

PETER SHANAHAN

EDUCATION

1982	Ph.D.	Environmental Engineering	Massachusetts Institute of Technology
1974	M.S.	Environmental Earth Sciences	Stanford University
1973	B.S.	Civil Engineering	Massachusetts Institute of Technology
1973	B.S.	Earth and Planetary Sciences	Massachusetts Institute of Technology

PROFESSIONAL HISTORY

1988-date	HydroAnalysis, Inc.
2004	Tufts University
1996-date	Massachusetts Institute of Technology
1981-1988	ERT, Inc. (now ENSR Corporation)
1980	International Institute for Applied Systems Analysis, Laxenburg, Austria
1978-1981	Massachusetts Institute of Technology
1976-1979	Resource Analysis/Camp Dresser & McKee Inc.
1974-1976	Bechtel, Inc.

AFFILIATIONS

Fellow, American Society of Civil Engineers (Committee on Hydrologic Transport and Dispersion, Chairman 1989-1990)

International Water Association (Task Group on River Water Quality Modeling, 1996-2002; Specialist Group on Systems Analysis and Integrated Assessment, 2000-present)

Water Environment Federation (Committee on Research, 1986-1992)

Association of Ground Water Scientists and Engineers (Editorial Board, Journal of Ground Water, 1990-1992)

American Geophysical Union

American Water Resources Association

American Society for Limnology and Oceanography

North American Lake Management Society

Conservation Commission, Acton, Massachusetts, 1990-1996

REGISTRATION

Professional Engineer (Civil), Massachusetts
Professional Engineer, Maine

REPRESENTATIVE EXPERIENCE

Dr. Shanahan has directed or been a major contributor to a wide variety of projects involving analysis and computer modeling of environmental water quality, hydrology, and hydraulics. These studies have included engineering analysis and design of water-pollution controls, hazardous waste site remedial actions, flooding and drainage controls, and water-resources development. Dr. Shanahan is an experienced expert witness and has represented clients in courtroom testimony, administrative hearings, negotiations with regulatory agencies, and public meetings. Dr. Shanahan is currently a Senior Lecturer in the Department of Civil and Environmental Engineering at the Massachusetts Institute of Technology, teaching undergraduate and graduate classes and serving as co-leader of the Master of Engineering Program project course.

Ground-Water Hydrology

Dr. Shanahan's experience includes a wide variety of projects involving the assessment and modeling of ground-water hydrology and quality, as well as using models to design remediation measures for contaminated ground water. Example projects include:

Reilly Tar & Chemical Superfund Site, St. Louis Park, Minnesota	Modeled ground-water flow in multiple aquifers affected by coal-tar compounds; developed model for design of gradient and source control wells.
Burkeville, Alabama	Modeled the hydrologic impacts of planned industrial supply well
Baltimore, Maryland	Modified USGS MOC ground-water contaminant transport model to assess DNAPL transport from manufactured gas plant site
Brainerd, Minnesota	Modeled contaminant transport to design ground-water remedy at Superfund site
More than twenty Massachusetts municipalities	Employed ground-water flow models to delineate Massachusetts aquifer protection Zone II

Dr. Shanahan also authored the section on modeling inactive hazardous waste sites in the Handbook on Manufactured Gas Plant Sites published by the Edison Electric Institute.

Hazardous Waste Site Consultation

Dr. Shanahan has served as a consultant on the investigation, remediation, and regulation of Superfund, RCRA, and other hazardous waste sites. Typical assignments include critical review of RI/FS documents, technical evaluation of hydrogeologic and modeling studies, and oversight of technical contractors. Representative past projects include:

Low-Level Radioactive Waste Site, Clark County, Illinois	Served as principal hydrologist for site characterization
Stringfellow Acid Pits, California	Provided consultation to attorney for one of the named site generators
Wells G&H, Woburn, Massachusetts	Managed ground-water remediation task for site Remedial Design/Remedial Action program
Slatersville and Forestdale Reservoirs, Rhode Island	Evaluated potential impact of Superfund sites on proposed water-supply development
Koppers Superfund Site, Galesburg, Illinois	Managed ground-water remediation task for site Remedial Design/Remedial Action program
Reilly Tar & Chemical, Indiana	Developed and negotiated RI/FS work plan

In other project assignments, Dr. Shanahan has assisted industrial groups and trade associations in critically reviewing and submitting comments to government agencies on proposed regulations governing Natural Resource Damage Assessments under CERCLA and Hazardous Waste Characterization under RCRA.

