

BEFORE THE  
WASHINGTON UTILITIES & TRANSPORTATION COMMISSION

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GENERAL RATE APPLICATION  
OF  
NORTHWEST NATURAL GAS COMPANY

December 31, 2018

**Direct Exhibit of Andrew C. Middleton**

**ENVIROMENTAL MITIGATION HISTORY**

**Exh. ACM-2**

## **Exhibit 1: Andrew Middleton Curriculum Vitae**

## **CURRICULUM VITAE**

### **Andrew C. Middleton, Ph.D., P.Eng., BCEE**

President, Corporate Environmental Solutions LLC

#### **SUMMARY**

Dr. Middleton's environmental engineering career spans over forty years and includes industrial environmental engineering, environmental consulting and expert testifying as well as university teaching and research. From 1974-78 he was on the faculties of the University of Ottawa and the University at Buffalo. The Koppers Co. of Pittsburgh next employed him for ten years where he began as a senior environmental engineer, progressed to vice president of environmental affairs and then to president of a wholly-owned, environmental services subsidiary, Keystone Environmental Resources, Inc. Following Koppers, he managed the U.S. branch of a German environmental services company, Haniel Umweltschutz GmbH (1988-89). Afterwards, during 1990-2001 he was a principal in RETEC, an environmental consulting firm.

In 2001, he founded Corporate Environmental Solutions LLC (CES) where he serves as president. CES provides consulting services in the areas of manufactured gas plant and other industrial sites, the history of industrial sites, environmental dispute resolution, remediation cost estimation, treatment of industrial wastewaters, environmental site risk characterization and management, corporate environmental management, site assessment and remediation, and decision tree analysis for development environmental strategies.

Dr. Middleton has served as a member of the boards of directors of both publicly and privately held environmental companies and of advisory committees of university and research organization environmental programs. He has provided expert testimony before a number of public service commissions and courts and expert consulting in a number of confidential mediations and settlement negotiations regarding insurance claims, site cost allocations and third-party liability claims, including serving as a mediator between parties in environmental dispute resolution.

Dr. Middleton's environmental engineering career spans over forty years and includes environmental engineering, environmental consulting and expert testifying as well as university teaching and research. From 1974-78 he was on the faculties of the University of Ottawa and the University at Buffalo. The Koppers Co. of Pittsburgh next employed him for ten years where he began as a senior environmental engineer, progressed to vice president of environmental affairs and then to president of a wholly-owned, environmental services subsidiary, Keystone Environmental Resources, Inc. Following Koppers, he managed the U.S. branch of a German environmental services company, Haniel Umweltschutz GmbH (1988-89). During 1990-2001 he was a principal in RETEC, an environmental consulting firm.

In 2001, he founded Corporate Environmental Solutions LLC (CES) where he serves as president. In 2016, CES founded CES Clean Water LLC as a subsidiary to better focus its efforts on water and wastewater treatment and handling. CES and CES Clean Water provide services in the areas of treatment of water and wastewater, manufactured gas plant and other industrial sites, the history of industrial sites, environmental dispute resolution, remediation cost estimation, environmental site risk characterization and management, corporate environmental management, site assessment and remediation, and decision tree analysis for development environmental strategies.

Dr. Middleton has served as a member of the boards of directors of both publicly and privately held environmental companies and of advisory committees of university and research organization

environmental programs. He has provided expert testimony before a number of public service commissions and courts and expert consulting in confidential mediations and settlement negotiations regarding insurance claims, site cost allocations and third-party liability claims, including serving as a mediator between parties in environmental dispute resolution.

In addition, Dr. Middleton is currently serving as a member of the board of directors of the Augusta County Service Authority, which owns and operates the water supply and sewage collection and treatment systems in Augusta County, Virginia. In the current fiscal year, he is serving as Chair. The Authority operates a number of municipal wastewater treatment plants and potable water treatment plants as well as the water distribution lines and the collection sewers.

Dr. Middleton's publications and presentations on environmental engineering and management topics include 18 journal papers, two handbooks, 8 proceedings papers, more than 50 presentations as well as numerous technical reports spanning a broad range of environmental topics on wastewater treatment, site assessment and remediation and environmental management.

### **EDUCATION**

- Ph.D. Environmental Engineering (1975) - Cornell University
- M.S. Sanitary Engineering (1972) - Virginia Polytechnic Institute & State University
- B.S. Civil Engineering (1971) - Virginia Polytechnic Institute & State University

### **REGISTRATION/CERTIFICATION**

- Professional Engineer, Province of Ontario
- Board Certified Environmental Engineer by American Academy of Environmental Engineers and Scientists (BCEE)

### **PROFESSIONAL AFFILIATIONS**

- American Society for Testing and Materials including National including being a trainer for the ASTM Risk-Based, Corrective Action (RBCA) Standard
- Society for Industrial Archaeology
- Water Environment Federation
- American Society of Civil Engineers

### **AWARDS**

- 1971 B.S. with Distinction
- 1995 Linn H. Enslow Memorial Award from NY Water Environment Association
- 1999 High Energy Excellence Award from PECO Energy

### **FIELDS OF SPECIALIZATION**

- Industrial site assessment and remediation, including site and corporate histories, especially for
  - Manufactured gas plant (MGP) sites
  - Electric generating and distribution facilities

- Wood treating sites
- Coal tar sites
- Coke plant sites
- Wastewater treatment design, operation and troubleshooting
- Soil and groundwater remediation
- Risk-based decision making
- Environmental dispute resolution including expert consulting and witness testimony

### **SELECTED MGP PROJECT EXPERIENCE**

Dr. Middleton has managed and consulted in numerous projects regarding MGPs, byproduct coke ovens, tar distillation and creosoting plants across the United States and Canada, including research on historical operations, site investigations, analyses of remedial alternatives, analyses of environmental impacts, estimation of remediation costs, remediation and wastewater treatment. During these projects, he has been involved in some manner with more than 300 former MGP sites, including visits to at least 145 sites. His scope of work on the vast majority of the 300 sites included a review of historical information about the site. Dr. Middleton's experience and work on MGP sites is extensive and well known, the following being representative examples:

- Dr. Middleton has provided expert testimony on behalf of utilities before public service commissions in Illinois, Indiana, Massachusetts, New Jersey, Ohio, Oregon, and Michigan regarding the history of gas manufacture, histories of individual utilities and sites and remediation of MGP sites. He has provided expert consulting or expert witness testimony on behalf of a number of utilities in depositions and court, in confidential mediations and confidential settlement discussions regarding claims against historical insurance policies, PRP allocations and third-party liability claims. He received a High Energy Excellence Award from PECO Energy for work regarding MGP site cost recovery. He has also served as a mediator between utilities on allocation of remediation costs. The table at the end of this CV lists testimonies provided by Dr. Middleton. In addition to the matters listed in this table, Dr. Middleton has had a number of confidential consulting engagements regarding MGP sites across the U.S.

