000, \$15,000.

Principal Investigator, "Use of Microbial Risk Modeling to Determine the Benefits of Topical Antimicrobial Products", Soap and Detergent Association, 2000-2002 (with Joan Rose and Charles Gerba), \$163,000.

Principal Investigator, "Disinfection of Protozoa", Philadelphia Water Department, 2000-2001, \$50,000

Principal Investigator, "Evaluation of the Analytical Capabilities, Today and Near Future, for the Monitoring of Drinking Water for Accidental or Intentional Contamination", Philadelphia Water Department, 2002-2003, \$100,000.

Principal Investigator, "Building Biodecontamination: A Process Engineering Approach", National Science Foundation, 2003-2005, \$99,500 (with B. Farouk).

Principal Investigator, "Workshop on Advancing the Quality of Water (AQWA)", National Science Foundation, 2003-2004, \$99,000.

Principal Investigator, "Delaware Valley Water Source Tracking Effort (DeVaWaSTE)", Philadelphia Water Department, 2004-2011, \$400,000.

Principal Investigator, "Analysis of Data on Microbial Persistence With Antimicrobial Hand Products", Soap and Detergent Association, 2004, \$20,000.

Principal Investigator, "Activated Ozone for Water Disinfection", H2O3, Inc., 2004, \$35,000.

Principal Investigator, "Assessment of Physical Scale Models for Development of Room Decontamination Design Criteria", funded via National Bioterrorism Civilian Medical Response Center (CIMERC), 2004-5, \$55,000.

Principal Investigator, "Wastewater Disinfection Strategies for the Metropolitan Water Reclamation District of Greater Chicago", CTE Engineering, 2004-5, \$75,000.

Principal Investigator, "Expert Review of EPA Recreational Water Criteria – Scientific Basis", Metropolitan Water Reclamation District of Greater Chicago, 2005, \$22,500.

Co-Principal Investigator, "CLEANER Project Office", National Science Foundation, 2005-8, \$250,000 (Drexel share), \$3,000,000 total (lead institution: University of Illinois at Urbana-Champaign).

Co-Principal Investigator and Co-Director, "Center for Advancing Microbial Risk Assessment (CAMRA)", US EPA and US Department of Homeland Security (Cooperative Center of Excellence), 2005-2013, \$2,200,000 (Drexel share), \$10,000,000 total funding (lead institution: Michigan State University).

Principal Investigator, "The Drexel University GAANN Fellowship Program: Educating Renaissance Engineers", 2006-11 (\$510,000).

Principal Investigator, “Risk Assessment from Wet Weather Flows”, Philadelphia Water Department, 2007-2012, \$1,500,000.

Principal Investigator, “Expert Assistance with UV Disinfection Design at Chicago North Side Water Reclamation Plant”, 2012-13, \$55,000.

Co-Principal Investigator, Development of a Risk Management Strategy for Legionella in Recycled Water Systems, WaterReuse Foundation, 2013-5 (via subcontract from American Water), \$50,000 (Drexel Share)

Principal Investigator, Application of the Bioluminescent Saltwater Assimilable Organic Carbon Test as a Tool for Identifying and Reducing Reverse-Osmosis Membrane Fouling in Desalination, WaterReuse Foundation, 2012-14, \$248,000

Principal Investigator, Development of a Metamodel for Wastewater Disinfection by Peracetic Acid, Peroxychem (formerly FMC Corporation), 2013-16, \$100,000.

Principal Investigator, RAPID: Collaborative Research: Survival of Ebolavirus in the Water Environment: Surrogate Development and Disinfection Effectiveness, NSF, 2015-16, \$40,000.

Principal Investigator, Water Environment Research Foundation, Evaluation of Risk to Wastewater Collection Operators from disposal of hospital wastewater from Ebola patients, \$25,000, 2015-16

Co-Principal Investigator, US EPA, Water Conservation & WQ: Impacts of New Technology, 2016-2019, \$2.5 million.

Publications & Presentations

Books and Other Major Works

- 1) Recovery, Recycle and Reuse of Industrial Waste, K. E. Noll, C.N. Haas, C. Schmidt and P. Kodukula, Lewis Publishers, Chelsea MI (1985).
- 2) Process Design Manual for Wastewater Disinfection, coauthored by C.N. Haas. US EPA Center For Environmental Research Information, Cincinnati (1986).
- 3) Experimental Methodologies for the Determination of Disinfection Effectiveness, C.N. Haas, J.C. Hornberger, U. Anmangandla, M. Heath and J. Jacangelo. AWWA Research Foundation and American Water Works Association, Denver CO (1993).
- 4) Hazardous and Industrial Waste Treatment, (1995) Prentice-Hall, C.N. Haas and R. Vamos.
- 5) Development and Validation of Rational Design Methods of Disinfection (1995), AWWA Research Foundation, C.N. Haas, J. Joffe, J.C. Hornberger, U. Anmangandla, M. Heath and J. Jacangelo.
- 6) Benefits and Risks of Wastewater Chlorination (1997), The Chlorine Institute Inc. (Washington DC), Pamphlet 157, 193 pages, C.N. Haas, A. Fazil and A. Khan.
- 7) Benefits and Risks of Cooling Water Chlorination (1997), The Chlorine Institute Inc. (Washington DC), Pamphlet 158, 188 pages, C.N. Haas, A. Fazil and A. Khan.
- 8) Integrated Disinfection Design Framework (1998), AWWA Research Foundation and American Water Works Association, Denver CO, W.D. Bellamy, G.R. Finch and C.N. Haas.
- 9) Development of Disinfection Guidelines for the Installation and Replacement of Water Mains, AWWA Research Foundation, Denver CO, C.N. Haas, R.B. Chitluru, M. Gupta, W.O. Pipes, and G.A. Burlingame. (1998)
- 10) Quantitative Microbial Risk Assessment, C.N. Haas, J.B. Rose and C.P. Gerba, John Wiley (NY) (1999). (translated into Japanese)
- 11) Methodologies for the Determination of Disinfection Effectiveness, AWWA Research Foundation, C.N. Haas and G.R. Finch, Denver CO (2001).
- 12) Data Review on the Physical/Chemical Removal of Cryptosporidium, AWWA Research Foundation, C.N. Haas, K. French, G.R. Finch and R.K. Guest, Denver CO (2001).
- 13) Inactivation of Waterborne Emerging Pathogens by Selected Disinfectants, AWWA Research Foundation, J.G. Jacangelo, N.L. Patania, R.R. Trussell, C.N. Haas and C. Gerba, Denver CO (2002).
- 14) Effect of Initial Microbial Concentration on Disinfection Efficiency, AWWA Research Foundation, C.N. Haas and B. Kaymak, Denver CO (2002).
- 15) Quantitative Microbial Risk Assessment, C.N. Haas, J.B. Rose and C.P. Gerba, John Wiley (NY) 2nd ed. (2014).

Peer Reviewed Publications

- 1) “Oxygen Uptake Rate as an Activated Sludge Control Parameter.” Journal of the Water Pollution Control Federation, 51, 938-943 (1979), Charles N. Haas.

- 2) "Physiological Alterations of Vegetative Microorganisms Resulting From Aqueous Chlorination." *Journal of the Water Pollution Control Federation*, 52, 1976-1989 (1980), C.N. Haas and R.S. Engelbrecht.
- 3) "Chlorine Dynamics During Inactivation of Coliforms, Acid-Fast Bacteria and Yeasts." *Water Research*, 14, 1749-1757 (1980), C.N. Haas and R.S. Engelbrecht.
- 4) "A Mechanistic Kinetic Model for Chlorine Disinfection." *Environmental Science and Technology*, 14, 339-340 (1980), C.N. Haas.
- 5) "Application of Predator-Prey Models to Disinfection." *Journal of the Water Pollution Control Federation*, 53, 378-386 (1981), C.N. Haas.
- 6) "Rational Approaches in the Analysis of Chemical Disinfection Kinetics." Chapter in W. Cooper (ed.) *Chemistry in Water Reuse*. Vol. 1, pp. 381-399. Ann Arbor Science Publishers, Inc. (1981), C.N. Haas.
- 7) "Practical Mixed Culture Processes." *Advances in Fermentation Processes*, 4, 1-29 (1980), C.N. Haas, H.R. Bungay and M.L. Bungay.
- 8) "Biological Process Diffusional Limitations." *Journal of the Environmental Engineering Division, ASCE*, 107, 269-273 (1981), C.N. Haas.
- 9) "Repeated Exposure of *Escherichia coli* to Free Chlorine: Production of Strains Possessing Altered Sensitivity." *Water, Air and Soil Pollution*, 16, 233-242 (1981), C.N. Haas and E.C. Morrison.
- 10) "Sodium Alterations of Chlorine Equilibria: Quantitative Description." *Environmental Science and Technology*, 15, 1243-1244 (1981), C.N. Haas.
- 11) "Evaluation of the m-SPC Method as a Substitute for the Standard Plate Count in Water Microbiology." *Journal of the American Water Works Association*, 74, 322 (1982), C.N. Haas, M.A. Meyer and M.S. Paller.
- 12) "Enhancement of Chlorine Inactivation of *E. coli* by Sodium Ions." *Water Chlorination Environmental Impact and Health Effects*, volume 4, book 2, pp1087-96, edited by R.L. Jolley, Ann Arbor Science (1983), C.N. Haas and M. Zapkin.
- 13) "The Ecology of Acid-Fast Organisms in Water Supply, Treatment and Distribution Systems." *Journal of the American Water Works Association*, 75, 139-44 (1983), C.N. Haas, M.A. Meyer and M.S. Paller.
- 14) "Estimation of Risk Due to Low Doses of Microorganisms: A Comparison of Alternative Methodologies." *American Journal of Epidemiology*, 118, 573-82 (1983), C.N. Haas.
- 15) "The Utility of Endotoxins as a Surrogate Indicator in Potable Water Microbiology." *Water Research*, 17, 803-7 (1983), C.N. Haas, M.A. Meyer, M.S. Paller and M.A. Zapkin.
- 16) "Effect of Effluent Disinfection on Risks of Viral Disease Transmission via Recreational Exposure." *Journal of the Water Pollution Control Federation*. 55, 1111-6 (1983), C.N. Haas.
- 17) "Engineering at the Microorganism Scale." *Advances In Fermentation Processes*, 6, 149-73 (1983), H.R. Bungay, M.L. Bungay and C.N. Haas.
- 18) "Microbial Dynamics in GAC Filtration of Potable Water." *ASCE Journal of Environmental Engineering*, 109, 956-61 (1983), C.N. Haas, M.A. Meyer and M.S. Paller.
- 19) "Application of Ion Exchangers to Recovery of Metal from Semiconductor Wastes." *Reactive Polymers*, 2, 61-70 (1984), C.N. Haas and V. Tare.
- 20) "Microbial Alterations in Water Distribution Systems and Their Relationship to Physical-Chemical Characteristics." *Journal of the American Water Works Association*, 75, 475-481 (1983), C.N. Haas, M.A. Meyer and Marc S. Paller.
- 21) "Kinetics of Wastewater Chlorine Demand Exertion," *Journal of the Water Pollution Control Federation*, 56, 170-3 (1984) C.N. Haas and S.B. Karra.
- 22) "Kinetics of Metal Removal by Chelating Resin from a Complex Synthetic Wastewaters." *Water Air & Soil Pollution*, 22, 429-39 (1984) V. Tare, S.B. Karra, and C.N. Haas.
- 23) "Estimation of Effective Intra-Particle Diffusion Coefficients with Differential Reactor Columns," *Journal of the Water Pollution Control Federation*, 56, 442-8 (1984) A.A. Aguwa, J.W. Patterson, C.N. Haas and K.E. Noll.
- 24) "Is Sodium Thiosulfate a Suitable Neutralizer For Chlorine in Microbiological Determinations?," C.N. Haas and M.A. Zapkin. *Journal of Environmental Science and Health Part A: Environmental Science and Engineering*, 19, 507-20 (1984).
- 25) "Kinetic Limitations on the Selective Precipitation Treatment of Electronics Wastes." *Water Air & Soil Pollution*, 24, 253-65 (1985) S.B. Karra, C.N. Haas, V. Tare and H.E. Allen.
- 26) "Kinetics of Microbial Inactivation By Chlorine. I. Review of Results in Demand-Free systems." *Water Research*, 18, 1443-1449 (1984), C.N. Haas and S.B. Karra.
- 27) "Kinetics of Microbial Inactivation By Chlorine. II. Kinetics in the Presence of Chlorine Demand." *Water Research*, In 18, 1451-4 (1984), C.N. Haas and S.B. Karra.