Water Quality

Dr. Shanahan's water-quality experience includes academic research to develop modeling approaches and engineering experience analyzing information and using models in practical applications. Project experience includes a wide range of contaminants in rivers, lakes, and coastal environments. Representative examples include:

Lake Balaton, Hungary	Eutrophication model development
Mississippi River, Mississippi	Model of dissolved solids plume
Wateree River, South Carolina	Permit application for paper mill discharge
Conowingo Reservoir, Pennsylvania	Model of power plant thermal plume
Fishkill Creek, New York	Permit application for industrial discharge
East Machias River, Maine	Model of fish hatchery discharge
Westfield River, Massachusetts	Model of paper mill discharge
Ohio River, West Virginia	Model of phenol and ammonia plume
Strait of Malacca, Indonesia	Analysis of LNG plant thermal discharge
Fort Point Channel, Boston, Massachusetts	Model of cooling water discharge
Lake Galena, Pennsylvania	Model of lake eutrophication
Lake North Anna, Virginia	Model of cooling lake
Snake River, Idaho and Washington	Model of temperature and dissolved oxygen
Worcester, Massachusetts	Model of nonpoint source pollution and runoff

Dr. Shanahan has also served as a consultant to the U.S. Environmental Protection Agency, and the American Petroleum Institute advising on technical procedures for wasteload allocation.

Hydrology and Hydraulics

Dr. Shanahan has completed technical analyses and developed and applied models to a wide variety of hydrologic and hydraulic problems. Past projects include:

Cumberland River, Kentucky and Tennessee	Developed computer code to model rainfall runoff, reservoir operation, and flood flow
Oahe Dam, South Dakota	Modeled hydropower plant hydraulic transients
Fitchburg, Massachusetts	Developed stormwater management model for combined sewer system
Henrico County, Virginia	Managed comprehensive drainage and flooding model development project
Lake Balaton, Hungary	Developed model of wind-driven circulation
Development sites in Massachusetts	Applied the SCS TR-20 model for stormwater analysis and design
Nuclear waste repository, Texas	Served as principal investigator for water resources site study

Dr. Shanahan is also a co-author of the U.S. Army Corps of Engineers generalized model for hydraulic transients in hydropower systems, WHAMO (Water Hammer and Mass Oscillation).

Expert Testimony and Agency Negotiation

Dr. Shanahan has represented clients in agency negotiations, courtroom testimony, public meetings, and other forums on a variety of technical issues associated with hazardous waste, ground water, and surface water. Dr. Shanahan has provided expert testimony in the following:

Re: Request of Citizens to Preserve Santee-Cooper for an Adjudicatory Hearing (South Carolina DHEC) – adjudicatory hearing testimony on surface water quality modeling supporting NPDES permit application

Walter Cairns v. J. Winston Fowlkes and Gerald H. Abrams (Mass., Middlesex County) – trial testimony on flooding of property

Re: Application of Birchwood Realty to operate a sanitary landfill (Rhode Island Department of Environmental Management) – adjudicatory hearing testimony on potential ground-water impacts of proposed landfill

In the Matter of The Safety and Suitability of the Martinsville Alternative Site (before the Illinois Low-Level Radioactive Waste Disposal Facility Siting Commission) – hearing testimony on hydrology of a proposed waste disposal site

Philadelphia Electric Company *et al.* v. Commonwealth of Pennsylvania Department of Environmental Management (Pennsylvania Environmental Hearing Board) – adjudicatory hearing testimony on lake eutrophication modeling

United States of America *et al.* v. Reilly Tar & Chemical *et al.* (D. Minn.) – deposition testimony on ground-water modeling

Aydin Corporation v. American Empire Insurance Co. *et al.* (Calif., San Francisco County) - deposition and trial testimony on ground-water contaminant transport

William R. Langdon and Charles D. Train v. Dover Board of Health (Mass., Middlesex County) - deposition testimony on ground-water quality issues associated with on-site septic systems

E.I. DuPont de Nemours and Company v. Admiral Insurance Company *et al.* (Del., New Castle County) - deposition testimony on surface-water flooding and ground-water contamination