As one testimony example, Dr. Middleton provided testimony in a bench trial regarding the Bangor, ME, MGP site, the subject of litigation about PRP allocation of costs for remediation of tar impacts to the sediments of the nearby river. [*Bangor vs. Citizens Communications ... USDC, Maine, Civil Docket No. 02-cv-183-B-S*] He researched the histories of gas manufacture and other tar-using and handling operations in Bangor, ME, and offered at the bench trial expert opinions on the amounts gas, tar and wastewater historically generated as well as tar handling and usage in the city not related to the MGP. These opinions provided one basis for allocation of sediment remediation costs.

- Dr. Middleton has provided senior consulting, program and project management services on MGP sites across the United States in the areas of corporate environmental management, environmental risk characterization and management, environmental dispute resolution, site assessment and site remediation and treatment of groundwater.
  - As one example, Dr. Middleton was the program manager for work to address 26 MGP sites in Indiana. The work included preliminary assessments on all 26 sites with follow up site investigations on 18 sites and remediation at one site to make way for a railroad transportation corridor. Dr. Middleton set up a multi-site program, which saved on the order of 20% in costs for assessment and investigation. The program set up standard templates for work plans, reports, H&S plans, QA/QC plans and analytical results, which provided an economy of scale and a standardized approach to performing the work. This

approach also promoted consistency of investigations, assessment and reporting amongst the multiple sites, which was an important consideration in subsequent matters. In addition, Dr. Middleton testified on behalf of Indiana Gas Company before the Indiana Utilities Regulatory Commission about the history of all 26 sites. Dr. Middleton also testified as an expert on behalf of Indiana Gas in its litigation with historical insurers about nine of these MGP sites.

- As another example, Dr. Middleton was the program manager for work to address 20 MGP sites in Pennsylvania, co-coordinating activities of two different consulting firms. Dr. Middleton was responsible for scheduling and budgeting for the program sites and preparing the annual plan submitted to the Pennsylvania Department of Environmental Protection on the progress of the program. Work included investigation, remediation and risk-based closure under Pennsylvania's Act 2. In addition, Dr. Middleton oversaw the effort to notify and survey residents and property owners downgradient of these MGP sites, an action required by Act 2. The program was set up to rely upon local gas company personnel to interact with the public to obtain this information. These personnel were trained with regard to the information they needed to obtain prior to making contact with the downgradient owners and residents.
- Over the past 20 years, Dr. Middleton has been a principal in the development and updating of a probabilistic cost estimation model for MGP sites. The role of the model is to provide a means to estimate future remediation costs where site characterization and remedy selection is insufficient to support a deterministic engineering estimate. CES's current version of this model has been used to provide cost estimates on a number of MGP sites for financial reporting or settlement of claims. In the case of financial reporting, CES's model has been scrutinized by external auditors of utilities.
- Dr. Middleton prepared presented the lecture on "MGP History" in the Electric Power Research Institute (EPRI) "MGP 101 Course." He has also presented MGP history lectures to state agencies on behalf of utilities, in individual utility MGP training courses and at MGP conferences.
- While at Koppers Company during 1978-88, Dr. Middleton worked extensively with currently operating and former by-product coke plants, coal tar distillation plants and wood treating plants that produced or processed coal tar or used its derivative, creosote. Koppers was one of the major operators and constructors of coke ovens, coal tar refineries and creosoting plants. He served in various positions including Vice President of environmental affairs. While Vice President, his department, consisting of up to 60 people, was responsible for the environmental matters at 55 operating facilities as well as the assessment and remediation of more than 75 active and closed facilities. In 1986, he led the transformation of this staff department into a commercial environmental subsidiary, which specialized in assessment and remediation of MGP, sites, by-product coke plants, creosoting plants as well as other industrial sites.

In the 1980s while at Koppers, Dr. Middleton was the program manager for obtaining environmental permits for a planned substantial synthetic fuels plant (peat to methanol) in eastern North Carolina. He assembled a multi-company team, which prepared and submitted applications for air, peat mining, NPDES discharge, groundwater dewatering, stormwater runoff and other planned activities. His work included presentations about the project in public meetings, in press briefings and in meetings with stakeholders.

He also worked on a number of MGP projects while at Koppers including:

- He was a co-author/editor of the 1984 EEI Handbook on Manufactured Gas Plant Sites, the first U.S. comprehensive manual on management of MGP sites.

- The subsidiary Keystone was one of the four original Gas Research Institute (GRI) contractors on its multi-year MGP research program and Dr. Middleton was one of the principle investigators directing Keystone's work.
  - Dr. Middleton was the project manager for the GRI project demonstrating the treatability of MGP groundwater in a municipal wastewater treatment plant. The paper published on this project won an award from the NY Water Environment Association.
  - Dr. Middleton was the project manager for the 1987 GRI manual on remediation of MGP sites. This manual was Volume IV of the four-volume set issued at the time.
- Dr. Middleton was the project manager for the investigation and risk assessment of the BC Expo Site in Vancouver, British Columbia. This site included a former MGP and wood treating site. The risk assessment was one of the first in British Columbia and it led to redevelopment of this site.

#### **MEMBERSHIP/COMMITTEE ACTIVITIES**

**1995-2014:** *National Trainer for ASTM* for its risk-based corrective action (RBCA) standard (E1739). In this capacity, Dr. Middleton instructs at the two-day ASTM RBCA course being held nationally. He has instructed hundreds of students in numerous of these courses across the U.S.

**2000-2006:** *Member of the External Advisory Panel, Environmental Engineering Department, SUNY/Buffalo, Buffalo, NY.* As a member he advised the Environmental Engineering Department on the educational needs of the environmental engineering practice on matters related to environmental remediation, waste treatment and management and management of environmental affairs. This panel periodically met with the faculty of the Department regarding the undergraduate environmental engineering program.

**1999-2004:** *Member of the Environmental Technical Advisory Board, Alcoa, Pittsburgh, PA.* As a member he advised the Alcoa Corporation on technical topics related to environmental remediation, waste treatment and management and management of environmental affairs, including topics for research and development. This board met several times annually with Alcoa's environmental management and remediation teams.

**1999-2002:** *Chair, Water Environment Research Foundation (WERF) Project Subcommittee on "Enhancing Biodegradability of Refractory Aromatics in Wastewater: Pretreatment with Elemental Iron, 99-CTS-3."* WERF awarded this grant to the University of Delaware for research on the capabilities of elemental iron to pretreat recalcitrant organic compounds in wastewater to improve their treatability in biological systems. The subcommittee then provided oversight on the progress of the research including review of the interim and final reports.