- 28) "Field Observations on the Occurrence of New Indicators of Disinfection Efficiency." *Water Research*, 19, 323-9 (1985), C.N. Haas, B.F. Severin, D. Roy, R.S. Engelbrecht, A. Lalchandani, and S. Farooq.
- 29) "Influence of Sodium, Potassium and Lithium on Hypochlorite Solution Equilibria." *Water Chlorination Environmental Impact and Health Effects*, volume 5, pp775-782 edited by R.L. Jolley, Lewis Publishers (1985), C.N. Haas and D.M. Brncich.
- 30) "Removal of New Indicators by Coagulation-Flocculation and Sand Filtration." *Journal of the American Water Works Association*, 77, 67-71 (1985). C.N. Haas, B.F. Severin, D. Roy, R.S. Engelbrecht, and A. Lalchandani.
- 31) "Direct Differential Reactor Studies on Adsorption from Concentrated Liquid and Gaseous Solutions." In *Fundamentals of Adsorption Processes*, A. Meyers and G. Belfort [eds.], pp411-20, United Engineering Trustees, NY (1984), K.E. Noll, C.N. Haas, J-P. Menez, A.A. Aguwa, M. Satoh, A. Belalia and P.S. Bartholomew.
- 32) "Sensitivity of Vegetative Protozoa to Free and Combined Chlorine." *Water Chlorination Environmental Impact and Health Effects*, volume 5, pp 667-80 edited by R.L. Jolley, Lewis Publishers (1985), C.N. Haas, K. Khater and A. Wojtas.
- 33) "Economic Incentives for Hazardous Waste Management." *Journal of Environmental Systems*, C.N. Haas, 14, 373-93 (1985).
- 34) "Toluene-Humic Acid Association Equilibria: Isopiestic Measurements." *Environmental Science and Technology*, 19, 643- 5 (1985) C.N. Haas and B.M. Kaplan.
- 35) "Adsorption of Cadmium to Kaolinite in the Presence of Organic Materials." *Water, Air and Soil Pollution*, 27, 131-40 (1986) C.N. Haas and N.D. Horowitz.
- 36) "Revegetation Using Coal Ash Mixtures," *ASCE Journal of Environmental Engineering*, 111, 559-73 (1985) C.N. Haas and J.J. Macak.
- 37) "Validation of the Hazard Ranking System for the Assessment of Feedstock Frequencies in Superfund Site Contaminants", *Hazardous Waste and Hazardous Materials*, 2, 535 (1985) G.A. Vanderlaan and C.N. Haas.
- 38) "Statistics of Enumerating Total Coliforms In Water Samples by Membrane Filter Procedures", *Water Research*, 20, 525-30 (1986) C.N. Haas and B. Heller.
- 39) "A Heuristic Relationship for Faculty Size in Engineering Schools," *Engineering Education*, 78(7):710-11 (1988), C.N. Haas.
- 40) "Wastewater Disinfection and Infectious Disease Risks", *CRC Critical Reviews in Environmental Control*, 17, 1, 1-20 (1986), C.N. Haas.
- 41) "Alteration of Chemical and Disinfectant Properties of Hypochlorite by Sodium, Potassium and Lithium", *Environmental Science and Technology*, 20, 822-6 (1986), C.N. Haas, M.G. Karalius, D.M. Brncich, and M.A. Zapkin.
- 42) "Kinetics of Cadmium and Copper Hydrolysis", *Water Science and Technology*, 19, 1021-7 (1987), J.W. Patterson, C.N. Haas, R.J. Vamos, and E. Cooney.
- 43) "Recovery, Recycle and Reuse of Hazardous Waste", *Journal of the Air Pollution Control Association*, 36, 1163-8 (1986) K.E. Noll, C.N. Haas and J.W. Patterson.
- 44) "Micromixing and Dispersion in Chlorine Contact Chambers" ,*Environmental Technology Letters*, 9: 35-44 (1988) C.N. Haas.
- 45) "Electrolytic Recovery Techniques", chapter in *Standard Handbook of Hazardous Waste Treatment*, McGraw Hill, A.A. Aguwa and C.N. Haas (1989).
- 46) "Preliminary Determination of Limiting Nutrients for Indigenous Bacteria in Chicago Intake Water" *Water, Air and Soil Pollution*, 37:65-72 (1988), C.N. Haas, P. Bitter and P.A. Scheff..
- 47) "Maximum Likelihood Analysis of Disinfection Kinetics" ,*Water Research*, 22, 669-77 (1988).
- 48) "Assessing the Need for Wastewater Disinfection", *Journal of the Water Pollution Control Federation*, 59, 856-64 (1987), C.N. Haas et al.
- 49) "On the Existence of Ternary Interactions in Ion Exchange", *AIChE Journal*, C.N. Haas (1988).
- 50) "Error in Variables Parameter Estimation", *Journal of Environmental Engineering*, 115, 259-64 (1989), C.N. Haas.
- 51) "Effects of Ceasing Disinfection on a Receiving Water", C.N. Haas, J.G. Sheerin and C. Lue-Hing, *Journal of the Water Pollution Control Federation*, 60, 667-673 (1988).
- 52) "Averaging TNTC Counts", *Applied and Environmental Microbiology*, 54(8), 2069-72 (1988), C.N. Haas and B. Heller.
- 53) "Assessment of Risks Associated with Enteric Viruses in Contaminated Drinking Water", in *Chemical and Biological Characterization of Sludges, Sediments, Dredge Spoils and Drilling Muds*, ASTM STP 976, pps.489-494 (1988), C.P. Gerba and C.N. Haas.

- 54) "Chemical Composition of Bottled Mineral Water", Archives of Environmental Health, 44, 102-16 (1989), H.E. Allen, M. Halley-Henderson and C.N. Haas.
- 55) "Test of the Validity of the Poisson Assumption for Analysis of MPN Results", Applied and Environmental Microbiology, 54(12), 2996-3002 (1988), C.N. Haas and B. A. Heller.
- 56) "Analysis of Disinfection Data from Dilution Count Experiments", Water Research, 23, 345-9 (1989), C.N. Haas.
- 57) "Statistics of Microbial Disinfection", Water Science and Technology, 21, 3, 197-201 (1989), C.N. Haas and B. Heller.
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- 223) Hamilton, K., K. Parrish, W. Ahmed and C. Haas (2018). "Assessment of Water Quality in Roof-Harvested Rainwater Barrels in Greater Philadelphia." Water **10**(2).
- 224) Ahmed, W., Q. Zhang, S. Ishii, K. Hamilton and C. Haas (2018). "Microfluidic quantification of multiple enteric and opportunistic bacterial pathogens in roof-harvested rainwater tank samples." Environmental Monitoring and Assessment **190**(2).
- 225) Sunger, N., K. A. Hamilton, P. M. Morgan, and C. N. Haas. 2018. "Comparison of pathogen-derived 'total risk' with indicator-based correlations for recreational (swimming) exposure." *Environ Sci Pollut Res Int*. doi: 10.1007/s11356-018-1881-x.

Presentations

- 1) "Amino Acids, Aquatic Bacteria and Diatoms: Possible Methods of Interaction." Presented at the 67th Annual Meeting of the Illinois State Academy of Sciences, Springfield, May, 1974.
- 2) "Physiological Alterations of Vegetative Microorganisms Resulting from Aqueous Chlorination," presented at the Research Symposium during the 51st annual meeting of the Water Pollution Control Federation, Houston, October, 1978.
- 3) "Physiological Basis for Chlorination," presented at a seminar of the Department of Civil Engineering, Syracuse University, November, 1978.
- 4) "Mechanistic Aspects of Disinfection Kinetics," presented at a seminar of the Department of Biomedical Engineering, Rensselaer Polytechnic Institute, Troy, NY, April, 1979.
- 5) "Mode of Microbial Inactivation by Chlorine", presented at the National Conference on Environmental Engineering, American Society of Civil Engineers, San Francisco, July, 1979.
- 6) "Rational Analysis of Ultraviolet Disinfection Kinetics," presented at the National Conference on Environmental Engineering, American Society of Civil Engineers, San Francisco, July, 1979.
- 7) "Rational Analysis of Microbial Regrowth." Presented at the 178th National Meeting of the American Chemical Society, Division of Environmental Chemistry, Washington, DC, September, 1979.
- 8) "A Quantitative Model of Post-Disinfection Microbial Dynamics." Presented at the Research Symposium during the 52nd Annual Meeting of the Water Pollution Control Federation, Anaheim, October, 1979.
- 9) "Rational Approaches in the Analysis of Chemical Disinfection Kinetics," Presented at the 179th National Meeting of the American Chemical Society, Division of Environmental Chemistry, Symposium on Chemistry and Chemical Analysis of Water/Wastewater Intended for Reuse, Houston, March, 1980.
- 10) "Repeated Exposure of E. coli to Free Chlorine: Production of Strains With Differential Resistance," Presented at the 80th Annual Meeting of the American Society of Microbiology, Miami, May, 1980.
- 11) "Acid-Fast Bacteria and Yeast as Indicators of Disinfection Efficiency." Invited Presentation before the Interstate Seafood Seminar, Ocean City, MD, October, 1980.
- 12) "Theory of Alternate Disinfectants." Invited presentation at the Seminar on Current Topics in Water Supply, New York State Section of the American Water Works Association, Ossining, NY, November, 1980.
- 13) "The Practical Importance of Understanding Disinfection Mechanisms." Presented at the 81st Annual Meeting of the American Society for Microbiology, Dallas, March, 1981.
- 14) "Effects of Various Additions on the Inactivation of E. coli by Chlorine. Presented at the 81st Annual Meeting of the American Society for Microbiology, Dallas, March, 1981.
- 15) "Statistical Analysis of New York State Department of Environmental Conservation Lake George Bacteriological Sampling Data." Presented at the 1st Symposium of the Lake George Research Group, Lake George, NY, April, 1981.
- 16) "Enhancement of Chlorine Inactivation of E. coli by Sodium Ions." Presented at the 4th Water Chlorination Conference, Monterey, CA, October, 1981.
- 17) "Practical Considerations in the Use of Halogen Disinfectants." Invited Presentation to the Second National Symposium on Municipal Wastewater Disinfection, sponsored by the U.S. EPA, Orlando, FL, January, 1982.
- 18) "Application of Ion Exchange to Recovery of Metals from Semiconductor Wastes." Presented at the NATO Advanced Studies Institute on Mass Transfer and Kinetics of Ion Exchange, Maratea, Italy, June, 1982.
- 19) "Estimation of Recreational Disease Risk due to Disinfection: Illinois—A Case Study." Presented at the 55th Annual Conference of the Water Pollution Control Federation, St. Louis, October, 1982.
- 20) Seminars presented during a visit to the Italian National Research Council, Water Research Institute, Bari, Italy, June, 1982:

- “Rational Analysis of Chlorination Kinetics.”
- “Use of Computer Equilibrium Models for Assessment of Industrial Waste Chemistry.”
- “Novel Precipitation processes for Metal Recovery from Semiconductor Wastes.”
- “Application of Ion Exchange to Recovery of Metals from Semiconductor Wastes.”
- “Solid Phase Differential Reactor Studies on Adsorption in Air and Water.”
- 21) Seminar presented to the Italian National Research Council, Water Research Institute, Rome, Italy, June 1982: “Metal Removal and Recovery Processes: Experimental Results and Equilibrium Calculations.”
 - 22) “Relating Microbial Changes in Water distribution to Physical-Chemical Water Quality.” Presented at the 74th Annual Conference, Illinois Section, American Water Works Association, Chicago, March 1983.
 - 23) “Direct Differential Reactor Studies of Adsorption from Liquid and Gaseous Solutions.” Presented at the Engineering Foundation Conference on Fundamentals of Adsorption, Upper Bavaria, West Germany, May, 1983.
 - 24) “Water and Wastewater Disinfection.” Seminar presented at IBM Corp., East Fishkill, NY, June 1983.
 - 25) “Kinetic Limitations on the Recovery of Metals From Wastewater by Precipitation.” Presented at the American Institute of Chemical Engineers National Meeting, Denver, August 1983.
 - 26) “Microbial Risk Assessment.” Invited Presentation at the Water Pollution Control Federation, Preconference Workshop on Wastewater Disinfection Alternatives, Atlanta, October, 1983.
 - 27) “Engineering Waterborne Disease Reduction: How Much Is Enough?” Speech before the Western Society of Engineers, Chicago, November, 1983.
 - 28) “Is Wastewater Disinfection Necessary?” Presentation to the Illinois Association of Environmental Professionals, April 1984.
 - 29) “Sensitivity of Vegetative Protozoa to Free and Combined Chlorine.” Presented at the 5th Conference on Water Chlorination: Environmental Impact and Health Effects, Williamsburg, VA, June, 1984.
 - 30) “Influence of Sodium Potassium and Lithium on Hypochlorite Solution Equilibria.” Presented at the 5th Conference on Water Chlorination: Environmental Impact and Health Effects, Williamsburg, VA, June, 1984.
 - 31) “Scientific Principles of Disinfection” and “Need Assessments for Disinfection.” Presented at the University of Wisconsin-Milwaukee Engineering Extension Program on Disinfection of Water and Wastewater, May, 1984.
 - 32) “An Engineers View of Economic Incentives for Hazardous Waste Management.” Seminar presented to the Institute of Environmental Studies, Drexel University, Philadelphia, August 1984.
 - 33) “Effect of Cessation of Chlorination on Receiving Water Microbiology.” Presented at a seminar of the Research and Development Department, Metropolitan Sanitary District of Greater Chicago, October 1984.
 - 34) “Hazardous Waste Management Challenges.” Invited plenary presentation to the Annual Meeting of the Illinois Public Health Association, Peoria, April, 1985.
 - 35) “Steps Towards a Rational Kinetic Model of Wastewater Chlorination”, seminar presentation, Department of Civil and Sanitary Engineering, Michigan State University, April, 1985.
 - 36) Presentation on potential risk avoidance due to earlier intervention in a Salmonella outbreak before the Illinois House of Representatives Committee on State Government Administration and Regulatory Reform June, 1985.
 - 37) “Development of Acid Fast and Yeast Organisms as New Indicators of Disinfection Efficiency”, seminar presented to the Department of Microbiology and Immunology, University of Arizona, Tucson, August, 1985.
 - 38) “Is Wastewater Disinfection Worth the Cost?”, seminar to the School of Civil Engineering, Purdue University, March 1986.
 - 39) “Recovery, Recycle and Reuse of Industrial Wastes”, Presented at a program on Wastewater Pretreatment and Toxicity Control, University of Wisconsin Extension at Milwaukee, March, 1986.
 - 40) “Chlorine Residual”, presented at the WPCF Conference on Analytical Techniques in Pollution Control, Denver, May 1986.
 - 41) “On the Poisson Assumption for Analysis of MPN Results”, presented at the American Water Works Association Annual Meeting, Denver, June, 1986.
 - 42) “Kinetics of Cadmium and Copper Hydrolysis”, International Association on Water Pollution Research and Control, Biennial Conference, Rio de Janeiro, Brazil, August, 1986.
 - 43) “Wastewater Disinfection: Concepts and Practices”, R.S. Engelbrecht and C.N. Haas, invited paper, Second Joint Seminar on Wastewater Treatment Technology, Japan Sewage Works Association/Water Pollution Control Federation, Hiroshima City, Japan, November, 1986.
 - 44) “Relationship Between Disinfection Mechanism and Disinfection Kinetics”, invited paper, Seminar on Water and Wastewater Disinfection, American Society of Microbiology Annual Meeting, Atlanta, GA, March 1987.
 - 45) “Disinfection Methods and Regulatory Changes”, invited presentation to the Illinois Association of Water Pollution Control Operators, Springfield, IL, April, 1987.