Insurance Company of North America v. Kayser-Roth Corporation *et al.* (Rhode Island) – trial testimony on ground-water flow and contaminant transport

Rohm & Haas Company v. AIU Insurance Company *et al.* (New Jersey) – trial testimony on ground-water contaminant transport

Trans World Airlines v. Associated Aviation Underwriters *et al.* (Mo., St. Louis) – trial testimony on ground-water contamination

In the matter of Worcester School Department (before the Massachusetts Department of Environmental Protection) – adjudicatory hearing testimony concerning storm water quantity and quality

Patricia A. Collins and Tara Marie Sullivan v. Town of Dover (Norfolk County Superior Court, Massachusetts, Civil Action No. 99-1161) – trial testimony on surface-water flooding

Dr. Shanahan has also provided deposition testimony regarding ground-water contamination and transport in the following:

United States Aviex Company v. Travelers Insurance Company (W. D. Mich.)

State of Michigan v. Agra Land, Inc. *et al.* (Mich., Ingham County)

Union Carbide Corporation v. Aetna Casualty & Surety Company *et al.* (NJ, Essex County)

The Cessna Aircraft Company v. Hartford Accident and Indemnity Company *et al.* (D. Kansas)

Aluminum Company of America v. Accident and Casualty Insurance Company *et al.* (Wash., King County)

Stapan Company v. Admiral Insurance Company *et al.* (Illinois, Cook County)

Weyerhaeuser Company v. Commercial Union Insurance Co. (Wash., King County)

Nashua Corporation v. American Home Assurance Company *et al.* (Mass., Suffolk County)

Pfizer, Inc. v. Employers Insurance of Wausau *et al.* (New Jersey, Middlesex County)

Dr. Shanahan has also assisted in numerous permit and regulatory negotiations, including a major role in constructing the settlement and associated remedial action plan for the Reilly Tar & Chemical Superfund Site in St. Louis Park, Minnesota.

PUBLICATIONS

- Shanahan, P., "A Groundwater Model Used to Sense Subsurface Geology in an Alluvial Basin near Tombstone, Arizona," M.S. Report, Department of Applied Earth Sciences, Stanford University, Stanford, California, June 1974.
- Harleman, D.R.F., E. E. Adams and P. Shanahan, "Field Verification of a Stratified Cooling Pond Model," Proceedings of the VXIII Congress, International Association for Hydraulic Research, Cagliari, Italy, Volume 4, pages 309-316, September 1979.
- Shanahan, P. and B. M. Harley, "Graphics for Hydraulics Transients Simulation," Proceedings of the Second Conference on Computers in Civil Engineering, American Society of Civil Engineers, Baltimore, Maryland, pages 27-36, June 1980.
- Harleman, D.R.F. and P. Shanahan, "Aspects of Wind-Driven Circulation and Mixing in Eutrophication Studies of Lake Balaton," Proceedings of the Second Joint MTA/IIASA Task Force Meeting on Lake Balaton Modeling, Hungarian Academy of Sciences, Veszprém, Hungary, Volume 1, pages 50-66, August 27-30, 1979.
- Shanahan, P., D.R.F. Harleman and L. Somlyódy, "Modeling Wind-Driven Circulation in Lake Balaton," Collaborative Paper 81-7, International Institute for Applied Systems Analysis, Laxenburg, Austria, February 1981.
- Shanahan, P. and D.R.F. Harleman, Discussion of "Cells-in-Series Simulation of Riverine Transport" by H.G. Stefan and C. Demetracopoulos, *ASCE Journal of the Hydraulics Division*, Volume 108, Number HY5, pages 731-734, May 1982.
- Shanahan, P. and D.R.F. Harleman, "Linked Hydrodynamic and Biogeochemical Models of Water Quality in Shallow Lakes," Report Number 268, Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, 279 pages, March 1982.
- Shanahan, P. and D.R.F. Harleman, "Users Manual for the M.I.T. Lake Circulation Models (MITLAKE)," Technical Report 285, Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, 47 pages, June 1982.
- Somlyódy, L., editor, "Eutrophication of Shallow Lakes: Modeling and Management, The Lake Balaton Case Study," Proceedings of a Workshop Organized by the Hungarian Academy of Sciences, the International Institute for Applied Systems Analysis, the Hungarian National Water Authority and the Hungarian Committee for Applied Systems Analysis, 29 August-3 September 1982, Veszprém, Hungary, Collaborative Paper 83-S3, International Institute for Applied Systems Analysis, Laxenburg, Austria, 1983.
- Harleman, D.R.F. and P. Shanahan, "Hydrodynamic and Mass Transport Aspects of the Lake Balaton Models"
- van Straten, G., P. Shanahan and L. Somlyódy, "State-of-the-Art Discussion on Eutrophication Modeling: Summary and Conclusions"
- Shanahan, P. and D.R.F. Harleman, "Transport in Lake Water Quality Modeling," *ASCE Journal of Environmental Engineering*, Volume 110, Number EE1, pages 42-57, February 1984.
- Shanahan P. and D.R.F. Harleman, "A Linked Hydrodynamic and Biogeochemical Model of Eutrophication in Lake Balaton," in *Analysis of Ecological Systems: State-of-the-Art in Ecological Modeling*, edited by W.K. Lauenroth, G.V. Skogerboe and M. Flug, Proceedings of Symposium held from 24 to 28 May, 1982, Fort Collins, Colorado, Sponsored by the International Society for Ecological Modelling, Elsevier Publishing Company, pages 837-843, 1983.
- Shanahan, P., "Water Temperature Modeling: A Practical Guide," Proceedings of the Stormwater and Water Quality Model Users Group Meeting, April 12-13, 1984, Detroit, Michigan, U.S. Environmental Protection Agency, Report EPA-600/9-85-003.
- Shanahan, P., "Adaption of the USGS 3-D Ground Water Flow Model for Simplified Mass Transport Analysis," Proceedings of the Eastern Regional Ground Water Conference, July 1984, Newton, Massachusetts. National Water Well Association, Dublin, Ohio, 1984.
- Shanahan, P. and D.R.F. Harleman, Discussion of "Phytoplankton Modeling in the Embayments of Lakes," by J.-T. Kuo and R.V. Thomann, *ASCE Journal of Hydraulic Engineering*, Volume 111, No. 1, pages 113-116, February 1985.