**1998-2004:** *Chair, Water Environment Research Foundation (WERF) Project Subcommittee on "Evaluating and Optimizing Source Treatment Technologies to Improve the Biodegradability of Organic Compounds, 99-WWF-5."* This subcommittee solicited and awarded a WERF grant to San Diego State University for research on the capabilities of advanced oxidative technologies to pretreat recalcitrant organic compounds in wastewater to improve their treatability in biological systems. The subcommittee then provided oversight on the progress of the research including review of the interim and final reports.

## EMPLOYMENT/BOARD MEMBERSHIPS

**Feb 2016-Present:** *Member of the Board of Directors of the Augusta County Service Authority (ACSA):* The ACSA provides water and sewer service to residents of Augusta County, Virginia, and operates the Augusta Regional Landfill.

**Nov 2001-Present:** *President, Corporate Environmental Solutions LLC.* Dr. Middleton founded this company in 2001 to provide environmental services. He is responsible for technical, operational and business affairs. He personally provides senior consulting services in the areas of corporate environmental management, environmental risk characterization and management, environmental dispute resolution, site assessment and remediation, and treatment of industrial wastewaters.

**1981-2001:** *Civil Engineering Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania:* Intermittent teaching of graduate courses in contaminated water treatment. He developed an innovative approach for the water and wastewater treatment course by unifying the subject matter into a course on "Treatment of Contaminated Water." This course focused on selection and design of a treatment system based on the nature and concentrations of contaminants and the intended means of disposition using a matrix of individual unit processes. The approach is applicable regardless of whether the contaminated water is municipal or industrial wastewater, groundwater or storm runoff. This approach contrasts to separate courses for water, wastewater or groundwater treatment.

**Jan 2001-Nov 2001:** *Senior Vice President, The RETEC Group, Inc.* In this capacity he was responsible for executive oversight of engineering, science and technology efforts across the company as well as his technical consulting client program management practices. Additionally, he managed the O&M Group and provided consulting and engineering services, project and program management and business development in environmental management; contaminated water treatment; and, in site assessment and remediation.

**Apr 1999-Dec 2000:** *General Manager of ThermoRetec's Site Management and Closure Division.* Responsible for the division technical and business affairs including division P&L. This division had a Construction Group and an Operations and Maintenance (O&M) Group. The construction group carried out large civil remediation construction projects (e.g., excavation, sheet piling, slurry walls, landfill covers, contaminated water treatment plant construction) for industrial and utility clients. The O&M Group operated remediation systems (e.g., groundwater extraction and treatment, land treatment units for bioremediation of soil, soil venting, NAPL recovery, landfill leachate treatment) across the U.S. also for industrial and utility clients. Additionally, he provided consulting and engineering services in environmental management, contaminated water treatment, laboratory and field treatability projects on site assessment and remediation.

**Jan 1990-Apr 1999:** *Principal of ThermoRetec Consulting Corporation.* Responsible for technical and business affairs of company. ThermoRetec (formerly RETEC) is an engineering and remedial services company specializing in on-site treatment of organic wastes. Day-to-day duties included project management of RI/FS's on Superfund sites, site remediation, environmental audits of industrial facilities, design and operation of treatment facilities for contaminated groundwater, soils, industrial and municipal wastewaters, permitting of industrial facilities, and remedial technology development. He also was the principal investigator on field research studies for site remediation. He served as a member of ThermoRetec's Board of Directors from 1990 until 1995.

**Jun 1991-Dec 1996:** *Member of the Board of Directors of EnSys Environmental Products, Inc.:* EnSys was a biotechnology start up company developing and selling immunoassay test kits for the analysis of soil and water. During his tenure on the Board, EnSys went public in an IPO in 1993 and merged with Strategic Diagnostics, Inc. (symbol: SDIX) in 1996. Dr. Middleton provided advice on commercialization opportunities for new test kits, served on the Audit Committee and chaired the Compensation Committee of this publicly traded company.



**May 1990-Dec 1995:** *Member of the Board of Directors of Remediation Technologies, Inc (RETEC):* RETEC was a privately held company during his tenure on the Board. It tripled in size in this five-year period and became an acquisition of the publicly traded Thermo Remediation, Inc. (later renamed ThermoRetec) in December 1995. Dr. Middleton provided advice on strategic direction for the company as well as on technology commercialization.

**Jul 1988-Dec 1989:** *President of Haniel Environmental Services, Inc. (HES).* Responsible for operations, technical matters and business affairs. HES was the U.S. branch of a German company specializing in site remediation. While in this position, his technical activities included managing soil gas surveys and *in situ* clean up of volatile organic compounds with soil venting and groundwater aeration systems, as well as general site decommissioning and remediation, project management of RI/FS's, and technical support of litigation. He served on the boards of directors of HES and its subsidiary companies during this his tenure as President.

**Jun 1986-Jun 1988:** *President of Keystone Environmental Resources, Inc. (also founder of Keystone).* Responsible for management and leadership that grew the company from 90 employees to over 250 with ten offices in the United States and Canada offering environmental consulting, analytical, and remediation services. Keystone was a wholly owned subsidiary of Koppers. Keystone specialized in the investigation and remediation of wood treating, tar-contaminated and chemical sites and in the design and operation of wastewater and groundwater treatment systems. He was also the principal investigator for Keystone's research project funded by the Gas Research Institute on assessment and remediation of manufactured gas plant sites and the director of the company's research and development efforts on new environmental technologies. He served on the board of directors of Keystone and continued as Vice President of Koppers Environmental Resources.

**Aug 1984-Jun 1986:** *Vice President and General Manager of Pioneering Technologies (in addition to Environmental Resources):* Overall responsibilities for a program made up of a Materials Science Department, a Manufacturing Technologies Department, a Technical Information Department, and a Project Management Group; activities included research on polymer science and wood treating chemicals, computer-assisted drafting; instrumentation and control, systems design and installation, and computer and library facility management. Project management activities included facilitating use of a computer-based project management system throughout Koppers Science and Technology activities, especially on interdisciplinary teams. Additionally, Dr. Middleton directed this department's interactions with Koppers' venture investments in biotechnology and materials science.

**Jun 1981-Jun 1988:** *Vice President and General Manager of Environmental Resources Department, Koppers Company, Inc., Monroeville, Pennsylvania:* Overall responsibility for management of Koppers environmental affairs. Included in Koppers operations were over 50 Chemical & Allied Products plants including 17 wood preserving plants, as well as other facilities producing metal products and road materials. In addition to the operating facilities, his overall responsibility included management of over 50 previously operated plants (wood treating and chemical plants) and disposal sites, a number of which are Superfund sites. His duties also included management of the environmental reserves for remediation of previously operated properties as well as developing an annual budget for activities on these sites. He built a multi-disciplinary staff of environmental engineers and scientists from 1981-1986, which was of such quality and capability that it was converted to a P&L subsidiary in 1986 (Keystone Environmental Resources, Inc.) to provide services outside of Koppers on a commercial basis.