- 46) "Further Studies on Hypochlorite Ion Pair Chemistry and Disinfection Efficiency", 6th Water Chlorination Conference, Oak Ridge TN, May, 1987.
- 47) "Inherent Experimental Variability", invited presentation at the American Water Works Association pre-conference seminar on "Assurance of Adequate Disinfection: ct or not ct", Kansas City, June, 1987.
- 48) "Wastewater Chlorination and Dechlorination", invited presentation to the Michigan Section, American Water Works Association, Ann Arbor, February 1988.
- 49) Invited presentations before a seminar sponsored by the Michigan Water Pollution Control Association on Wastewater Disinfection: Public Health Related Issues: "Effect of Effluent Disinfection on Risks of Viral Disease Transmission via Recreational Water Exposure" and "Water Pollution Control Federation Disinfection Committee: Report Status", Ann Arbor, May 1988.
- 50) Invited speaker "Comparative Aspects of Solid Waste Management", seminar on "Recycling and Solid Waste Disposal" sponsored by the University of Illinois, Rockford, June 1988.
- 51) "Statistics of Microbial Disinfection", International Association on Water Pollution Research and Control Biennial Meeting, Brighton, UK, July 1988.
- 52) "Maximum Likelihood Analysis of Giardia Disinfection by Chlorine", First Biennial Water Quality Symposium: Microbiological Aspects, Banff, Alberta, August 1988.
- 53) "Maximum Likelihood Analysis of Disinfection Kinetics", seminar to the Environmental Engineering Program, Department of Civil Engineering, University of Illinois at Urbana-Champaign, February 1989.
- 54) "Multicomponent Interactions In Environmental Engineering", seminar to the Institute of Environmental Studies, Drexel University, April 1989.
- 55) "Chlorination/Dechlorination for New Disinfection Criteria", invited presentation at the Water Pollution Control Federation preconference workshop, San Francisco, October 1989.
- 56) "Fundamental Considerations in Development of Solvent Dissolution Processes for Plastics", presented at the 6th International Conference on Solid Waste Management and Secondary Materials", Philadelphia, December 1990.
- 57) "Failure of Chick's Law in Batch to CSTR Extrapolation of Chlorine Disinfection of Escherichia coli", presented at the Annual Conference of the American Water Works Association, Philadelphia, June, 1991.
- 58) "Occurrence of Pathogens and their Associated Risk", invited paper, Regulating Drinking Water in the 1990's, sponsored by the Northeast Regional Environmental Public Health Center, April, 1991, Amherst MA.
- 59) "Status of Chloramination", invited paper, Preconference Seminar on Water Quality Effects of Chloramination, AWWA Annual Meeting, June 1991, Philadelphia, PA.
- 60) "Binary and Ternary Equilibria of Ion Exchange", 46th Purdue Industrial Waste Conference, May 1991, West Lafayette IN.
- 61) "Equilibrium of Mixed Solid Phases", 46th Purdue Industrial Waste Conference, May 1991, West Lafayette IN.
- 62) "Biological Sulfide Prestripping for Metal and COD Removal", Annual Conference of the Water Pollution Control Federation, October 1991, Toronto, Canada.
- 63) "Comparative Performance of Interval Estimators for Virtually Safe Dose", Annual Meeting of the Society for Risk Analysis, December 1991, Baltimore.
- 64) "Nonideal Interactions in Metal Separations in Environmental Engineering", seminar to the Department of Chemical Engineering, Drexel University, January 27, 1992.
- 65) "Risk Assessment of Infectious Disease from Waterborne Exposures", seminar to the Department of Bioscience and Biotechnology, Drexel University, April 2, 1992.
- 66) "New Approaches for the Analysis of Mixture Toxicity Data", presented at the 16th Biennial Conference of the International Association on Water Pollution Research and Control, Washington D.C., May 1992.
- 67) "Occurrence of Microorganisms", invited presentation to the Netherlands Public Health Institute, Bilthoven, June 1992.
- 68) "Microbial Risk Assessment", invited presentation to the Netherlands Public Health Institute, Bilthoven, June 1992.
- 69) "Quantifying Microbial Risk", invited presentation at the First International Conference on the Safety of Water Disinfection: Balancing Chemical and Microbial Risks, Washington D.C., August 1992.
- 70) "Trends in Environmental Protection", invited presentation at the 6th environmental affairs conference, Betz Laboratories Inc., Trevose PA, September 1992.
- 71) "Microbial Risk Assessment for Drinking Water", poster by C.P. Gerba, Joan Rose and C.N. Haas, Society for Risk Analysis Annual Conference, San Diego CA, December 1992.
- 72) "The Risk of Illness from Drinking Water", seminar to the Department of Civil and Architectural Engineering and the Environmental Studies Institute, Drexel University, January 1993.

- 73) "Microbial Risk Assessment of Drinking Water", seminar to the Department of Environmental and Occupational Health and the Department of Civil Engineering and Mechanics, University of South Florida, Tampa, March 1993.
- 74) "Testing for the Presence of Interactive Toxic Effects: A New Quantitative Procedure Based on Isobole Analysis", presented at the Eastern North America Regional (ENAR) Meeting of the Biometric Society/American Statistical Association/ Institute of Mathematical Statistics, Philadelphia, PA, March 1993, with Bruce A. Stirling.
- 75) "Nonideal Interactions in Metal Separation Processes", seminar to the Department of Civil Engineering, University of Delaware, March 1993.
- 76) "The Effect of Free Chlorine, Preformed Monochloramine, Chlorine+ Preammoniation and Ozone on Giardia muris Cyst Viability", presented at the Annual Conference of the Pennsylvania Section of AWWA, April 1993, with Joel Hornberger, Uma Anmangandla and Josh Joffe.
- 77) "The Necessity for Wastewater Disinfection", invited presentation at the American Society for Microbiology conference on "Water Quality in the Western Hemisphere", San Juan PR, April 1993.
- 78) "Modeling the Risk of", D.E. Friedman, C.N. Haas and J.B. Rose, poster presentation at the American Society for Microbiology conference on "Water Quality in the Western Hemisphere", San Juan PR, April 1993.
- 79) "What We Think We Know and What We Think We Don't Know About Chlorination and Dechlorination", presented at the Water Environment Federation Specialty Conference on Wastewater Disinfection, May 1993, Whippany NJ.
- 80) "Pathogen Risks and Treatment Options", presented at the AWWA Preconference Seminar on Groundwater Disinfection, San Antonio, Texas, June 1993.
- 81) "Monte Carlo Methods in Risk Assessment", seminar presented at Roy F. Weston Co., West Chester PA, June 1993.
- 82) "Application of Risk Assessment to Standard Setting for Closed Life Support Systems", C.P. Gerba, C.N. Haas and J.B. Rose, presented at the 23rd International Conference on Environmental Systems, Colorado Springs, CO, July 1993.
- 83) "Verification of a Mechanistic Kinetic Model for Chloroform Formation from a Model Precursor During Water Chlorination", C.N. Haas and K. Topudurti, presented at the National Meeting of the American Chemical Society, Chicago IL, August 1993.
- 84) Invited discussion, "Health Effects of Water Reuse", presented at the Water Environment Research Foundation Assessment Workshop on "Water Reuse Assessment", WEF Annual Conference, Anaheim CA, October 1993, C.N. Haas.
- 85) "Simplified Method for Microscopic Determination of Giardia Disinfection Efficiency", C.N. Haas, J.C. Hornberger, U. Anmangandla and J. Joffe, AWWA Water Quality Technology Conference, Miami FL, November 1993.
- 86) "Bench to Pilot Scale Up: Impact on Microbial Inactivation", Mark S. Heath, Joseph G. Jacangelo and C.N. Haas, AWWA Water Quality Technology Conference, Miami FL, November 1993.
- 87) "Microbiological Issues", invited presentation to the US EPA Federal-State Toxicology and Risk Assessment Committee, Washington DC, December 1993.
- 88) Invited presentations to faculty and administration at University of Texas-El Paso: "Environmental Science and Engineering at Drexel University" and "Future Trends in Environmental Protection", November 1993.
- 89) "Estimating Risk from Waterborne Microorganisms", presented at the Annual Meeting of the Society for Risk Analysis, Savannah GA, December 1993.
- 90) "Microbial Risk Assessment", seminar presented to the USDA, Agricultural Research Service, Eastern Regional Research Center, Philadelphia, February 1994.
- 91) "Waterborne Microbial Diseases", invited presentation to AWWA – USEPA Workshop on Information Collection Rule, Washington DC, March 1994.
- 92) "Relevance of UIUC Disinfection Research to Current Problems", invited presentation, UIUC-CERL Symposium on Molecular Biology in Environmental Engineering, in Honor of Richard S. Engelbrecht, Champaign-Urbana IL, March 1994.
- 93) "Can Chlorine be Eliminated from Water Treatment?", invited seminar, MIT Program in Technology and Public Policy, May 1994.
- 94) "Reconciliation of Microbial Risk Assessment and Epidemiology: The Case of the Milwaukee Outbreak", AWWA Annual Conference, June 1994, New York City.

- 95) "The Risk of Infectious Disease from Drinking Water", seminar to the Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, July 1994.
- 96) "The Relationship Between Endemic and Epidemic Disease Risk", presented at the biennial meeting of the International Association on Water Quality, Budapest Hungary, July 1994.
- 97) "Application of Reaction Engineering Approaches to Disinfection Process Design", seminar to the Department of Civil Engineering, University of Illinois at Urbana-Champaign, August 1994.
- 98) "Some Observations on Cryptosporidium Risk", invited presentation, "Water for Healthy Living: A Workshop on Public Decisions about Cryptosporidium", sponsored by AWWA, Washington DC, September 1994.
- 99) "Dose-Response Relationships and Community Risk", invited presentation, "Symposium on Waterborne Cryptosporidium", sponsored by the Centers for Disease Control and Prevention, Atlanta GA, September 1994.
- 100) "Cryptosporidium in Water: What is the Problem?", presented at the Pennjerdel Water Supply Committee meeting, Philadelphia, October 1994.
- 101) "Waterborne Diseases: Who is at Risk", presented at the AWWA Water Quality Technology Conference, San Francisco CA, November 1994, CP Gerba, JB Rose and CN Haas.
- 102) "Chlorine Ban Proposals from the Viewpoint of Water and Wastewater Treatment", invited presentation, Symposium on the Future Uses of Chlorine: The Role of the University, Massachusetts Institute of Technology, November 1994.
- 103) "Application of Reaction Engineering Approaches to Disinfection Process Design", seminar to Texas A&M University, Department of Civil and Ocean Engineering, August 1995.
- 104) "Statistical Analysis of Microbial Data", presented to the AWWA Technical Action Workgroup on Disinfection and Microbials, Washington DC, September 1995.
- 105) "Understanding the Behavior of Giardia and Cryptosporidium in an Urban Watershed: Explanation and Application of Techniques to Collect and Evaluate Monitoring Data", presented at the AWWA Water Quality Technology Conference, New Orleans, November 1995. CS Crockett and CN Haas.
- 106) "Generalized Independence And Additivity: Two Approaches To Quantitatively Describing Non-Ideal Toxic Behavior Of Chemical Mixtures", presented at the Society for Risk Analysis Annual Meeting, Honolulu, December 1995, CN Haas, S. Kersten, K. Cidambi and MJ Frank.
- 107) "Quantitative Microbial Risk Assessment: Review of Principles and Application to Recreational Settings", seminar to the University of Hawaii Water Resources Institute, December 1995.
- 108) "Principles of Microbial Risk Analysis", presented to the US Department of Agriculture, Office of Risk Assessment and Cost-Benefit Analysis, April 10, 1996.
- 109) "Dose Response Assessment for Infectious Microorganisms", invited presentation, Annual Meeting – American Society for Microbiology, New Orleans, May 23, 1996.
- 110) "Risk of Chemical Mixtures: Novel Methods", seminar to Procter and Gamble Co., Cincinnati OH, November 12, 1996 (with audio feed to P&G Europe).
- 111) "Novel Quantitative Approaches for Chemical Mixtures", seminar to Department of Environmental Systems Engineering, Clemson University, April 4, 1997.
- 112) "The Role of Risk Assessment in Setting US Drinking Water Standards". Nishihara Invited Lecture delivered to:
 - Hokkaido University (Japan) – Environmental Engineering program
 - Tokyo University – Department of Urban and Environmental Engineering
 - Nishihara Sanitation Company
 - Nihon University – Department of Civil Engineering
 - Japan Ministry of Health – Membrane 21 Conference
 - September 1-15, 1997.
- 113) "What we Think We Know and What We Think We Don't Know about Chlorination-Dechlorination", presented at the preconference workshop on Disinfection, Water Environment Federation Technical Conference, October 18, 1997, Chicago.
- 114) "Risk of HIV to Wastewater Operators". Presentation at the 70th Annual Water Environment Federation Technical Conference, October 23, 1997, Chicago.
- 115) "Correlations and Copulas in Monte Carlo Analysis". Platform-Poster at the Annual Meeting of the Society for Risk Analysis, Washington DC, December 10, 1997.
- 116) "Risk Assessment for Household Sanitation", seminar to Procter and Gamble Co., Cincinnati OH, February 19, 1998.
- 117) "Risk Based Criteria for Pathogens in Drinking Water: Has the Time Come?", Seminar to the Department of Civil and Environmental Engineering, University of Delaware, March 27, 1998.