- Somlyódy, L. and G. van Straten, editors, *Modeling and Managing Shallow Lake Eutrophication with Application to Lake Balaton*, Springer-Verlag, 1986. (ISBN 3-540-16227-5)
- Chapter 9, "Wind-Induced Water Motion" by P. Shanahan, D.R.F. Harleman and L. Somlyódy
- Chapter 10, "Lake Eutrophication Model: A Coupled Hydrophysical-Ecological Model" by P. Shanahan and D.R.F. Harleman
- Shanahan, P. and D.P. Galya, "Mixing and Transport" (annual literature review), *Journal Water Pollution Control Federation*, Volume 60, Number 6, pages 933-940, June 1988.
- Cosgrave, T., P. Shanahan, J.C. Craun and M. Haney, "Gradient Control Wells for Aquifer Remediation: A Modeling and Field Case Study," Proceedings of the Solving Ground Water Problems with Models Conference, February 7-9, 1989, Indianapolis, Indiana. The Association of Ground Water Scientists and Engineers, Dublin, Ohio, 1989.
- Shanahan, P. and D.P. Galya, "Mixing and Transport" (annual literature review), *Journal Water Pollution Control Federation*, Volume 61, Number 6, pages 924-931, June 1989.
- Shanahan, P. and S.C. Gaudet, "Mixing and Transport" (annual literature review), *Research Journal of The Water Pollution Control Federation*, Volume 62, Number 4, pages 546-555, June 1990.
- Shanahan, P., "Mixing and Transport" (annual literature review), *Research Journal of The Water Pollution Control Federation*, Volume 63, Number 4, pages 536-543, June 1991.
- Beard, T.C., C.J. Perry, T.C. Fox, T.G. Naymik, and P. Shanahan, "Iterative Approach to Groundwater Flow Modeling of the Martinsville Alternative Site (MAS), under Consideration for Low-Level Radioactive Waste (LLRW) Storage in Clark County, Illinois", *Environmental Geology and Water Sciences*, Volume 18, Number 3, pages 195-207, November 1991.
- Henderson-Sellers, B., editor, *Water Quality Modeling: Volume IV: Applications to Lakes and Reservoirs*, CRC Press, 1991. (ISBN 0-8493-6974-6)
- Chapter 7, "Case Study of Lake Balaton, Hungary" by P. Shanahan, R.A. Luettich, Jr. and D.R.F. Harleman.
- Shanahan, P., "Mixing and Transport" (annual literature review), *Water Environment Research*, Volume 64, Number 4, pages 514-523, June 1992.
- Shanahan, P., "A Water-Quality History of the Blackstone River, Massachusetts, USA: Implications for Central and Eastern European Rivers," *Water Science and Technology*, Volume 30, Number 5, pages 59-68, 1994. (Also published as Working Paper WP-94-31, International Institute for Applied Systems Analysis, Laxenburg, Austria, May 1994.)
- Shanahan, P., and L. Somlyódy, "Modeling the Impacts of Diffuse Pollution on Receiving Water Quality" in V. Novotny, editor, *Nonpoint Pollution and Urban Stormwater Management, Water Quality Management Library, Volume 9*. Technomic Publishing Company, Lancaster, Pennsylvania, 1995. (ISBN 1-56676-305-3) (Also published as Working Paper WP-95-2, International Institute for Applied Systems Analysis, Laxenburg, Austria, January 1995.)
- Shanahan, P., "Ground-Water Remediation and Modeling," in V. Novotny and L. Somlyódy, editors, *Remediation and Management of Degraded River Basins with Emphasis on Central and Eastern Europe*. Springer-Verlag, New York, 1995. (ISBN 3-540-60115-5)
- Shanahan, P., "The Changing Approach to Water-Quality Management in the United States," Working Paper WP-96-62. International Institute for Applied Systems Analysis, Laxenburg, Austria, June 1996.
- Somlyódy, L., and P. Shanahan, "Municipal Wastewater Treatment in Central and Eastern Europe; Present Situation and Cost-Effective Development Strategies." The World Bank, Washington, D.C. 1998. (ISBN 0-8213-4085-9)
- Bonas, A.R., I.D. MacFarlane, P. Shanahan, H.E. Dawson, and L.W. Gelhar. "The use of groundwater modeling to predict DNAPL transport." Poster presented at The First International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California. May 18-21, 1998.
- Shanahan, P., and L. Somlyódy, "Task Group progress on river water quality model." *Water Quality International*, pages 56-57, June 1998.