**Feb 1979-May 1981:** *Manager of Water Quality Engineering Section of Environmental Resources and Occupational Health Department, Koppers Company, Inc., Monroeville, Pennsylvania:* The objective of this section was to provide in-house water quality engineering services to Koppers Company. Projects included activated sludge treatability studies (bench-scale and pilot plant) at tar distillation plants; wastewater characterization studies at tar distillation and chemical plants; treatability studies for oil removal (bench-scale and pilot plant) at tar distillation and chemical plants; activated sludge plant startup at coke plants; preparation of activated sludge control programs at coke, chemical, and tar distillation

plants; hydrogeologic surveys at tar distillation, wood preserving, and coke plants; fish toxicity studies on chemical and tar distillation plant wastewaters; priority pollutant surveys at chemical, coke, and tar distillation plants; development of wastewater treatment processes to achieve BAT for coke, tar distillation, and synthetic fuels plants. In this position, he also established a treatability laboratory program for wastewater, groundwater, sludge and soil.

**Jun 1978-Jan 1979:** *Senior Research Engineer, Research Department, Koppers Company, Inc., Monroeville, Pennsylvania:* Responsible for water pollution control projects with Koppers Company, Inc., including activated sludge pilot plant study with continuous fish bioassays of effluent at a chemical plant; preparation of operational control programs at chemical sludge plants for coke and tar distillation plants.

**Jul 1976-May 1978:** *Assistant Professor of Civil Engineering, SUNY at Buffalo, Buffalo, New York:* Teaching graduate and undergraduate courses in water and wastewater treatment and environmental engineering; acquiring and directing funded programs of research in water pollution control engineering, supervised graduate students and development of water pollution control laboratories; two students received Ph.D. degrees and nine received M.S. degrees in environmental engineering under his direction.

**Sep 1974 – Jun 1976:** *Assistant Professor of Civil Engineering, University of Ottawa, Ottawa, Ontario:* Teaching graduate and undergraduate course in water and wastewater treatment and environmental engineering; acquiring and directing funded programs of research in water pollution control engineering; supervising graduate students and development of water pollution control laboratories; seven students received M.S. degrees in environmental engineering under his direction.

**Sep 1971 – Aug 1974:** *EPA Post Masters Trainee, Cornell University, Ithaca, New York:* Study in the Environmental Engineering Ph.D. Program under Dr. A. W. Lawrence in Civil and Environmental Engineering School. In addition to his experimental research on the kinetics of microbial sulfate reduction, he also developed an approach for least cost design of wastewater treatment systems. He received a Ph.D. in environmental engineering.

**Sep 1970 – Aug 1971:** *Public Health Fellow, VPI&SU, Blacksburg, Virginia:* Study in Sanitary Engineering Program under Dr. E. M. Jennelle, Civil Engineering Department. He conducted experimental research on the water quality of a large, pumped storage reservoir near VPI for his Master's thesis. He received an MS in sanitary engineering.

**Mar-Jun, Sep-Dec 1968; Mar-Jun, Sep-Dec, 1969:** *Co-op student in Civil Engineering, Wiley & Wilson Consulting Engineers & Architects, Lynchburg, Virginia:* Worked as Engineering Design Assistant on municipal water and wastewater projects and as a land and route survey party member. The Co-op Program was part of his undergraduate work at Virginia Tech, from which he received a BS in civil engineering with distinction.

#### **PUBLICATIONS (JOURNALS)**

1. Middleton, A.C. and Lawrence, A.W., 1973. Discussion of "Optimal Design of Wastewater Treatment Systems by Enumeration," by G.F. Parkin and R.R. Dague, Journal Environmental Engineering Division, ASCE, 99, 960.
2. Middleton, A.C. and Lawrence, A.W., 1974. "Cost Optimization of Activated Sludge Systems," Biotechnology and Bioengineering, XVI, 807.
3. Middleton, A.C. and Lawrence, A.W., 1976. "Least Cost Design of Activated Sludge Systems," Journal Water Pollution Control Federation. 48, 395.
4. Middleton, A.C. and Lawrence, A.W., 1977. "Kinetics of Microbial Sulfate Reduction," Journal Water Pollution Control Federation. 49, 1659.

5. Middleton, A.C. and Rovers, F.A., 1976. "Average pH," Communications, Journal Water Pollution Control Federation, 48, 395.
6. Adamowski, K and Middleton, A.C., 1977. "Steady-State Dissolved Oxygen Model for the Rideau River," Canadian Journal of Civil Engineering. 4, 471.
7. Craig, E.W., Meredith, D.D., and Middleton, A.C., 1977. Discussion of "Simplified Optimization of Activated Sludge Process," by C.P.L. Grady, Jr., Journal Environmental Engineering Division, ASCE, 103, 1158.
8. MacInnes, C.D., Middleton, A.C., and Adamowski, K, 1978. "Stochastic Design of Flow Equalization Basins," Journal Environmental Engineering Division, ASCE, 104, 1277.
9. Craig, E.W., Meredith, D.D. and Middleton, A.C., 1978. "Cost Optimization of the Activated Sludge Process Using the Box-Complex Algorithm," Journal Environmental Engineering Division, ASCE. 104, 1101.
10. Westerndorf, J.R. and Middleton, A.C., 1979. "Chemical Aspects of the Relationship Between Drinking Water Quality and Long-Term Health Effects: An Overview," Journal American Water Works Association. 71, 417.
11. Fritz, J.J., Middleton, A.C., and Meredith, D.D., 1979. "Dynamic Process Modeling of Wastewater Stabilization Ponds," Journal Water Pollution Control Federation, 51, 2724.
12. Fritz, J.J., Meredith, D.D., and Middleton, A.C., 1980. "Non-Steady State Bulk Temperature Determination for Simple Aquatic Ecosystems: Stabilization Ponds," Water Research (U.K.), 14, 413.
13. Habicht, M.H., Adamowski, K., and Middleton, A.C., 1981. "Potential Eutrophication of the Rideau River by an Urban Drainage Waterway," Canadian Journal of Civil Engineering, 8, 165.
14. Hughey, P.W., Meredith, D.D., and Middleton, A.C., 1982. "Optimal Operation of an Activated Sludge Plant," Journal Environmental Engineering Division, ASCE, 108, 349.
15. Smith, J.R., Luthy, R.G., and Middleton, A.C., 1988. "Microbial Ferrous Iron Oxidation in Acidic Solution," Journal Water Pollution Control Federation, 60, 518.
16. Meredith, D.D., Middleton, A.C., and Smith, J.R., 1990. "Design of Detention Basins for Industrial Sites," Journal Water Resources Planning and Management, ASCE, 116, 586.
17. Middleton, A.C., Nakles, D.V., and Linz, D.G., 1991. "The Influence of Soil Composition on Bioremediation of PAH-Contaminated Soils," Remediation, 1, 391.
18. Smith, J.R., Neuhauser, E.F., Middleton, A.C., Weightman, R.L, Linz, D.G., 1993. "Treatment of Organically Contaminated Groundwaters in Municipal Activated Sludge Systems," Water Environment Research, 65.
19. Lawrence, A.W. and Middleton, A.C., "The Sludge Age Concept and the Activated Sludge Process: a 45 Year Retrospective Commentary," Environmental Engineer & Scientist, Winter 2014, 28-32.