- 118) "Back to the Future: Engineering Safe Water and Safe Food in the 21st Century", Invited Lecture, Villanova University Chapter of Sigma Xi, April 3, 1998.
- 119) "Benefits of Employing a Disinfectant Residual", invited presentation at the AWWA/IWSA Conference on Disinfectant Residuals, April 26, 1998, Philadelphia PA. Also presented in Mulheim, Germany, October 2, 1998.
- 120) "Predicting Disinfection Performance In Continuous Flow Systems From Batch Disinfection Kinetics", presented at the biennial Conference of the International Association on Water Quality, June 1998, Vancouver BC (Canada).
- 121) "Frameworks for Assessing Reliability of Multiple, Independent Barriers in Potable Water Reuse", presented at the biennial Conference of the International Association on Water Quality, June 1998, Vancouver BC (Canada).
- 122) "A Quantitative Risk Assessment Model For *Listeria monocytogenes* And *E. coli* O157:H7", presented at the International Association of Milk, Food and Environmental Sanitarians, Nashville TN, August 1998/
- 123) "Epidemiology, Microbiology and Risk Assessment of Waterborne Pathogens Including *Cryptosporidium*", invited presentation – Conference on the National Food Safety Initiative: Implications for Microbial Data Collection, Analysis and Application, Arlington VA, October 15, 1998.
- 124) "What Is Disinfection?", presented at AWWA Preconference Workshop, November 1, 1998, San Diego CA.
- 125) "Risk Based Criteria for Pathogens in Drinking Water: Has the Time Come?", seminar to Department of Civil Engineering, San Diego State University, December 2, 1998, San Diego CA.
- 126) "Predicting Disinfection Performance in Continuous Flow Systems from Batch Disinfection Kinetics", seminar to the Department of Environmental Science and Engineering, University of North Carolina at Chapel Hill, November 11, 1998.
- 127) "Back to the Future: Engineering Safe Water and Safe Food in the 21st Century", presented to the Philadelphia Chapter of the Society for Risk Analysis, March 23, 1999.
- 128) "The Future of Drinking Water Science [and Engineering]". Invited presentation – EPA/AWWA Conference on Drinking Water: 2025. June 14, 1999, Washington DC.
- 129) "Watershed Management for Pathogen Control". Invited presentation – New York State Energy Research and Development Agency Conference on Management of Small Reservoirs. June 16, 1999, Albany NY.
- 130) "Formulation and Validation of a Dose Response Model for *Escherichia coli* O157:H7", presented at the International Symposium on Waterborne Pathogens, AWWA, Milwaukee WI, August 31, 1999.
- 131) "Inactivation of *Legionella pneumophila* by Free Chlorine", presented at the International Symposium on Waterborne Pathogens, AWWA, Milwaukee WI, August 31, 1999.
- 132) "Predicting Disinfection Performance in Continuous Flow Systems from Batch Disinfection Kinetics", seminar to the Department of Civil & Environmental Engineering, New Jersey Institute of Technology, September 22, 1999.
- 133) "Risk Based Criteria for Pathogens in Drinking Water: Has the Time Come?", seminar to the Department of Civil and Environmental Engineering, Princeton University, October 20, 1999.
- 134) "Community Level Impacts of Waterborne Infections", presented at the annual meeting of Society for Risk Analysis, Atlanta, December 7, 1999.
- 135) "Dermal Microbial Risk Assessment: Impact Of Germicidal Soap On Risk Of Infection From *Staphylococcus aureus*", presented at the annual meeting of the Society for Risk Analysis, Atlanta, December 6, 1999.
- 136) "Microbes and Monte Carlo", presented at the annual meeting of the American Association for Advancement of Science, Washington DC, February 22, 2000.
- 137) "Statistical Modeling in Drinking Water Production", invited presentation, IWA Workshop of Modeling Conventional Drinking Water Treatment Processes, Mar 16, 2000, Delft, The Netherlands.
- 138) "Dose Response Models", invited presentation, WHO-FAO Workshop on Microbial Risk Assessment, Utrecht, The Netherlands, June 13, 2000.
- 139) "Probabilistic Modeling of Drinking Water Treatment", seminar to the Department of Civil and Environmental Engineering, Duke University, September 7, 2000.
- 140) "Microbial Risk Factors: How We Got Here and Alternative Futures", invited presentation, AWWA Water Quality Technology Conference, Salt Lake City, November 7, 2000.
- 141) "Progress and Data Gaps in Quantitative Microbial Risk Assessment", invited presentation at the 2001 Asian Water Quality Conference, Fukuoka, Japan, September 12, 2001.
- 142) "Progress and Data Gaps in Quantitative Microbial Risk Assessment", invited presentation to the Department of Urban and Environmental Engineering, University of Tokyo, Japan, September 18, 2001.

- 143) "Decontamination Using Chlorine Dioxide", Testimony before the US House of Representatives, Committee on Science, hearing on "The Decontamination of Anthrax and Other Biological Agents", November 8, 2001, Washington DC.
- 144) "Bioterrorism 101", Invited presentation, Lehigh University chapter of Sigma Xi, November 28, 2001.
- 145) "The Role of Risk Analysis in Understanding Bioterrorism", invited plenary address, Society for Risk Analysis Annual Meeting, Seattle WA, December 3, 2001.
- 146) "The Risk of Inhalation Exposure to Anthrax Spores", seminar to the School of Environmental Science, Engineering and Policy, Drexel University, February 15, 2002.
- 147) "Disinfection Modeling", invited presentation, WEF Disinfection Specialty Conference, St. Petersburg FL, February 17, 2002.
- 148) "Microbial Dose-Response Models", presented at a short course on microbial risk assessment offered by the University of Ottawa to personnel from Food Canada and Health Canada, March 1, 2002, Ottawa, Canada.
- 149) "Chemical and Biological Terrorism and Higher Education", presented at a workshop organized by the Association of Independent Colleges and Universities of Pennsylvania, Harrisburg PA, March 7, 2002.
- 150) Invited Distinguished Public Health Scientist Lecture, "The Role of Risk Assessment in Responding to the Threat of Anthrax", Johns Hopkins University, Bloomberg School of Public Health, Baltimore, May 16, 2002.
- 151) "Risk Assessment, Bioterrorism and the Food Industry", invited presentation, First International Conference on Microbial Risk Assessment: Food, College Park MD, July 25, 2002.
- 152) "Quantitative Assessment Of Benefits From Using Topical Antimicrobial Hand Products: Case Study On E. coli Risk From Handling Raw Beef", Society for Risk Analysis Annual Meeting, New Orleans, December 9, 2002.
- 153) "Towards a Fourth Generation in Water (Chemical) Disinfection Process Design", seminar presented to the Department of Civil and Environmental Engineering, Tulane University, December 10, 2002.
- 154) "Risk Assessment, Bioterrorism and the Food Industry", seminar to the Eastern Regional Research Center, USDA, Wyndmoor PA, January 10, 2003.
- 155) "Pathogens: Understanding Risks and Control", invited presentation – Symposium on Drinking Water and Health, sponsored by Philadelphia Suburban Water and Drexel University, Philadelphia, March 25, 2003.
- 156) "Chemical and Biological Threats", presented at a workshop on Community Infrastructure Protection, Pennoni Associates, March 26, April 2, April 30 and May 7, Wilmington DE, Mt. Laurel NJ, Harrisburg PA and Philadelphia (2003).
- 157) "How Much is Enough to Protect Public Health: Statistical and Sampling Size Considerations for Environmental Sampling", invited presentation, Annual Meeting of the American Society for Microbiology, Washington DC, May 21, 2003.
- 158) "Overview of Risk Assessment Concepts and Methodologies", invited presentation, Workshop on Quantifying The Health Risk from Water Recycling Schemes, Brisbane, Australia, September 3, 2003.
- 159) "Quantitative Microbial Risk Assessment and Uncertainty Analysis", invited presentation, Workshop on Quantifying The Health Risk from Water Recycling Schemes, Brisbane, Australia, September 3, 2003.
- 160) "Numerical Investigation of the Effects of Reactor Configuration on the Efficacy of Microbial Inactivation", presented at the WEF Annual Conference, October 2003, Los Angeles CA.
- 161) "Quantitative microbial risk assessment+20: victories, challenges and a look forward", seminar to the Harvard Center for Risk Analysis, October 31, 2003, Boston MA.
- 162) "Risk Assessment", presented at workshop on "Reclaimed Water: Whose Water is it?", AWWA WQTC Conference, November 2, 2003, Philadelphia.
- 163) "Selection of an Appropriate Batch Inactivation Model – Why it Matters", presented at the WQTC Conference, Philadelphia, November 2003.
- 164) "Arrivederci "Minimal Infectious Dose": Have We Learned the Lesson Yet?., presented at the 2003 Annual Meeting of the Society for Risk Analysis, Baltimore, December 7, 2003.
- 165) "Emission Rates of Biological Aerosols during the Land Application of Biosolids? Presented at the 2003 Annual Meeting of the Society for Risk Analysis, Baltimore, December 9, 2003.
- 166) "Disinfection 2020 (20/20)", Seminar presented to the Department of Civil Engineering, Villanova University, March 18, 2004.
- 167) "Disinfection 2020 (20/20)", Seminar presented to the Department of Civil and Environmental Engineering, University of Cincinnati, June 4, 2004.
- 168) "Quantitative Microbial Risk Assessment: An Introduction", invited presentation, 5th Annual Environmental Health Conference of the Association of Schools of Public Health, July 12, 2004 , University of Minnesota.