- Rauch, W., M. Henze, L. Koncsos, P. Reichert, P. Shanahan, L. Somlyódy, and P. Vanrolleghem, "River Water Quality Modelling: I. State of The Art," *Water Science and Technology*, Volume 38, Number 11, pages 237-244, December 15, 1998.
- Shanahan, P., M. Henze, L. Koncsos, W. Rauch, P. Reichert, L. Somlyódy, and P. Vanrolleghem, "River Water Quality Modelling: II. Problems of The Art," *Water Science and Technology*, Volume 38, Number 11, pages 245-252, December 15, 1998.
- Somlyódy, L., M. Henze, L. Koncsos, W. Rauch, P. Reichert, P. Shanahan, and P. Vanrolleghem, "River Water Quality Modelling: III. Future of The Art," *Water Science and Technology*, Volume 38, Number 11, pages 253-260, December 15, 1998.
- Hellweger, F., E. Naranjo, P. Shanahan, K. Fellows, G. Ostroff and P. Anid, "Screening-Level GIS Tools for Modeling Environmental Contamination from Mining Activities," 19th Annual ESRI International User Conference, San Diego, California, July 26-30, 1999. (<http://gis.esri.com/library/userconf/proc99/proceed/papers/pap964/p964.htm>).
- MacFarlane, I.D., J.E. Lige, A.R. Bonas, P.J.S. Colberg, E.J. Bouwer, and P. Shanahan, "Results of an Integrated Laboratory, Field, and Modeling Program to Demonstrate Natural Attenuation in a Low Redox Aquifer Impacted by Hydrocarbon DNAPL," Geological Society of America Annual Meeting, Denver, Colorado, October 25-28, 1999.
- Lehr, J., editor, *Standard Handbook of Environmental Science, Health and Technology*, McGraw-Hill Publishing Company, 2000. (ISBN 0-07-038309-X)
- Chapter 1, Section 5B, "Mixing and Transport of Pollutants in Surface Water" by P. Shanahan and S.C. Gaudet.
- Chapter 24, Section 3, "Sensitive Environmental Systems, Alpine Lakes" by P. Shanahan.
- Shanahan, P., D. Borchardt, M. Henze, W. Rauch, P. Reichert, L. Somlyódy, and P. Vanrolleghem, "River Water Quality Model No. 1: I. Modelling Approach." *Water Science and Technology*. Vol. 43, No. 5, Pp. 1-10, 2001.
- Reichert, P., D. Borchardt, M. Henze, W. Rauch, P. Shanahan, L. Somlyódy, and P. Vanrolleghem, "River Water Quality Model No. 1: II. Biochemical Process Equations." *Water Science and Technology*. Vol. 43, No. 5, Pp. 11-30, 2001.
- Vanrolleghem, P., D. Borchardt, M. Henze, W. Rauch, P. Reichert, P. Shanahan, and L. Somlyódy, "River Water Quality Model No. 1: III. Biochemical Submodel Selection." *Water Science and Technology*. Vol. 43, No. 5, Pp. 31-40, 2001.
- Reichert, P., D. Borchardt, M. Henze, W. Rauch, P. Shanahan, L. Somlyódy, and P. Vanrolleghem, *River Water Quality Model No. 1. Scientific and Technical Report No. 12*. ISBN 1 900222 82 5. IWA Publishing, London, England. 2001.
- Lantagne, D., P. Gschwend, and P. Shanahan, "Point-Of-Use Water Filtration in Rural Haiti: Trihalomethane Production and Factors for Program Success." WEFTEC Latin America 2001, San Juan, Puerto Rico, November 11-14, 2001.
- Shanahan, P., "Modelling advance for river quality." *Water21, Magazine of the International Water Association*. Pp. 38-41. April 2002.
- Oates, P.M., P. Shanahan, and M.F. Polz, "Solar Disinfection (SODIS) for Point-of-Use Water Treatment in Haiti and Simulation of Solar Radiation Global for Global SODIS Assessment." *Water Research*. Vol. 37, No. 1, Pp. 47-54. January 2003.
- Anderson, P.D., V.J. D'Aco, P. Shanahan, S.C. Chapra, M.E. Buzby, V.L. Cunningham, E.P. Hayes, B.M. DuPlessie, F. Mastrocco, N.J. Parke, J.C. Rader, J.H. Samuelian, and B.W. Schwab. "Screening Analysis of Human Pharmaceutical Compounds in U.S. Surface Waters." *Environmental Science & Technology*. Vol. 38, No. 3, Pp. 838-849, February 01, 2004.
- Novotny, Vladimir and Paul Brown, editors. *Cities of the Future: Towards integrated sustainable water and landscape management*. ISBN 1843391368. IWA Publishing, London, England. September 2007.
- "Ground Water and Cities" by Peter Shanahan and Bruce L. Jacobs.
- Bras, R. L., F. Chagnon, E. E. Adams, J. Atkinson, O. Madsen, S. Murcott, U. Shamir, P. Shanahan, and L. Thatcher, 2007. Donald R. F. Harleman: A Life of Excellence and an Excellent Life. *Journal of Hydraulic Engineering, ASCE*. Vol. 133, No. 11, Pg. 1187-1191. November 2007.