#### **PUBLICATIONS (BOOKS)**

1. Craun, J.C. and Middleton, A.C. (co-editors/authors), 1984. Handbook on Manufactured Gas Plant Sites, Washington, D.C.: Edison Electric Institute.
2. Unites, D., Nakles, D., Menzie, C., Middleton, A., and Helsel, R. (co-editors/authors), 1987. Management of Manufactured Gas Plant Sites, Vol. I-IV, Chicago, Illinois: Gas Research Institute.

### **PUBLICATIONS (CONFERENCE PROCEEDINGS)**

1. Weyland, H.J. and Middleton, A.C., 1977. "Metals Recovery from Metallic Hydroxide Sludges Through Microbial Sulfate Reduction," Proceedings 9<sup>th</sup> Mid-Atlantic Industrial Waste Conference, Bucknell University, Lewisburg, Pennsylvania.
2. Lee, G.C., Meredith, D.D., and Middleton, A.C., Eds., 1979. "Proceedings of Hazardous Waste Management and Disposal Seminar," WREE Report No. 79-2, Civil Engineering SUNY/Buffalo, Buffalo, New York.
3. Bhattacharyya, A. and Middleton, A.C., 1979. "Development of Biological Treatment System Achieving BATEA for Coke Plant Wastewaters," Proceedings 11<sup>th</sup> Mid-Atlantic Industrial Waste Conference, Pennsylvania State University, State College, Pennsylvania.
4. Bhattacharyya, A. and Middleton, A.C., 1980. "Solids Retention Time: A Controlling Factor in the Successful Biological Nitrification of Coke Plant Wastes," Proceedings 12<sup>th</sup> Mid-Atlantic Industrial Waste Conference, Bucknell University, Lewisburg, Pennsylvania.
5. Bhattacharyya, A. and Middleton, A.C., 1980. "Enhanced Biological Treatment System for Coke Plant Wastewater Achieving Complete Nitrification," Proceedings 35<sup>th</sup> Industrial Waste Conference, Purdue University, Lafayette, Indiana.
6. Middleton, A.C., 1981. "Process Control for Activated Sludge Treatment of Coke Plant Wastewater," Proceedings: Symposium on Iron and Steel Pollution Abatement Technology for 1980, EPA-600/9-81-017, Philadelphia, Pennsylvania.
7. Middleton, A.C., Smith, J.R., Urbassik, M.R., Keffer, R.E., Sawchuck, P.W., and Edwards, G.E., 1984. "Industrial Wastewater Treatability Study Achieving BCT/BAT Treatment," Proceedings 16<sup>th</sup> Mid-Atlantic Industrial Waste Conference, Pennsylvania State University, State College, Pennsylvania.
8. Middleton, A.C., 1995. "Historical Overview of Manufactured Gas Processes Used in the United States," presented at International Symposium and Trade Fair on the Clean-up of Manufactured Gas Plants, Prague, Czech Republic; published in Land Contamination & Reclamation, Vol. 3, No. 4, pp.5-17 – 5-19.

### **PRESENTATIONS**

1. Middleton, A.C. and Jenelle, E.M., "The Influence of an Impoundment on the Priority of Effluent Treatment in the Upstream Watershed," presented at 26<sup>th</sup> Annual Meeting, Virginia Water Poll. Control Assn., Roanoke, Virginia, April 30, 1970.
2. Middleton, A.C. and Jenelle, E.M., "Processes Influencing Water Quality in a Pumped Storage Reservoir," presented at 8<sup>th</sup> Annual Meeting, Am. Water Resources Assn., St. Louis, Missouri, October 31, 1972.
3. Middleton, A.C. and Lawrence, A.W., "Cost Optimization of Activated Sludge Wastewater Treatment Systems," presented at 166<sup>th</sup> National Meeting, Am. Chem. Soc., Chicago, Illinois, August 30, 1973.
4. Middleton, A.C. and Lawrence, A.W., "Least Cost Design of Activated Sludge Systems," presented at 46<sup>th</sup> Annual Meeting, Water Pollution Control Federation, Cleveland, Ohio, October 22, 1973.
5. Adamowski, K and Middleton, A.C., "Water Quality of the Rideau River," invited seminar at 2<sup>nd</sup> Annual Science Education Day Conf., Kanata, Ontario, April 12, 1975.

6. Middleton, A.C. and Lawrence, A.W., "Kinetics and Engineering Significant of Microbial Sulfate Reduction," presented at 47<sup>th</sup> Annual Meeting, Water Pollution Control Federation, Miami Beach, Florida, October 8, 1975.
7. Middleton, A.C., "The Science of Environmental Impact Statement," invited seminar for Buffalo Section of ASCE Workshop on "The Preparation of Environmental Impact Statements," Buffalo, New York, February 8, 1977.
8. Middleton, A.C., "Design of the Activated Sludge Process," invited seminar for Buffalo Section ASCE Workshop on "Design and Operation of the Activated Sludge Process," Buffalo, New York, March 14, 1978.
9. Middleton, A.C. and Lawrence, A.W., "The Effect of Recycle Sludge Pumping Rates on the Activated Sludge Process," invited seminar for Buffalo Section ASCE Workshop on "Design and Operation of the Activated Sludge Process," Buffalo, New York, March 14, 1978.
10. Westendorf, J.R., Middleton, A.C., and Kasprzak, P.J., "Co-Disposal of a Combined Municipal/Industrial Wastewater Treatment Plant Sludge with Municipal Refuse in a Sanitary Landfill," presented at 52<sup>nd</sup> Annual Conference Water Pollution Control Federation, Houston, Texas, October, May 14, 1980.
11. Middleton, A.C., "Wastewater Treatment for Coke and Coal-Tar Distillation Plants," presented at the Spring Meeting American Coke and Coal Chemicals Institute, Hilton Head, South Carolina, May 19, 1981.
12. Middleton, A.C., "Hazardous Wastes," presented at Disaster Emphasis Day, Annual Conference, Church of the Brethren, Indianapolis, Indiana, June 23, 1981.
13. Hughey, P.W., Meredith, D.D., and Middleton, A.C., "Optimal Operation of an Activated Sludge Wastewater Treatment Plant," presented at The International Symposium on Real Time Operation of Hydrosystems, Waterloo, Ontario, Canada, June 25, 1981.
14. Middleton, A.C., "Removal of Priority Pollutants From Coal-Tar Condensate Water," invited speaker at The Fate of Wastewater-Borne Priority Pollutants Subjected to Biological Treatment, U.S. EPA Seminar, Washington, D.C., May 4, 1982.
15. Malik, D.P., Middleton, A.C., Bryant, D.L., Sgro, G.A., Fillo, J.P., Charna, R.B., and Maruhnich, E.D., "Water Usage and Treatment, Tennessee Synfuels Project," presented at ASCE Conference on Water & Energy: Technical & Policy Issues, Pittsburgh, Pennsylvania, May 1982.
16. Middleton, A.C., "BAT Regulations for Coke Plants," invited speaker at Fall Meeting, Manufacturing and Environmental Committee, American Coke and Coal Chemicals Institute, Indianapolis, Indiana, September 14, 1982.
17. Middleton, A.C., "Priority Pollutant Removal From Coke and Coal-Tar Distillation Plant Wastewaters By Biological Treatment," invited speaker at Biological Treatment, Priority Pollutants and BATEA Seminar, Philadelphia, Pennsylvania, December 10, 1982.
18. Middleton, A.C., "Wastewater Treatment For Coke Plants: Regulations and Capabilities," invited speaker at Eastern States Coke Conference, Pittsburgh, Pennsylvania, February 1983.
19. Middleton, A.C., "Land Disposal and Spill Site Environments," invited speaker at Genetic Control of Environmental Pollutants, University of Washington, Seattle, August 1, 1983.
20. Middleton, A.C. and Oster, L.A., "Projected Environmental Costs to Permit and Operate the PMA Methanol Plant," presented at the AIChE 1984 Summer National Meeting, Philadelphia, Pennsylvania, August 19, 1984.