- 169) “Quantitative microbial risk assessment+20: victories, challenges and a look forward”, seminar to the Department of Soil, Water and Environmental Science, University of Arizona, Tucson, October 25, 2004.
- 170) “Arrivederci “Minimal Infectious Dose”: Have We Learned the Lesson Yet?”, invited presentation – Workshop on Microbial Risk Assessment, US EPA – National Exposure Research Laboratory, Cincinnati OH, November 18, 2004.
- 171) “Reducing Waterborne Infectious Disease”, seminar presented to the Department of Environmental Health Science, University of Michigan School of Public Health, November 29, 2004.
- 172) “Chemical Terrorism Against Food and Water Supplies”, Symposium on Toxic Industrial Chemicals and Toxic Industrial Materials, sponsored by ATSDR and American Society for Medical Toxicology, Drexel University, June 13, 2005.
- 173) “Simulation of Anthrax Spore Transport and Inactivation in a Room: Scaling Analysis”, S Soni, B Farouk and CN Haas, Proceedings of the 2005 ASME International Mechanical Engineering Congress and Exposition, November 5-11, 2005 Orlando FL.
- 174) “Human and Animal Health Risks Associated With Biosolids”, C.N. Haas, presented at the annual meeting of the American Society for Microbiology, Orlando FL, May 23, 2006.
- 175) “Thresholds: (Lack of) Evidence for their Existence, and What We Would See if They Were Significant”, invited presentation – Upstate NY Chapter of the Society for Risk Assessment, October 13, 2006.
- 176) “Animal Dose Response Data for Predicting Risk of BT Events: Preliminary Thoughts on Validation Using the 2001 AMI Incident as a Case Study”, presented at the annual meeting of the Society for Risk Analysis, December 2006.
- 177) “Basic Microbial Dose Response”, C.N. Haas, presented at the annual meeting of the American Society for Microbiology, May 20, 2007, Toronto.
- 178) “Developing Unifying Principles in Microbial Risk Assessment”, presented at the annual meeting of the American Society for Microbiology, May 22, 2007, Toronto.
- 179) “E coli O157:H7 – What we Know about Assessing its Risk to Human Health”, presented at the annual meeting of the American Society for Microbiology, May 23, 2007, Toronto.
- 180) “Evolution of Disinfection of Water”, presented at the annual meeting of the American Society for Microbiology, June 2008, Boston.
- 181) “100 Years of Disinfection”, presented at the biennial conference of the International Water Association, Vienna, September 2008.
- 182) “Bioterrorism as a “New” Environmental Engineering Challenge”, Invited presentation to the 3rd International Workshop on Environmental and Health Risk for Sustainability, University of Tohoku, Sendai, Japan, February 2, 2009.
- 183) “Basic Microbial Dose Response”, presented at the biennial conference of the International Water Association, Montreal, September 2010.
- 184) “Statistical factors to consider in establishing risk based pathogens criteria for recreational water”, Invited presentation – Gulf Coast Governors Conference on Gulf of Mexico Pathogens, Sarasota FL, September 2010.
- 185) “A Path to Fundamental Based Optimal Process Design in Environmental Engineering by Computer Experiments and Metamodels?” Seminar to the Department of Civil & Environmental Engineering, Temple University, October 2010.
- 186) “Animal and Human Dose-Response Models for prominent *Brucella* species”, Presentation at Annual Conference of Society for Risk Analysis (by Sondra Teske, post-doc), Salt Lake City, December 2010.
- 187) “Dose-Response Model of Rocky Mountain spotted fever for humans”, Presentation at Annual Conference of Society for Risk Analysis (by Sushil Tamrakar, PhD student), Salt Lake City, December 2010.
- 188) “Dose Response Using Animal Data”, Invited presentation to the FDA Workshop on Listeriosis, Washington DC, March 2011.
- 189) “Risk Informed Response Plans for *B. anthracis*”, invited presentation to the Armed Forces Public Health Conference, Newport News, March 2011.
- 190) “Re-envisioning a more sustainable urban water cycle”, Invited presentation at Peking University in Shenzhen, April 2011.
- 191) “Introduction to QMRA”, presentation at the biennial conference of the Association of Environmental Engineering and Science Professors, Tampa, July 2011.
- 192) “Quantifying Risks from Exposure to inhaled Microorganisms”, Invited presentation, 2012 Bioaerosol Symposium, Yonsei University, Seoul, Republic of Korea, May 17, 2012.
- 193) Organized and Chaired Symposium on “Quantitative Microbial Risk Assessment (QMRA) – Progress, Applications and the Future” at the 2012 World Congress on Risk, Sydney, Australia, July 19, 2012.

- 194) “Assessing Risk from Waterborne Microorganisms: from *Bacillus coli* to *atgcaagta*”, Invited keynote address, International Conference on Assessing Pathogen Fate, Transport and Risk in Natural and Engineered Water Treatment, Banff, Alberta, Canada, September 25, 2012.
- 195) “Wastewater microbiological monitoring as a health sentinel”, invited presentation, Symposium on Wastewater Microbiological Monitoring, Tohoku University, Sendai, Japan, October 20, 2012.
- 196) “US policies in Climate Change; the role of science and technology”, invited presentation, Fifth Congress on the State of the Environment: Extreme weather management and health, Interamerican University of Puerto Rico, San Germain PR, February 11, 2016.
- 197) “Quantitative Microbial Risk Assessment of *Legionella* and *Mycobacterium* in Harvested Rainwater”, presented (by Kerry Hamilton), Society for Risk Analysis, San Diego, December 13, 2016.
- 198) “Presidential Roundtable: Post-Election Prospects and Challenges for Risk Policy”, paper on Safe Drinking Water and Clean Water Acts, Society for Risk Analysis, San Diego, December 12 2016.
- 199) “Risks from Ebola Virus Discharge from Hospitals for Sewer Workers”, presented (by Taylor Rycroft), Society for Risk Analysis, San Diego, December 14, 2016.
- 200) “Water Disinfection: From Laboratory Bench to Full Scale. Where We Are and Where We Need to Go.”, presented at the American Chemical Society, San Francisco, April 3, 2017.
- 201) “Exposure to *Salmonella* sp. and *H. pylori* from lettuce irrigated with contaminated water”, Presented at the biennial meeting of the Association of Environmental Engineering and Science Professors, Ann Arbor MI, June 22, 2017.

Non-Reviewed Publications

- 1) “Chemical Basis for Interaction Between Aquatic Bacteria and Phytoplankton,” Final Report to the National Science Foundation, Student Originated Studies Program (1973).
- 2) “Soluble Phase Chemistry of Trace Metal Transport Through Secondary Wastewater Treatment Systems,” M.S. Thesis, Department of Environmental Engineering, Illinois Institute of Technology (1974).
- 3) “Heavy Metals Transport Through Municipal Sewage Treatment Plants.” Proceedings, 2nd National Conference on Complete Water Reuse (1975). With J.W. Patterson and P. Shimada.
- 4) Discussion on “Temperature-Toxicity Model for Oil Refinery Waste.” Journal of the Environmental Engineering Division, Proceedings ASCE, 101,446 (1975).
- 5) “New Microbial Indicators of Disinfection Efficiency.” Annual Report to the U.S. Army Medical Research and Development Command (1975). With R.S. Engelbrecht et al.
- 6) “Inactivation of New Indicators of Disinfection Efficiency, Part I. Free Available Chlorine Species Kinetics.” Proceedings, 96th Annual Meeting, American Water Works Association (1976). With F. Surucu.
- 7) Discussion on “Cyanophage Analysis as a Biological Pollution Indicator—Bacterial and Viral.” Journal of the Water Pollution Control Federation, 49, 1913 (1977).
- 8) “Acid-Fast Bacteria and Yeasts as Disinfection Indicators: Enumeration Methodology.” Proceedings, 5th Water Quality Technology Conference, AWWA. (1977). With R.S. Engelbrecht.
- 9) “New Microbial Indicators of Disinfection Efficiency.” U.S. EPA Environmental Protection Technology Series 600/2-77- 052 (1977). With R.S. Engelbrecht et al.
- 10) “Mechanism of Inactivation of New Indicators of Disinfection Efficiency by Free Available Chlorine.” Ph.D. Thesis, Department of Civil Engineering, University of Illinois at Urbana-Champaign (1978).
- 11) “Literature Review—Disinfection.” Journal of the Water Pollution Control Federation, 50, 1134 (1978), with J. Gould.
- 12) “The Future of Chlorination.” Rensselaer Fresh Water Institute at Lake George Newsletter, 8 #3 (1978).
- 13) “Acid-Fast Bacteria and Yeasts as Indicators of Disinfection Efficiency.” US With R.S. Engelbrecht, et al.
- 14) Discussion on “Effects of Chlorination on Differentiated Coliform Groups.” Journal of the Water Pollution Control Federation, 51, 2961(1979).
- 15) “Literature Review—Disinfection.” Journal of the Water Pollution Control Federation, 51, 123 (1979). With J. Gould.
- 16) “Mode of Microbial Inactivation by Chlorine.” Proceedings of the ASCE Environmental Engineering Specialty Conference, pp646-52 (1979). With R.S. Engelbrecht.
- 17) “Rational Analysis of Ultra-Violet Disinfection Reactors.” Proceedings of the ASCE Environmental Engineering Specialty Conference, pp540-7 (1979). With G. P. Sakellaropoulos.
- 18) Discussion on “Kinetics of Bacterial Deactivation with Chlorine.” Journal of the Environmental Engineering Division, ASCE, 105, 1198 (1979).

- 19) "Hazardous Waste Processing and Disposal Practices—Best Technology." Report to the New York State Environmental Facilities Corporation (1979). With W.W. Shuster, et al.
- 20) "The Potential for the Application of Resource Recovery Practices in the Hazardous Waste Processing and Disposal Industry." Report to the New York State Environmental Facilities Corporation (1979). With W.W. Shuster, et al.
- 21) "Literature Review-Disinfection." *Journal of the Water Pollution Control Federation*, 52, 1224 (1980 with J. Gould).
- 22) "Literature Review—Disinfection." *Journal of the Water Pollution Control Federation*, 53, 789 (1981), with J. Gould.
- 23) "What are Hazardous Wastes?" In R.L. Robbins (ed.) *Limiting Liability for Hazardous Wastes*, Chicago-Kent College of Law (1981).
- 24) "Technical Arguments Against the Adoption of Changes in the Illinois Wastewater Fecal Coliform Standards." Paper submitted to the Illinois Pollution Control Board (1981).
- 25) "Practical Considerations in the Use of Halogen Disinfectants." In A.D. Venosa (ed.), *Proceedings of the Second National Symposium on Wastewater Disinfection*, U.S. Environmental Protection Agency, EPA600/9-83-009 (1983).
- 26) "Literature Review—Disinfection." *Journal of the Water Pollution Control Federation*, 54, 646 (1982). With J.J. McCreary.
- 27) "Evaluation of High-Performance Phosphorus Control POTW's in the Great Lakes Basin." Final Report to the US EPA. With J.W. Patterson et al.(1982).
- 28) "Management of Hazardous Wastes: An Illinois Perspective." Report to the Illinois Institute of Natural Resources, With J.W. Patterson (1982).
- 29) "Microbiological Alterations in Water Quality in Distribution Systems and Granular Activated Carbon." Final Report to the US EPA. With M.A. Meyer et al. (1983).
- 30) "Incentives for the Treatment and Disposal of Hazardous Wastes by Alternative Methods." Report to the US EPA and the American Association for the Advancement of Sciences (1984).
- 31) "Wastewater Disinfection-A Review of the Technical and Legal Aspects in Illinois." Metropolitan Sanitary District of Greater Chicago, Department of Research and Development, Report 84-17 (1984). With C. Lue-Hing et al.
- 32) "Computer Applications to Chemical Equilibria in Modeling and Simulation of Aqueous Environment." *Proceedings of the 2nd International Conference on Computer Aided Analysis and Design in Civil Engineering* (1985). With V. Tare.
- 33) "Risks Associated with Viruses in Drinking Water", *Proceedings of the Third Conference on Progress in Chemical Disinfection*, p460-8 (1986), C.P. Gerba and C.N. Haas.
- 34) "Effects of Ceasing Chlorination on Selected Indicator Populations Downstream of Metropolitan Chicago's Major Wastewater Treatment Facilities", Metropolitan Sanitary District of Greater Chicago, Department of Research and Development, Report 87-17 (1987). With S. Sedita and C. Lue-Hing.
- 35) "Methods and Monitoring – Statistical Approaches", Chapter 20 in *Drinking Water Microbiology: Progress and Recent Developments*, G.A. McFeters[ed.], Springer-Verlag, New York (1990). C.N. Haas and B. Heller.
- 36) "Development and Testing of a Methodology to Identify, ex post facto, the Determinants of Remedial Actions at Superfund Sites", Center for Hazardous Waste Management, IIT/IITRI (1989). With G. Paulson et al.
- 37) "User Manual for the Computer Program WASTE (Waste Alternative Solutions to Evaluate) [and accompanying software]. Report to the Illinois Department of Energy and Natural Resources, J.W. Van Nortwick, C.N. Haas and R. Porter (1989).
- 38) "Editorial: Acting in the Face of Uncertainty", *Journal of the Water Pollution Control Federation*, 62, 2, 115 (1990).
- 39) Discussion on "Analysis of Inactivation of *Giardia lamblia* By Chlorine", *Journal of Environmental Engineering*, 115, 1, 1210-2 (1990).
- 40) "Editorial: Let's Surprise Rip Van Winkle", *Research Journal of the Water Pollution Control Federation*, 63, 5, 755 (1991).
- 41) "Demand Exceeds Supply for Environmental Engineers", *Engineering Horizons*, Fall (1992), pp27-28.
- 42) Invited Book Review, "Taste and Odor Problems Associated with Chlorine Dioxide", *Environmental Progress*, 13(1):F10-11 (1994).
- 43) "The Risk of Over reliance on Risk Assessment", *Water Environment Research*, 67, 1, 3 (1995).
- 44) "Waterborne Diseases – Who is at Risk?", *Proceedings of the 1994 AWWA Water Quality Technology Conference*, II:57-71, CP Gerba, JB Rose and CN Haas (1995).