- Durant, J.L., B. Jacobs, and P. Shanahan, "Historical Inputs of N-nitrosodimethylamine to the Public Drinking Water Supply in Wilmington, Massachusetts," In: Roger W. Babcock, Jr. and Raymond Walton, editors, *Proceedings of The World Environmental & Water Resources Congress, May 12-16, 2008, Honolulu, Hawaii*. American Society of Civil Engineers, Reston, Virginia.
- Till, J., H. Grogan, L. Hay-Wilson, J. Rocco, A. Rood, B. Jacobs, and P. Shanahan, "Overview of Environmental Transport Models Contained in the Risk Analysis, Communication, Evaluation, and Reduction (RACER) Software Tools at Los Alamos National Laboratory," WM2009: HLW, TRU, LLW/ILW, Mixed, Hazardous Wastes & Environmental Management, March 1-5, 2009, Phoenix, Arizona.
(http://www.x-cd.com/wm/program/View_abstract.cfm?ID=9070)
- Baker, L. A., Editor. 2009. *The Water Environment of Cities*. New York, Springer Science+Business Media, LLC.
- "Groundwater in the Urban Environment" by Peter Shanahan
- "Principles for Managing the Urban Water Environment in the 21st Century" by Larry A. Baker, Peter Shanahan, and Jim Holway.
- Hanson, L.S., R.M. Vogel, P. Kirshen, and P. Shanahan, "Generalized Storage-Reliability-Yield Relationships for Rainwater Harvesting Systems," World Environmental & Water Resources Congress, May 17-21, 2009, Kansas City, Missouri.
- Chua, Lloyd H. C., Peter Shanahan, Edmond Y. M. Lo, Eng Ban Shuy, Janelle Thompson, Cameron C. Dixon, Kathleen B. Kerigan, Jean Pierre Nshimiyimana, Jessica M. Yeager, Li-Jun Lee, and Yu-Ling Por, 2010. Dry Weather Bacteria Monitoring and Variation with Land Use for Kranji Reservoir Catchment, Singapore. 17th Congress of the Asia and Pacific Division of the International Association of Hydraulic Engineering and Research, Auckland, New Zealand, February 21-24, 2010 (accepted).