21. Spencer, J.D., Middleton, A.C., Smith, J.R., Campbell, J.R., and Zeff, J.D., "Evaluation of Treatment Technologies for Contaminated Groundwater," presented at the Water Pollution Control Federation 59<sup>th</sup> Annual Conference/Exposition, Los Angeles, California, October 6-9, 1986.
22. Middleton, A.C., "Opportunities for Chemical Engineers in Hazardous Waste Management," presented to the Pittsburgh Section of AIChE, Pittsburgh, Pennsylvania, January 13, 1987.
23. Middleton, A.C., "Environmental Management," invited speaker at the annual meeting of the National Wood Window and Door Association, Maui, Hawaii, February 1987.
24. Hegnauer, A. and Middleton, A.C., "Environmental Considerations at Manufactured Gas Plant Sites," presented at the American Gas Association Distribution/Transmission Conference, Las Vegas, Nevada, May 1987.
25. McShea, L.J., Smith, J.R., Middleton, A.C., and Zeff, J.D., "Chemical Oxidation of Aqueous Pentachlorophenol and Phenolics by UV-Ozonation," presented at the American Institute of Chemical Engineers 1986 Summer National Meeting, Boston, Massachusetts, August 24-27, 1986.
26. Middleton, A.C., Presentation on bioremediation of wood treating wastes to Committee on Small Business, Subcommittee on Energy and Agriculture, U.S. House of Representatives, Washington, D.C., September 1987.
27. Hiller, D.H. and Middleton, A.C., "Die Abwicklung von Schadensfällen in den USA," presented at Harress Geotechnik-Umweltseminar, Kloster Banz, Germany, October, 21-22, 1988.
28. Smith, J.R., Fu, J.K., and Middleton, A.C., "Field Work Evaluating Engineered Biodegradation System Treatment of Soil Contaminated with Wood Preserving Chemicals," presented at Conference on Genetically Engineered or Adapted Microorganisms in Hazardous Waste Treatment, Washington, D.C., December 1988.
29. Middleton, A.C., "Co-Treatment of Groundwater in POTWs," presented at Management of Manufactured Gas Plant Sites Technology Transfer Seminar sponsored by EEI, EPRI, and GRI, Pittsburgh, Pennsylvania, April 19-20, 1989.
30. Middleton, A.C. and Hiller, D.H., "*In Situ* Aeration of Groundwater, a Technology Overview," presented at Conference on Prevention and Treatment of Soil and Groundwater Contamination in the Petroleum Refining and Distribution Industry, Montreal, Quebec, October 16-17, 1990.
31. Linz, D.G., Neuhauser, E.F. and Middleton, A.C., "Perspectives on Bioremediation in Gas Industry," presented at Environmental Biotechnology Symposium, Knoxville, TN, October 17-19, 1990.
32. Middleton, A.C., "A Historical Perspective of Manufactured Gas Plant Operations," presented at 1990 Manufactured Gas Plant Site Workshop sponsored by AGA, Boston, MA, October 31-November 1, 1990.
33. Middleton, A.C., "Past Operations and Present-Day Site Management," presented at MGP Technology Transfer Seminar sponsored by EPRI and GRI, Atlanta, GA, April 2-3, 1991.
34. Middleton, A.C., "Remediation Options and Technologies," presented at Manufactured Gas Plant Site Workshop sponsored by NEGA, Sutton, MA, October 9, 1991.
35. Saber, D.L., Smith, J.R., Lawrence, A.W. and Middleton, A.C., "Optimization of an Oil Recovery/Groundwater Treatment System Based upon Treatability Study/Engineering Evaluations of Superfund Site Clean-Up," presented at the AIChE 1992 Summer National Meeting, August 9-12, 1992.