- 45) "Risk Assessment in Microbial Water Quality Criteria", Australian Water and Wastewater Association Journal, November/December, pps 18-20, CN Haas (1995).
- 46) "Microbial Risk Assessment: A New Tool in Water Quality Management", CP Gerba, JB Rose and CN Haas, Proceedings of the 6th International Conference for "Ecology and Environmental Quality", June/July 1996, Jerusalem.
- 47) "Linking Microbiological Criteria for Foods with Quantitative Risk Assessment", Chapter 14 in JJ Sheridan, RL Buchanan and TJ Montville (eds.), HAACP: An Integrated Approach to Assuring the Microbiological Safety of Meat and Poultry, Food and Nutrition Press, Trumball CT (1996).
- 48) "Quantitative Microbial Risk Assessment for Reclaimed Water", Proceedings – WaterTech, 1996 Annual Conference of the Australian Water and Wastewater Association, Sydney, May 1996, pp254-260. CP Gerba, JB Rose and CN Haas.
- 49) "Microbial Risk Assessment: A New Tool in Water Quality Management", Preservation of Our World in the Wake of Change, (Y Steinberger, ed.), VIA/B:732-735 (1996).
- 50) "Main Disinfection – Why Do it the Way We Do?", Opflow, 22(9):1,4 (1996), GA Burlingame, CN Haas and WO Pipes.
- 51) "Viewpoint: Acceptable Microbial Risk", Journal of the American Water Works Association, 88(12):8 (1996), CN Haas.
- 52) "Risk Assessment of HIV in Wastewater Collection and Treatment Systems", CN Haas, pages 103-108, in HIV in Wastewater, WEF Monograph (C. Lue-Hing, P. Tata and L. Casson eds.), Alexandria VA (1999).
- 53) "Disinfection in the 21st Century", Journal of the American Water Works Association, 92(2):72-3 (2000), C.N. Haas.
- 54) "Editorial: Environmental Engineering and Bioterrorism?", Journal of Environmental Engineering, 128(5):397 (2002), C.N. Haas.
- 55) "Toxic and Contaminant Concerns Generated by Hurricane Katrina", The Bridge (published by the National Academy of Engineering), Spring 2006, p5-13, D.D. Reible, C.N. Haas, J.H. Pardue, and W.J Walsh.
- 56) "WATERS Network – Transforming the Way the United States Assesses Water Quality and Manages This Valuable and Threatened Resource", WATER21 (International Water Association), Paula Estornell, Charles N. Haas, Barbara Minsker, Jerald L. Schnoor and Jami L. Montgomery, April 2007..

Student Advising

Rensselaer Polytechnic Institute

Year	Degree	Student	Title
1979	M.Eng.	P.A. Sajous	Oxygen Uptake Rate as a Control of Activated Sludge Process
1979	M.Eng.	E.C. Morrison	Altered Sensitivity to Chlorine in E. coli.
1980	M.S.	P.A. Hughes	Laboratory Investigation of the Activated Sludge Process with Alum Addition for the Removal of Trace Metals.
1980	M.S.	C.A. Weitz, Jr.	Ultraviolet Reactor Design Using Hydraulic Parameters.
1982	M.Eng.	M.A. Zapkin	Inactivation of Escherichia coli by Chlorine in the Presence of Various Additives.

Illinois Institute of Technology

Year	Degree	Student	Title
1981	M.S.	L.M. Mele	Surface Water Hydrology of Coal Refuse Disposal Sites.
1982	M.S.	R. Garunas	Acid Waste Gas Biodesulfurization: An Alternative to Chemical Sulfur Recovery Processes.
1982	M.S.	K.A. Lavelle	Desulfobacter Biocatalyzed Reduction of Gypsum Wastes: Applications to Phosphoric Acid Manufacturing.
1983	M.S.	S.B. Karra	Kinetic Limitations on the Recovery of Metals From Wastewater by Precipitation.
1984	M.S.	K. Khater	Inactivation of Tetrahymena pyriformis By Monochloramine.
1984	M.S.	T. Jamrock	Effect of Time and Temperature on the E.P. Toxicity Test.
1984	M.S.	A. Wojtas	Inactivation of Tetrahymena pyriformis By Free Chlorine.

1984	M.S.	D.M. Brncich	The Determination of Stability Constants for Na, Li, and K Ion Pairs with Ocl
1984	M.S.	N. Horowitz	The Effect of Organic Ligands on the Adsorption of Cadmium Onto Kaolinite.
1984	M.S.	B. Kaplan	The Influence of Humic Acid on Solubility and Air-Water Partitioning of Toluene.
1984	M.S.	J. Macak	The Use of Coal Ash Mixtures as a Final Cover in the Reclamation of Landfills.
1985	M.S.	G. Vanderlaan	Feedstock Chemicals and the Hazard Ranking System Data Base.
1985	M.S.	M. Karalius	Inactivation of Escherichia coli by Chlorine in the Presence of K ⁺ and Li ⁺ Ions.
1985	M.S.	Robert Renaud	Investigation of Thiosulfate and other Dechlorinating Agents.
1985	M.S.	John Sheerin	Magnitude and Decay of Fecal Coliforms in Chlorinated and Non Chlorinated Wastewater Discharges.
1985	M.S.	J.R. O'Donnell	Spectrophotometric Determination of KD for the LiOCl, NaOCl and KOCl Ion Pairs.
1986	M.S.	Paul Bitter	Analysis of Five Nutrient Effects on the Growth of Microorganisms in the City of Chicago Drinking Water Supply.
1986	M.S.	Bon Mui	Distribution of Coliforms in Lake Michigan.
1986	M.S.	R. J. Vamos	Kinetics of Cadmium Complexation Reactions with Chloride and Hydroxide
1986	M.S.	C. D. Trivedi	Inactivation of Escherichia coli by Free Chlorine and Monochloramine in the Presence of Potassium Ions.
1986	M.S.	Andrew Kling	Energy Waste in Aeration Processes.
1986	M.S.	Angela Podesta	A Rapid Membrane Filter Technique For the Concentration of Plankton in Finished Drinking Water.
1987	M.S.	Paul Favara	Metal Removal in SBR Systems Treating Hazardous Waste Leachate.
1987	M.S.	H. D.-Markazi	Effect of Ethylene Glycol on Transport of Chloride thru Landfill Liner Material.
1988	M.S.	C. Brougnier	Co-Disposal of Plastics and Solvent Wastes as Residual Fuel.
1988	Ph.D.	K.V. Topudurti	Transfer of Chlorine from Monochloramines and Organochloramines to a THM Precursor.
1988	M.S.	Marc Bonem	Plant Deposition of Nitrogen Dioxide (co advised).
1990	Ph.D.	Yao Kouome	CSTR Microbial Inactivation by Free and Combined Chlorine.
1990	Ph.D.	C. Polprasert	Biological Sulfide Production for Heavy Metal Removal.
1990	Ph.D.	Richard Vamos	Binary and Ternary Equilibria of Cation Exchange.
1990	M.S.	Chi Lo	Assessment of Solid Waste Generation Patterns and Potential for Recycling on the IIT Campus.
1990	M.S.	P. Cunningham	Carcinogenic Risk Assessment: A Monte Carlo Study of Methods for Determining Confidence Limits on the Virtually Safe Dose
1991	Ph.D.	J. VanNortwick	Mixed Metal Precipitation
1991	M.S.	B. Bush	Carcinogenic Risk Assessment: Calculating Confidence Limits on the Virtually Safe Dose

Drexel University

Year	Degree	Student	Title
1992	M.S. (Env. Sci.)	Bruce Stirling	Biological Responses to Mixtures
1993	M.S. (Env. Eng.)	Joel Hornberger	Development of a Standard Method for the Determination of Disinfection Effectiveness Against Giardia Cysts
1993	M.S. (Env.Eng.)	Uma Anmangandla	Regression Analysis of Disinfection Kinetics
1994	M.S. (Env.Eng.)	Sean Kersten	Analysis Of Binary Toxic Mixtures Using A Model Of Independence
1995	M.S. (Env. Eng)	Kaushik Cidambi	Analysis Of Binary Toxic Mixtures Using A Generalized

1995	M.S. (Env.Eng)	Chris Crockett	Additivity Model Determination of Sources and Impacts of Giardia and Cryptosporidium in a Major Metropolitan Watershed
1996	PhD (Env Eng)	Jin Anotai	Effect of Calcium Ion on Chemistry and Disinfection Efficiency of Free Chlorine at pH 10
1996	M.S. (Env.Eng.)	Shubhangi Desai	Kinetics of Inactivation of G. muris by Monochloramine
1996	M.S. (Env.Eng.)	Aamir M Fazil	A Quantitative Risk Assessment Model for Salmonella
1996	M.S. (Env.Eng.)	R.B. Chitluru	Chlorination Kinetics for Water Main Associated Organisms
1996	M.S. (Env Sci)	J.L. Gambetese	Fate Modeling of Organic Compounds in Wastewater Treatment Plants: A Comprehensive Analysis of WATER7 and WATER8
1996	Ph.D.(Env Eng)	James Hagan	An Examination of Acute Environmental Toxicity of Pharmaceutical Compounds Using Quantitative Structure-Activity Relationships
1996	M.S. (Env Eng)	Josh Joffe	Data Analysis for Disinfection Kinetics Modeling.
1997	M.S. (Env Eng)	Joe Nattress	Benchmarking Giardia and Cryptosporidium Inactivation at the Philadelphia Water Department
1998	M.S. (Env Eng)	Dhumal Aturaliye	Electroporation Assisted Disinfection of Giardia and Cryptosporidium
1998	M.S. (Env Sci)	Aadithya Thayyar-Madabusi	A Quantitative Risk Assessment Model for Listeria monocytogenes and Escherichia coli O157:H7.
1999	Ph.D. (Env. Eng)	Mukul Gupta	Epidemiological Modeling of Waterborne and Foodborne Outbreaks
1999	MS (Env Eng)	Kathy French	Modeling Cryptosporidium Removal in Drinking Water by Physical Processes
1999	MS (Env Eng)	Chad Pindar	Clostridium perfringens as an Indicator for Cryptosporidium During Electroporation Assisted Disinfection
1999	MS (Env Eng)	Paul Batman	Water matrix effects on protozoan inactivation in chlorine-chloramine disinfection processes
1999	MS (Env Eng)	Dora D'Andrea	Inactivation efficiency of Mycobacterium by free chlorine
1999	MS (Env Sci)	Joseph Dmochowski	Benchmarking and modeling the inactivation of Legionella pneumophila using chlorine and chloramines
2000	MS (Env Eng)	Jason Sites	Analysis of Giardia Inactivation and Cryptosporidium Viability/Infectivity Assays in Various Disinfection Schemes
2001	PhD (Env Eng)	Paula R. Klink	Ion exchange on a chelating resin: multicomponent equilibrium predictions using binary data
2002	MS (Env Eng)	Jason Marie	Use of Microbial Risk Modeling to Determine the Benefit of Topical Antimicrobial Products
2002	PhD (Env Eng)	Dennis Greene	Numerical Simulation of Chlorine Disinfection Processes in Non-Ideal Reactors
2003	PhD (Env Eng)	Baris Kaymak	Effect of Initial Microorganism Concentration on Disinfection Efficiency by Chlorine.
2004	PhD (Env Eng)	Lijie Li	Effects of Initial Microbial Density on Disinfection Efficiency in a Continuous Flow System and Validation of Disinfection Batch Kinetics in a Continuous Flow System
2004	PhD (Env Eng)	Christopher Crockett	The Concentration and Resuspension of Cryptosporidium Oocysts by Sediments
2005	MS (MechE)	Sankalp Soni	Simulation of Contaminant Dispersal in An Apartment Building” (co-advised with Baki Farouk)
2005	PhD (Env Eng)	Thomas W. Armstrong	A quantitative microbial risk assessment model for human inhalation exposure to Legionella
2006	PhD (EnvEng)	Timothy A. Bartrand	High-Resolution Experimental and Numerical Analysis of Fine Bubble Ozone Contactors (co advised with Baki Farouk)
2006	MS (EnvEng)	Bishel B. Baby	A Dose-Response Analysis for Plague bacterium: Yersinia pestis

2007	PhD (EnvEng) (co advised)	Lynn A Arlauskas- Dekleva	1-Hydroxyanthraquinone: Activity in Paracoccus denitrificans and Potential Application for Biomass Reduction in Wastewater Treatment Facilities.
2008	MS (Env Eng)	Robert Praga	Water exposure and health impacts of recreational waters in an urban watershed
2009	PhD (EnvEng)	Joanna M. Pope	Tracking the Sources of Fecal Contamination in the Wissahickon Creek Watershed using Phenotypic and Genotypic Analytical Methods
2009	PhD (EnvEng)	Mark Weir	Development of Physiologically Based Pathogen Transport and Kinetics Model for Inhalation of Bacillus anthracis Spores
2010	PhD (EnvEng)	Shamia Hoque	Development of Computational Fluid Dynamics based Multiple Linear and Neural Network Metamodels for Bioaerosol Fate and Transport in Indoor Environments
2010	PhD (EnvEng)	Paula Estornell	Sustainable Development: Which Policy Process – Autocratic or Democratic- Leads to More Durable Policy and Environmental Outcomes?
2010	PhD (EnvEng)	Yin Huang	Incorporating Time to Response into Dose-Response Models Used in Quantitative Microbial Risk Assessment
2011	PhD (EnvEng)	Sushil Tamrakar	Dose-Response Models of Rickettsiae and Other Biological Agents of Concern
2011	MS (EnvEng)	Adam Erispaha	Modeling of Trihalomethane Formation Based on Consensus of Existing Empirical Models
2013	PhD (EnvEng)	Michael Ryan	Microbial Source Tracking of Human and Animal Waste Pollution of Diverse Watersheds and of Green Infra- structures using Molecular Methods
2013	PhD (EnvEng)	Neha Sunger	Quantitative Health Risk Assessment of Recreational Water Users in Philadelphia
2015	PhD (EnvEng)	Lauren Weinrich	The Impact of Assimilable Organic Carbon on Biological Fouling of Reverse Osmosis Membranes in Seawater Desalination
2016	MS (EnvEng)	Taylor Rycroft	Risks from Pathogen Discharge from Hospitals to Sewer Workers: Quantitative Microbial Risk Assessments for <i>Ebolavirus</i> and <i>Mycobacterium avium</i> Complex
2017	PhD (EnvEng)	Kerry Hamilton	Quantitative Microbial Risk Assessment for sustainable water resources
2017	PhD (EnvEng)	Bidya Prasad	Incorporating the Host-Pathogen Kinetics of Time-Dose- Response into Epidemic Outbreaks