PRESENTED PAPERS AND LECTURES

- Shanahan, P. and D.R.F. Harleman, "A Linked Hydrodynamic and Biogeochemical Model of Eutrophication in Lake Balaton," presented by P. Shanahan at the 3rd International Conference on State-of-the-Art in Ecological Modeling, Fort Collins, Colorado, May 24, 1982.
- Harleman, D.R.F. and P. Shanahan, "Hydrodynamic and Mass Transport Aspects of the Lake Balaton Models," presented by P. Shanahan at the Workshop on Eutrophication of Shallow Lakes, Hungarian Academy of Sciences, Veszprém, Hungary, August 29, 1982.
- Shanahan, P., "Water Temperature Modeling: A Practical Guide," presented at the Stormwater and Water Quality Model Users Group Meeting, U.S. Environmental Protection Agency, Detroit, Michigan, April 13, 1984.
- Shanahan, P., "Adaption of the USGS 3-D Ground Water Flow Model for Simplified Mass Transport Analysis," presented at the Eastern Regional Ground Water Conference, National Water Well Association, Newton, Massachusetts, July 1984.
- Shanahan, P., "Directions in Superfund Response Actions: Investigation, Treatment Alternatives and Cleanup Standards," lecture at the 1986 Environmental Law Institute, Minnesota Institute for Legal Education, Minneapolis, Minnesota, March 20, 1986.
- Shanahan, P., "Type B Natural Resource Damage Assessment: Overview" and "Surface Water and Geologic Resources," presented at the 1986 Washington Conference on Damages to Natural Resources, The Center for Energy and Environmental Management, Alexandria, Virginia, November 18, 1986.
- Shanahan, P. and R.J. Fine, "Trends in Superfund Response Actions," Paper No. 87-17.2, presented by P. Shanahan at the 80th Annual Meeting and Exhibition, Air Pollution Control Association, New York, New York, June 22, 1987.
- Shanahan, P., "Ground-water Remediation at Coal-Tar Contamination Sites," presented at Seminar on Implications of SARA and RCRA Closure/Continuing Release Provisions on the Iron and Steel Industry, American Iron and Steel Institute, Pittsburgh, Pennsylvania, October 7, 1987.