36. Smith, J.R., Lawrence, A.W. and Middleton, A.C., "Sequencing Batch Reactor Treatment of Superfund Site Groundwater," presented at the 65<sup>th</sup> Annual Water Environment Federation Conference, New Orleans, LA, September 20-24, 1992.
37. Middleton, A.C., Lawrence, A.W., Morgan, D.J., Lees, M.G. and Hayes, T.D., "Biosparging Strategies for Containment and Remediation of Organic Contaminant Groundwater Plumes at E&P Sites Using Either Vertical or Horizontal Sparge Wells," presented at The Eighth International IGT Symposium on Gas, Oil and Environmental Biotechnology, Colorado Springs, Colorado, December 11-13, 1995.
38. Middleton, A.C., Draybuck, B.M., Grizzle, P.L. and Hayes, T.D., "Pilot Test of Biosparging at a Natural Gas Plant and Pipeline Facility," presented at the Ninth International IGT Symposium on Gas, Oil, and Environmental Biotechnology, Colorado Springs, Colorado, December 9-11, 1996
39. Middleton, A.C., Lawrence, A.W., Draybuck, B.M., Grizzle, P.L. and Hayes, T.D., "The Role of Preliminary Testing in the Design of a Biosparge System at a Natural Gas Plant and Pipeline Facility," presented at the 1997 SPE/EPA Exploration & Production Environmental Conference, Dallas, Texas, March 3-5, 1997.
40. Middleton, A.C., "Historical Operations at MGP Sites," presented at the Illinois Manufactured Gas Plant (MGP) Forum, Bloomington, Illinois, May 20, 1999 and at the Midwest Energy Association Meeting, Colorado Springs, CO, October 15, 1999.
41. Middleton, A.C., "Future Needs to be Addressed by Environmental Engineers and Scientists," presented at the University at Buffalo, Buffalo, NY, October 22, 1999.
42. Middleton, A.C., "Future Corporate Needs to be addressed by Environmental Engineers and Scientists," presented at Carnegie Mellon University, Pittsburgh, PA, February 18, 2000, and the University of Texas Austin, Austin, TX, February 23, 2000.
43. Middleton, A.C., "Future Trends in Corporate Environmental Management," presented at the University of Pittsburgh, Pittsburgh, PA, March 22, 2000.
44. Hasel, M.J., Shamory, C. and Middleton, A.C., "Thermal Desorption of Heavily Impacted MGP Soils under New TCLP Exemption," presented at the GTI 14<sup>th</sup> International Conference on Site Remediation Technologies, Orlando, FL, December 2-6, 2001.
45. Middleton, A.C., "The Effect of Historical Issues on Risk," presented at the AGA MGP Workshop, Washington, DC, August 6, 2004.
46. Morgan, D., Mahfood, J., Malle, J., Middleton, A. and McGraw, D., "The Effect of Site Remediation Risk Level on Potential Incidence of Cancer within the United States," poster displayed at the Midwestern Risk Assessment Meeting, Indianapolis, IN, August 26, 2004.
47. Middleton, A.C. and Flaherty, J.M., "PAH Sources: Sources and Their Identification," presented at the MEA Environmental Management Conference, Chicago, IL, September 23, 2004.
48. Bhattacharyya, A., Blayden, J.M., and Middleton, A.C. "Estimating Historic Tar Production at Manufactured Gas Plants," presented at the poster session of National Gas Technologies 2005 Conference, Orlando FL, January 30-February 2, 2005.
49. Blayden, J.M., Gould, J.E., Middleton, A.C., Morgan, D.J., Sladky, B.R. and McCauley, P.B., "Integration of State Risk-Based Closure Endpoints into Probabilistic Remediation Cost Estimates for MGP Sites," presented at the National Gas Technologies 2005 Conference, Orlando FL, January 30-February 2, 2005.
50. Sladky, B.R., Fernandes, A.C., Middleton and Morgan, D.J. "Long-Term Management Issues Resulting from Risk-Based Closure of MGP Sites," presented at the National Gas Technologies 2005 Conference, Orlando FL, January 30-February 2, 2005.

51. Middleton, A. C. "Financial Strategies for Environmental Projects," presented at the MEA Environmental Management Conference, Colorado Springs, CO, September 28, 2005.
52. Middleton, A. C. and Gould, J. E. "Data Management," presented at the MEA Environmental Management Conference, Colorado Springs, CO, September 28, 2005.
53. Fernandes, A. F. and Middleton, A.C., "A Unified Multi-State Utility MGP Management Program," presented at MGP 2006 Conference, Reading, UK, April 4-6, 2006.
54. Middleton, A.C., Weightman, R.L. and Blayden, J.M. "Forensic Observation during MGP Site Remediation," poster displayed at MGP 2006 Conference, Reading, UK, April 4-6, 2006.
55. Lynch, M.J., Sylvester, J.M., Hart-Lovelace, J., Jones, D.R., and Middleton, A.C. "Insurance Recovery for MGP Site Clean-Up Costs," presented at MGP 2006 Conference, Reading, UK, April 4-6, 2006.
56. Morgan, D.J., Middleton, A.C. and Blayden, J.M. "Business Management Considerations in the Selection of Institutional and Engineering Controls for MGP Site Remediation," presented at MGP 2006 Conference, Reading, UK, April 4-6, 2006.
57. Middleton, A.C. "Influence of History of MGPs – Lecture 1," presented at EPRI MGP 101 Course, Philadelphia, PA, June 18, 2008.
58. Lawrence, A.W. and Middleton, A.C., "The Sludge Age Concept and the Activated Sludge Process: A 45-Year Historical Review," presented at AAEEES W. Wesley Eckenfelder Memorial Breakfast of the NJWEA Meeting, Atlantic City, NJ, Winter 2014, May 13, 2014.

#### **SELECTED TECHNICAL AND RESEARCH REPORTS**

1. Middleton, A.C. and Lawrence, A.W., 1973. "Cost Optimization of Activated Sludge Wastewater Treatment Systems," EPM Technical Report No. 73-1, Department of Environmental Engineering, Cornell University, Ithaca, New York.
2. Middleton, A.C. and Lawrence, A.W., 1974. "Least Cost Design of Activated Sludge Wastewater Treatment Systems," EPM Technical Report 74-1, Department of Environmental Engineering, Cornell University, Ithaca, New York.
3. Adamowski, K and Middleton, A.C., 1976. "Comprehensive Water Quality Study of the Rideau River from Long Island to Hog's Back Falls, June-July, 1975," Final Report to the Ontario Ministry of Environment, Kingston, Ontario.
4. Middleton, A.C. and McDougall, W.J., 1977. "Technological Alternatives for Industrial Wastewater Treatment," Seminar Notes, Civil Engineering, SUNY/Buffalo, Buffalo, New York.
5. Uchida, A. and Middleton, A.C., 1978. "Water Quality Modeling of Mine Acid Drainage II: Laboratory Evaluation of Preliminary Model," WREE Report No. 78-3, Civil Engineering, SUNY/Buffalo, Buffalo, New York.
6. Fritz, J.J., Meredith, D.D., and Middleton, A.C., 1978. "Modeling and Design of Wastewater Stabilization Ponds," WREE Report No. 78-4, Civil Engineering, SUNY/Buffalo, Buffalo, New York.
7. Middleton, A.C., Narbaitz, R.M., and Uchida, A., 1980. "Phosphorus Solubilization during Anaerobic Decomposition of Algae," WREE Report No. 80-1, Civil Engineering, SUNY, Buffalo, Buffalo, New York.
8. Fritz, J.J., Middleton, A.C., and Meredith, D.D., 1981. "Application of a Rational Process Model in Design of Waste Stabilization Ponds," WREE Report, Civil Engineering, SUNY/Buffalo, Buffalo, New York.



9. Kasprzak, P.J., Meredith, D.D., and Middleton, A.C., 1982. "Effect of Primary Settling Tank Efficiency on Cost Optimization of the Activated Sludge Process," WREE Report, Civil Engineering, SUNY/Buffalo, Buffalo, New York.
10. Numerous other technical, research and expert reports have been prepared during employment outside universities.