Student Research In Progress at Drexel University:

Degree	Student	Topic
PhD (EnvE)	Paul Kohl (2013-)	Energy Recovery from Wastewater Flows
PhD (MechE)	Wangshu Wei (2014)	Metamodels from CFD Analysis of Disinfection Contactors (co-advised with B. Farouk)

Teaching Experience

Rensselaer Polytechnic Institute

Undergraduate	Graduate
Unit Processes	Advanced Aquatic Chemistry
Thermodynamics	Biological Treatment
Environmental Engineering Laboratory	
Chemistry for Environmental Engineers	

Illinois Institute of Technology

Undergraduate	Graduate
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Water & Wastewater Treatment
Introduction to Environmental Engineering

Environmental Chemistry
Biochemical Engineering
Physical Treatment
Sanitary Design
Hazardous Waste Engineering
Industrial Waste Treatment Criteria
Groundwater Contamination
Data Analysis

Drexel University (* - Undergraduate Course)

Undergraduate

Environmental Engineering I
Unit Operations Laboratory
Reaction Kinetics & Mass Transfer
Bioterrorism (Special Topics)
Professional Practice in Environ. Eng.
Environmental Engineering Laboratory I, II
Introduction to Environmental Engineering
Water & Wastewater Design III

Graduate

Unit Operations: Biological
Chemistry of the Environment
Risk Assessment
Advanced Environmental Chemistry
Unit Operations: Physical-Chemical
Topics in Environmetrics
Hazardous Waste & Groundwater Treatment
Biostatistics
Environmental Impacts
Sanitary Microbiology

Service on External Graduate Student Committees

Alexa Oblensky, University of North Carolina at Chapel Hill, Department of Environmental Science and Engineering (advisor – Phil Singer), 2002-2006.

Benjamin Tanner, University of Arizona, Department of Soil, Water and Environmental Sciences (advisor – Ian Pepper), 2003-2004.

James Brooks, University of Arizona, Department of Soil, Water and Environmental Sciences (advisor – Ian Pepper), 2003-2004.

Domenico Santoro, Polytechnic of Bari at Taranto (Italy), Faculty of Environmental Engineering (external examiner and collaborator; advisor – Lorenzo Liberti), 2004-2005.

Post-Doctoral Scholars Advised

Vinod Tare (PhD – IIT Kanpur) – 1985-87

Timothy Bartrand (PhD – Drexel Univ.) – 2007-8

Sharon Nappier (PhD – Johns Hopkins) – 2008 – 2009

Toru Watanabe (Japan Society for Promotion of Science sponsored; PhD Tohoku Univ.) – 2008-2009

Sondra Teske (PhD – Univ. of Arizona) – 2009 –2012

Michael Ryan (PhD – Drexel University) – 2013--2014

Professional Activities

Editorial Boards

Founding Editor in Chief - Quantitative Microbiology (Kluwer), 1998-2001

Applied and Environmental Microbiology (Editorial Board, 1988-1994)

Water Environment Research (Board of Editorial Review, 1989-1995; Chair 1991-1995)

Ozone Science & Engineering (Editorial Board, 1999 - 2001)

Journal of Medical Risk (Editorial Board, 2003-)

Risk Analysis (Associate Editor – Microbial Risk, 2006-)

Panels and Seminars Chaired

Organized and Chaired a Seminar on "Mode of Action of Halogen Disinfectants Used in Water and Wastewater Treatment" at the Annual Meeting of the American Society for Microbiology, Dallas, March, 1981.

Organized and Chaired a Session on "Disinfection and Chemical Oxidation" at the Annual Meeting of the American Institute of Chemical Engineers, New Orleans, November, 1981.

Organized and Chaired a Session on "Potpourri: Industrial and Toxic Wastes" at the National Meeting of the American Institute of Chemical Engineers, Cleveland, August, 1982.

Organized and Co-Chaired a Session on "Recovery of Metal Values From Industrial Wastes" at the National Meeting of the American Institute of Chemical Engineers, Denver, August 1983.

Invited Chairman on "Disinfection of Wastewater Effluents" NSF State of the Art Conference on Disinfection of Wastewater Effluents and Sludges, Miami, May 1984.

Organized and Chaired a Preconference Workshop on "Alternative Wastewater Disinfection Processes: Design and Operation", WPCF, Los Angeles, October 1986.

Organized and Chaired a Preconference Workshop on "Emerging Issues in Effluent Disinfection", WPCF Preconference Workshop, Philadelphia, October 1987.

Co-Organized and Co-Chaired a Preconference Seminar on "Practical Experience with Ozone for Organics Control and Disinfection", AWWA, Cincinnati, June 1990.

Co-Organized and Co-Chaired a Preconference Seminar on "Water Quality Changes from Chloramination", AWWA, Philadelphia, June 1991.

Co-Organized and Co-Chaired a Preconference Seminar on "Meeting Disinfection Byproducts Standards", AWWA, Vancouver, June 1992.

Organized opening general session, "When is Wastewater Disinfection Necessary?" at WEF Specialty Conference on Wastewater Disinfection, Whippany NJ, May 1993.

Co-Organized Preconference Seminars on "Disinfection: The New Basics" and "When is Groundwater Disinfection Necessary", AWWA, June 1993, San Antonio.

Co-Organized Symposium on "Microbial Risk Assessment in Water and Food" at the Annual Conference, Society for Risk Analysis, Savannah GA, December 1993.

Organized a Workshop on Microbial Risk Assessment of Food, Society for Risk Analysis, Washington DC, December 1997.

Co-Organized Disinfection Specialty Conference, Water Environment Federation, Baltimore MD, April 19-22, 1998.

Program Committee, AWWA/IWSA Conference "Protecting Water Quality in the Distribution System: What is the Role of Disinfectant Residual", Philadelphia, April 26-28, 1998.

Organized NSF supported expert workshop on Advancing the Quality of Water (AQWA), Chapel Hill NC, March 10-12, 2004.

Co-Organized WEF/AWWA/IWA Disinfection Specialty Conference, Pittsburgh PA, February 4-7, 2007

Professional Society Activities

American Society of Civil Engineers,
 Environmental Engineering Division.
 Member, Task Committee on Disinfection Risk Assessment 1981-1985.
 Water Supply and Resource Management Committee
 Chairman, Task Committee on Control of Microbes in Drinking Water, 1989-90
 Member, Executive Committee, Department Heads Council (2011-)

American Water Works Association
 Member, Research Division Committee on Disinfection, 1980-1992.
 Member, Water Quality Division Committee on Disinfection, 1982-present.; Chairman, 1989-1994
 Member, Water Quality Division Committee on Organisms in Water, 1983-1987.
 Member, Water Quality Division Committee on Status of Waterborne Diseases in the US and Canada, 1987-1995
 Member, Student Activities Committee, 1984-1990.
 Illinois Section Student Activities Committee, Member, 1981-1990; Chairman, 1983-1986.

American Water Works Association Research Foundation (AWWARF)
 member, various project advisory committees (1993-current)

Association of Environmental Engineering and Science Professors
 Chairman, Committee to revise recruitment brochure, 1981-1983.
 Member, Board of Directors, 2001-2004
 Treasurer and Member of the Executive Committee, 2002-2004
 Chairman, Conference Planning Committee, 2003-present

International Water Association

USA National Committee

delegate (from ASM) 1988-2000.

Chairman 1994 - 2000

Chairman, USANC Membership Committee, 1991-1993.

Program Committee for 1998 (Vancouver), 2000 (Paris), 2001 (Berlin) and 2002 (Melbourne) Conferences, 1996-2001.

Water Environment Federation

Director-at-Large, 2004-2006.

Member, Research Committee, 1978-1982.

Member, Research Committee Task Force on Toxic Substances, 1980-1982.

Member, Committee on Disinfection, 1980-1988, 1991-present.

Vice-Chairman, 1982-1985.

Chairman, 1985-1988.

Member, Research Symposium Subcommittee of the Program Committee, 1984-1986.

Member, Illinois Association Student Activities Committee, 1981-1990.

Member, Technical Practices Committee Task Force on Disinfection, 1982-1985.

Chairman, Specialty Conference Planning Committee: Microbial Aspects of Surface Water Quality, 1988-1989.

Member, Board of Editorial Review for the Research Journal, 1989-1995.

Chairman, 1992-1995.

Co-Chairman, Third Specialty Conference on Disinfection (Baltimore, April 1998)

Water Environment Federation Research Foundation

member, Project Subcommittee (UV Disinfection) - Sept 1996-1998

member, Project Subcommittee (Water Reuse) - Oct. 1997-2001

member, Board of Directors – 2006-2009

Standard Methods for the Examination of Water and Wastewater

Chairman, Joint Task Group on Chlorine Residual, 1984-1992.

Member, Joint Task Group on Chlorine Demand, 1988-1994.

Society for Risk Analysis, Councilor (member, Board of Directors), 2000–2003

American Association for the Advancement of Science, Division Y (General Interest)

Electorate Nominating Committee (2002-2005).

Chair-Elect (2008-9)

Chair (2009-2010)

American Society for Microbiology

Public and Scientific Affairs Board, Committee on Environmental Microbiology, Member (2003-2010)

Continuing Education Programs

Seminar on Current Topics in Water Supply, New York State Section of the American Water Works Association, Ossining, NY, November, 1980.

Limiting Liability for Hazardous Wastes, a continuing education program for lawyers, sponsored by the Chicago-Kent College of Law, Chicago, November, 1981, was also a member of the program Steering Committee.

WPCF Preconference Workshop on Wastewater Disinfection Alternatives, Atlanta, October 1983, Co-organizer and participant.

University of Wisconsin-Milwaukee, Engineering Extension. Disinfection of Water and Wastewater, May 1984.

WPCF Preconference Workshop on Disinfection Risk Assessment, New Orleans, September 1984, Co-organizer and participant.

University of Wisconsin-Milwaukee, Engineering Extension. Disinfection of Wastewater, May 1985.

University of Wisconsin-Milwaukee, Engineering Extension. Wastewater Pretreatment and Toxicity Control, March, 1986.

University of Wisconsin-Milwaukee, Engineering Extension. Disinfection of Water, June 1986.

WPCF Preconference Workshop on Design and Operation of Alternative Disinfection Systems, Los Angeles, October, 1986, Organizer and participant.

WPCF Preconference Workshop on Emerging Issues in Effluent Disinfection. Philadelphia, October, 1987, Organizer and participant.

WPCF Specialty Conference on Microbial Aspects of Surface Water Quality, Chicago, May 1989, Organizer.
WPCF Preconference Workshop on Changing Standards for Effluent Disinfection, San Francisco, October 1989.
California Business Law Institute, Environmental Regulation in Illinois, participant, November 1989.
University of Wisconsin-Madison, Engineering Extension. Disinfection of Wastewater, October 1989, October 1990.
University of Wisconsin-Madison, Engineering Extension. Disinfection of Water, November 1989.
International Association of Milk, Food and Environmental Sanitarians, Co-Organized Workshop on Microbial Risk Assessment of Foods, Pittsburgh, July 1995.
WEF Specialty Conference on Disinfection, Baltimore MD, April 1998, co-organized.
AWWA/IWSA Symposium on Disinfection Residuals, Philadelphia PA, April 1998, member - planning committee.

University Service

Rensselaer Polytechnic Institute

RPI Department of Chemical and Environmental Engineering Committee on Graduate Students, Member, 1978-1981.
Planning Committee for the UPS Conference, RPI Fresh Water Institute, 1979.
Member, RPI Biohazard Safety Committee, 1979-1981.
Advised RPI Safety Manager on Chemical Waste Disposal Practices, 1980-1981.