- Cosgrave, T., P. Shanahan, J.C. Craun and M. Haney, "Gradient Control Wells for Aquifer Remediation: A Modeling and Field Case Study," presented by P. Shanahan at the Solving Ground Water Problems with Models Conference, Indianapolis, Indiana, February 7-9, 1989.
- Shanahan, P., "Drainage: Basic Functions," workshop presented at the Massachusetts Association of Conservation Commissions 1991 Annual Meeting, Worcester, Massachusetts, March 2, 1991.
- Shanahan, P., "Experience in Remediation of Water Quality at U.S. Hazardous Waste Sites," presented at Water Resources Project Advisory Board Meeting, International Institute of Applied Systems Analysis, Laxenburg, Austria, March 30, 1992.
- Shanahan, P., "Ground-Water Models for Analysis of Water-Supply Problems," presented at Computer Symposium, Exhibition & Demonstration, New England Water Works Association, Boxborough, Massachusetts, October 27, 1993.
- Shanahan, P., "Ground-Water Remediation and Modeling," presented at NATO Advanced Research Workshop on Remediation and Management of Degraded River Basins with Emphasis on Central and Eastern Europe, International Institute for Applied Systems Analysis, Vienna, Austria, June 14, 1994.
- Shanahan, P., "A Water-Quality History of the Blackstone River, Massachusetts, USA: Implications for Central and Eastern European Rivers" presented at Water Quality International '94, Seventeenth Biennial Conference and Exhibition, International Association on Water Quality, Budapest, Hungary, July 25, 1994.
- Shanahan, P., "The Changing Approach to Water-Quality Management in the United States," presented at Degraded River Basins in Central and Eastern Europe: Summary Workshop on Findings and Policy Implications, International Institute for Applied Systems Analysis, Laxenburg, Austria, May 31, 1996.
- Shanahan, P., "Vulnerability of Water Quality to Climate Change," presented at EPA Workshop on Water and Climate Change: Regions of Vulnerability, University of Colorado, Boulder, Colorado, January 29-30, 1998.
- Shanahan, P., M. Henze, L. Koncsos, P. Reichert, W. Rauch, L. Somlyódy, and P. Vanrolleghem, River Water Quality Modelling: II. Problems of The Art," presented by P. Shanahan at Water Quality International 1998, Nineteenth Biennial Conference and Exhibition, International Association on Water Quality, Vancouver, British Columbia, Canada. June 24, 1998.
- Shanahan, P., D. Borchardt, M. Henze, L. Koncsos, W. Rauch, P. Reichert, L. Somlyódy, and P. Vanrolleghem, River Water Quality Model No. 1: I. Modelling Approach. Presented by P. Shanahan at 1st World Congress of the IWA, Paris 2000, Paris France. July 4, 2000.
- Shanahan, P., Indices for Water Quality. Presented by P. Shanahan at the UNESCO Workshop on Indicators for the World Water Development Report, The Hague, Netherlands. October 11, 2000.
- Shanahan, P. and D. Lantagne, Indicators for Water Quality. Presented by P. Shanahan at the Workshop on Indicator Development for the World Water Development Report, World Water Assessment Programme, UNESCO, Rome, Italy, February 8-10, 2002.
- Shanahan, P. Ground Water and Cities—Hydrological and Historical Perspectives. Presented at Fall 2008 Seminar Series, Center for Urban Environmental Research and Education, University of Maryland, Baltimore County. October 24, 2008

TEACHING

- Course 1.34, Waste Containment and Site Remediation Technology, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2001-2009 academic years.
- Course 1.013, Senior Civil and Environmental Engineering Design, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2007-2009 academic years.
- Course 1.782, Environmental and Geoenvironmental Engineering M.Eng. Project, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 1996-2009 academic years.

Course 1.083, Environmental Health Engineering, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2006-2009 academic years.

Saturated Zone Transport and Surface-Water Transport, Training Course in Environmental Risk Assessment Analysis for the U.S. Nuclear Regulatory Commission, Bethesda, Maryland. January 27 and 28, 2009.

Course 1.725J, Chemicals in the Environment: Fate and Transport, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2005-2008 academic years.

Course 1.85, Water and Wastewater Treatment Engineering, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2004-2007 academic years.

Course 1.096, Environmental Engineering Clinic, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2005-2006 academic year.

Course ESD 1.7, Water Pollution Analysis, Master's course in Engineering for Sustainable Development, Cambridge University, Cambridge, United Kingdom. 2004-2005 academic year.

Ground-water Transport and Computer Codes for Estimating Transport, Emerging Topics in Radiation Protection and Risk Assessment, Kiawah Island, South Carolina. Risk Assessment Corporation. March 17, 2004.

Course CEE172, Fate and Transport of Chemicals in the Environment, Department of Civil and Environmental Engineering, Tufts University. 2003-2004 academic year.

Course 1.061/1.61, Transport Processes in the Environment, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology. 2001-2002 academic year.

Specialty Course on Diffuse Pollution Management, Vancouver, British Columbia, Canada. Technomic Publishing Company, Inc. June 25-26, 1998.

HONORS AND AWARDS

Maseeh Excellence in Teaching Award, Department of Civil and Environmental Engineering, MIT, May 2006.