Illinois Institute of Technology

Member, IIT Graduate Study Committee, 1981-90.
Chairman, Departmental Faculty Search Committee, 1982-1984, 1987, 1990.
Member, Armour College Committee on Promotion and Tenure, 1984-1986.
Member, Institute Library Planning Committee, 1983-88.
IIT Faculty Senate, Recording Secretary, 1984-1986.
Corresponding Secretary, 1987-1988.
Member, New Business Committee, and IIT Projects Manager, Center for Hazardous Waste Management, 1987-89.
Member, Search Committee for Dean of Armour College of Engineering, 1987-1988.
Member, Department Chairman Search Committee, 1988-9.
Member, IIT Faculty Council, 1989-90
Chairman, Academic Affairs Committee, 1989-90

Drexel University

University

Faculty Senate

Member 1991-1992, 1994-1997
Vice Chair, 1994-1995
Chair, 1995-1996

Member, University Appeals Committee, 1991-94, 2013-2016
Member, Search Committee for Associate Director of Enrollment Management (Graduate/Part Time), 1992
Chairman, University Biosafety Committee, 1996-1998.
University Assessment Committee (preparation for Middle States visit), 1998-2001
Member
Co-chair, Research & Graduate Task Force
Chairman, Search Committee for a Director of SESEP, 2000-2002
Member, Law School Development Committee, 2004-5.
Co-Director, Drexel Engineering Cities Initiative (DECI), 2008-2010
Member, Vice Provost for Research Search Committee, 2009-10
Member, Academic Excellence Award Committee, 2009-10
Member, Dean of Public Health Search Committee, 2012-2013

College/School

Chairman, BS Environ. Eng. Curriculum Development Committee, 1993.
Chairman, Environmental Policy Faculty Search Committee, 1997.
Member, The Drexel Engineering Curriculum Revision Committee, 2005-2007.

Department

Chairman, Environmental Studies Institute Curriculum Committee, 1991-1994
Chairman, Civil and Architectural Engineering Department Graduate Committee, 1991-1992
Member, Civil and Architectural Engineering Department Committee on Laboratory Renovation, 1993-4.
Member, Search Committee, Architectural Engineering Faculty, 1993-1994.
Member, Search Committee, Environmental Engineering Faculty, 1996.
Member, Search Committee, Environmental Chemistry Faculty, 1993-1994, 1996
Chairman, SESEP Faculty Search Committee, 1997-1998.
Chairman, SESEP Curriculum Committee, 1999-2002
Chairman, ABET Preparation for Initial BS EnvE Accreditation, 1999-2002
Chair, Midterm Review Committees for Assistant Professors Lordgooei and Wartman, 2002.
Member, Departmental Promotion Committee for Associate Professor Welty, 2002.
Member, Department Head Search Committee, 2002-2003.
Member, CAEE Department Undergraduate Curriculum Committee, 2002-2005
Member CAEE Department Graduate Committee, 2003-2005
Chair, CAEE Department Faculty Search Committee, 2003-2004

Consulting Activities

Energy & Resource Recovery Corporation (Subsidiary of Alpha Portland Industries)--performed a regulatory analysis and preliminary feasibility study for the use of hazardous wastes and spent solvents as supplemental fuel in cement kilns, 1979.

New York State Department of Civil Service - served as a member of oral examination panels for the positions of Associate Sanitary Engineer and Associate Air Pollution Control Engineer, March through May, 1981.

Patterson Associates, Inc.
--preparation of a state-of-the-art report on hazardous wastes in Illinois, Illinois Institute of Natural Resources, May through October, 1981.
--determination of hazardous waste production potential and management options for the forging industry, June through October, 1981.
--analysis of a the waste management profile for a large, privately held, conglomerate, November, 1986.

K.A. Steel Chemicals, Inc. --preparation of a technical document and testimony against the proposed changes in the Illinois wastewater fecal coliform standards, October 1981 through February, 1982.

PEER Consultants, Inc. -- reviewed draft US EPA report entitled "User Guide for Evaluating Remedial Action Technologies." August, 1982.

Waste Management, Inc. --Prepared testimony on the need for additional hazardous waste disposal capacity in Will County, Illinois, October, 1982.

Katz, Friedman, Schur and Eagle/United Auto Workers-- evaluation of technical documents relating to environmental impact of cooling water discharge at Quad Cities/Cordova Generating Station, June 1983-ongoing.

Bituminous Insurance Companies--evaluation of possible mechanisms for failure of the Galesburg, IL anaerobic digester, November 1984-1985.

Metropolitan Sanitary District of Greater Chicago--preparation of oral and written civil service examination materials and service on oral examination panels, 1981-1990.

Battelle Columbus Laboratories -- peer review of a document on feasibility of risk assessment for sludge management. August, 1985.

Hydrite Chemical Co.--Preparation of expert testimony on changes in wastewater bacteriological standards in the State of Wisconsin, December 1985 - March, 1986.

US EPA (Region VIII) -- Advised on the efficiency of and the means to improve disinfection and dechlorination at the Metro Denver Wastewater Treatment Plant, March 1986.

East Bay Municipal Utility District (Oakland, CA) -- Serve as a technical advisor on the design of an innovative stormwater overflow disinfection system, August 1986-April 1987.

E & E Hauling, Inc. -- Advised on environmental impact of an asphalt hot melting facility, January 1987.

Confidential client -- Advised on the feasibility of a proposal for a new solid waste disposal facility, March, 1987.

Peat Marwick Main, Inc. -- Preparation of examination questions for wastewater treatment plant operational personnel, November, 1987.

Metropolitan Waste Systems, Inc.
 -- Preparation of testimony on need for solid waste disposal capacity in La Salle County, IL, March - May, 1988, January-May, 1989.
 -- Assessment of need for a solid waste transfer station in Blue Island, IL. January 1989.

Madison (WI) Metropolitan Sanitary District -- Review of Petition for Disinfection Waiver and presentation of supporting testimony, August, 1988-February, 1989.

US EPA (Region IX)/US Department of Justice -- Expert witness regarding removal of pathogens and trace pollutants by secondary treatment processes (US and California vs. City of San Diego), October 1989 - February 1991.

James M. Montgomery Engineers -- Statistical evaluation of disinfection byproduct data, February 1990 - September 1990.

Land and Lakes Co. -- Assessment of need for additional solid waste disposal capacity in Will County, IL. December 1989 - November 1990.

Chlorine Institute -- preparation of review on chlorine fate in freshwater systems as part of FIFRA reregistration application, July-August, 1990.

Wade Miller and Associates, Inc., Cadmus Inc. -- Provided input and assistance in development of disinfection byproduct regulatory analysis in drinking water, July 1991 - 1998.

City of Philadelphia - Department of Personnel -- Served on Oral Examination Panel for Water Treatment Engineer, March 1993.

Miller, Cassidy LaRocca and Lewin; Carr Goodson and Lee; Elzufon Austin and Drexler - Expert witness on chlorination practices in water treatment (Hoechst Celanese et al. v. National Union et al.; Delaware Chancery Court), 1991-1994.

Montgomery Watson Engineers - Technical Advisory Panel Member, Multiclient Study on Disinfection of *Cryptosporidium* in Drinking Water, 1995-1999.

Carollo Engineers - Microbial Criteria Development for a Water Treatment Plant, including consideration of recycle streams and *Cryptosporidium*, 1996-1997.

Procter and Gamble Co.-Evaluate Beneficial Effects of Anti-Microbial Preparations, 1997-1999.

Procter and Gamble Co.-Analyze Kinetics of Algal Growth on Inhibitory Substrates, 1998-1999.

Holland & Knight - provide expert report and testimony regarding water and wastewater treatment (US and State of Maryland vs. Mayor and City Council of Baltimore), 1998-1999.

US Department of Justice - provide expert analysis on impact of sewage discharges on water quality (US vs. Penn Hills), 1998.

CDM, Inc. and Massachusetts Water Resources Authority - advise on novel integration approaches to evaluating disinfection "ct" values, 1998.

Foley, Hoag and Eliot (counsel for Massachusetts Water Resources Authority) -- expert in defense (US vs. Mass. Water Resources Authority) regarding necessity for filtration, 1999-2000.

Black and Veatch - Technical review and resource panel, Las Vegas Alternative Discharge Study, 2000.

McDermott, Will & Emery and Bayer Agricultural - Assistance with comments on proposed FDA withdrawal of use of fluoroquinolones in poultry rearing, 2001-2003.

Linowes And Blocher/Holland and Knight - Assistance with permit issues on limestone mining (potential groundwater impacts) in Miami-Dade, Florida, 2001-2004.

Alston and Bird - Provide expert support in administrative proceeding on behalf of Gwinnett County GA regarding defense against petition to deny effluent discharge permit modifications. (Lake Lanier Association et al. v. Georgia Environmental Protection Division). 2001-2002.

US Department of Justice - provide expert analysis on impact of microbial water quality on worker risks (John G. Abbott et al. vs. U.S.). 2002-2004.

Foley, Hoag and Eliot (counsel to Portland Water Bureau) – advise on regulatory issues relating to the Long Term 2 Enhanced Surface Water Treatment Rule, 2006.

Metropolitan Water Reclamation District of Greater Chicago (via CTE Engineers) – provide assistance with respect to regulatory proceedings on surface water quality and disinfection criteria, 2007-.

Hurvitz & Waldman – provide expert support in defense of litigation involving *Legionella* and drinking water, 2008-11.

US Department of Justice – provide expert analysis in criminal enforcement case under the Clean Water Act, 2011-2012

CDM, Inc. – Provide technical assistance regarding compliance with *Cryptosporidium* standards in Portland, OR, 2011-2012

Membership in Advisory Bodies

General

External Thesis Examiner, Indian Institute of Technology, Kanpur, 1979, 1981, 1983, 1993, 1996.
Chaired peer review panel to review the research program on "Microbial Degradation in Distribution Systems" for US EPA, June 1983.
Member, State of Illinois Hazardous Waste Task Force, 1983-4.
Member, US EPA peer review panel to review work on microbial inactivation in drinking water disinfection, March 1986.
Member, US EPA peer review panel to review program on risk assessment from microorganisms in wastewater sludges, April 1986.
Invited ad hoc reviewer for the Drinking Water Subcommittee, US EPA Science Advisory Board, June 1987.
Assisted in preparation of resource document on wastewater disinfection, US EPA, 1988.
Member, peer review panel, Oklahoma Council on Science and Technology, 1989.
Member, study section, National Institute of Environmental Health Sciences, 1991, 1994.
Invited Participant, Workshop on the Methodology for Deriving National Ambient Water Quality Criteria for the Protection of Human Health, US EPA -- Office of Science and Technology, September 1992.
Member, City of Philadelphia, Department of Health, Advisory Committee on Cryptosporidium, October 1995-1999.
Invited Participant, Consultation on "Harmonised Risk Assessment for Water-Related Microbiological Hazards", World Health Organization, Stockholm, Sweden, September 12-16, 1999.
Invited Participant, World Health Organization and Food and Agricultural Organization, joint workshop on "Hazard Characterization of Pathogens in Food and Water", Bilthoven, The Netherlands, June 13-18, 2000.
Honors examiner, Swarthmore College, May 2001.
Member, US EPA Board of Scientific Counselors Executive Committee, 2007-2012.

National Academies

Member, Panel on Augmentation of Potable Water Supplies with Reclaimed Water, National Academy of Sciences, Water Science and Technology Board, 1996-1998.
Invited Participant, Workshop on Microbial Risk Assessment, hosted by NAS Committee to Review New York City Watershed Management Strategy, April 1998.
Member, Committee to Review New York City Watershed Management Strategy, National Academy of Science, Water Science and Technology Board, 1998-99.
Member, Oversight Steering Committee and Statistics Panel, EPA-George Washington University Cooperative Agreement on Risk Assessment, 1999-.
Member, Committee on Drinking Water Contaminants, National Research Council Water Science and Technology Board, 1999-2001.
Member, Committee on Toxicants and Pathogens in Biosolid Fertilizers, National Research Council, Board on Environmental Studies and Toxicology, 2001-2002.
Member, review team for the Environmental Pollution Control MS Program, Pennsylvania State University, March 2001.
Member, Committee on Indicators for Waterborne Pathogens, National Research Council, Board on Life Sciences, 2002-2003
Member, Panel to Review EPA Research Plan on Water Security, National Research Council, Water Science and Technology Board, 2003-.2004
Member, Committee on Standards and Policies for Decontaminating Public Facilities Affected by Exposure to Harmful Biological Agents: How Clean is Safe? National Research Council, Board on Life Sciences, 2003-2005.
Member and Vice Chair, Committee on Public Water Distribution Systems: Assessing and Reducing Risks. National Research Council, Water Science and Technology Board, 2004-2006.
Member, Water Science and Technology Board (WSTB), National Research Council, 2004-2010.
Member, Committee on Water System Security, National Research Council, Water Science and Technology Board, 2004-2006.
Member, National Research Council Committee on Assessment of Water Reuse as an Approach for Meeting Future Water Supply Needs, 2008-2011.

Chair, National Research Council Committee on Evaluation of the Health and Safety Risk Analyses for the Planned Expansion of USAMRIID's Biosafety Level 3 and 4 Laboratories at Fort Detrick, Maryland, 2009-2010.

Member, US EPA Science Advisory Board Augmented Committee on Ecosystem Services and Processes to Provide Advice on Ballast Water Management, 2010-1.

Chair, National Research Council Committee on Assistance to the U.S. Army Medical Research and Materiel Command with Preparation of a Risk Assessment for the Medical Countermeasures Test and Evaluation (MCMT&E) Facility at Fort Detrick, MD, 2011

Member, National Research Council Committee on Risks and Benefits of Gain of Function Research, 2014-2016.

Member, National Academies Committee on Microbiomes of the Built Environment: From Research to Application, 2016-2017

Member, National Academies Committee on Strategies for Identifying and Addressing Biodefense Vulnerabilities Posed by Synthetic Biology, 2017-2018.

Member, National Academies Committee on Management of *Legionella* in Water Systems, 2018-19.

April 15 2018