### **FUNDED RESEARCH PROJECTS**

1. "Design of Aerated Lagoons for Low Temperature Operation," funded by Research Office, School of Graduate Studies, University of Ottawa, for the amount of \$4,500, during the period March 20,1975 to December 31,1975 (Principal Investigator).
2. "Assessment and Control of Storm Water Pollution," funded by National Research Council of Canada, for the amount of \$16,500 during the period of April 1, 1975 to March 31, 1978 (Principal Investigator).
3. "Development of a Water Quality Model for the Rideau River," funded by Ontario Ministry of the Environment for the amount of \$12,065 during the period of May 20, 1975 to August 8, 1975 (Co-Principal Investigator).
4. "Microbial Production of Limestone from Gypsum," funded by the SUNY Research Foundation for the amount of \$2,100 during the period of January 1, 1977-December 31, 1980 (Principal Investigator).
5. "Phosphorus Solubilization during Anaerobic Decomposition of Algae," funded by National Science Foundation for the amount of \$52,887 during the period of October 15, 1977-March 31, 1980 (Principal Investigator).
6. "Co-Disposal of Wastewater Treatment Sludge and Municipal Refuse – City of Niagara Falls, New York," funded by City of Niagara Falls, New York for the amount of \$1,500 during the period of June 1,1978 to September 30,1978 (Co-Principal Investigator).
7. "Metals Recovery from Waste Metallic Hydroxide Sludges through Microbial Sulfate Reduction," funded by Environment Canada for the amount of \$30,000 during the period of January 1980 to May 1980 (Co-Principal Investigator).
8. "Development of MGP Site Remediation Methodologies," funded by Gas Research Institute for the amount of \$250,000 during the period of June 1986-June 1988 (Principal Investigator).
9. "Co-Treatment of MGP Groundwater in a POTW," funded by Gas Research Institute for the amount of \$250,000 during the period of June 1987-June 1988 (Principal Investigator).
10. "Pilot Scale Biosparging Project," funded by Gas Research Institute for the amount of \$226,000 during the period January 1994-April 1995.

### **PAST PROFESSIONAL ACTIVITIES**

1. Lecturer, Short Course on Engineering Control of Industrial Wastewaters, Cornell University, June 1975.
2. Technical Advisor, Environmental Conservation Task Force, Greater Buffalo Development Foundation, December 1976-May 1978.
3. Organizer and Chairperson, Hazardous Waste Management and Disposal Seminar, SUNY/Buffalo, February 1979.
4. Associate Engineer, Conestoga-Rovers, Ltd., Waterloo, Ontario, 1976-78. Consultant to government and industry on water and wastewater treatment and waste disposal on land.

5. Member, Chemical Manufacturers Association (CMA) Five-Plant Study Work Group on Priority Pollutant Removal by Biological Treatment Plants.
6. Member, U.S. EPA TSCA Panel on Genetic Engineering of Microorganisms for Bioremediation, Washington, D.C., 1987.
7. Member, Environmental Advisory Committee, Fox Chapel Borough, PA, 1988-91.
8. Member, Industrial Advisory Committee, Gulf States Hazardous Research Center, Lamar University, Beaumont, TX, 1990-91.
9. Member, Technical Advisory Committee, New York State Hazardous Waste Management Center, SUNY/Buffalo, Buffalo, NY, 1988-95.
10. Organizer of Gas Research Institute Seminar on "Risk-Based Corrective Action for Gas Industry Applications," Chicago, IL, 1996-97.
11. Developer and Lecturer in Courses on Operation of a Refinery Activated Sludge Wastewater Treatment Plant, Ergon Refining, Newell, WV, 1997-99.

**HEALTH AND SAFETY**

- 40-hour OSHA Hazardous Waste Operations Training, 1991
- 8-hour Hazardous Waste Supervisor Training, 1992
- 10-hour OSHA Construction Outreach Training, 2000
- 8-hour Competent Person Training (Trenching), 2000
- Confined-Space Entry Training, 2005

**TESTIMONY**

YEAR	TESTIMONY	STATE	CASE
1988-89	Deposition and trial testimony (expert witness) in Broderick Investment Co. vs. Ponderosa Timber regarding wood treating plants (Broderick Investment Co.)	CO	---
1989	Deposition and trial testimony (expert witness) in USF&G Co. vs. Colorado National Bank, et al. regarding wood treating plants (Broderick Investment Co.)	CO	Civil Action No. 86-Z-1033
1989-90	Pre-filed direct and rebuttal and cross-examination testimony (expert witness) before Massachusetts Department of Public Utilities regarding manufactured gas plants (Bay State Gas, et. al.).	MA	DPU 89-161
1991	Deposition testimony (expert witness) in Burlington Northern vs. Washington Natural Gas, et. al. regarding manufactured gas plants (Electric Utilities Group)	WA	No. C89-155TB
1991	Pre-filed direct and cross-examination testimony (expert witness) before Illinois Commerce Commission regarding manufactured gas plants (Peoples Gas Light & Coke, et al.)	IL	ICC: Docket Nos. 91-0080 through 91-0095
1991	Trial testimony (expert witness) in Escambia vs. Soule regarding wood treating plants (Escambia)	FL	---

1992	Rebuttal and cross-examination testimony (expert witness) before the New Jersey Bureau of Regulatory Commissioners regarding manufactured gas plants (South Jersey Gas)	NJ	BRC Docket No. GR91071243J
1992	Direct and cross examination testimony (expert witness) before the New Jersey Bureau of Regulated Utilities regarding manufactured gas plants (New Jersey Natural Gas)	NJ	BRC Docket No. GR91081393J□
1992	Deposition testimony (expert witness) in Chemical Lehman Tank Lines vs. Aetna regarding wastewater management (Chemical Lehman)	NJ	Case No. 89-1543
1993	Pre-filed direct and cross-examination testimony (expert witness) before Indiana Utilities Regulatory Commission regarding manufactured gas plants (Indiana Gas)	IN	Cause No. 39353 Phase II
1993	Deposition and trial testimony (expert witness) in Broderick vs. Hartford regarding wood treating plants (Broderick Investment Co.)	CO	Civil Action No. 86-Z-1033 CA No. 90-1112
1993	Deposition and trial testimony (expert witness) in Washington Natural Gas vs. Aetna regarding manufactured gas plants (Washington Natural Gas)	WA	Civil Action No. 91-2-13506-1
1994	Deposition testimony (fact witness) in Koppers Company vs. Aetna regarding the Koppers Company, Inc. (1978-1988)	PA	Civil Action No. 85-2136
1994-95	Pre-filed direct and cross-examination testimony (expert witness) before the Michigan Public Service Commission regarding manufactured gas plants (Consumers Power Company)	MI	Case No. 4-10755
1995	Testimony (expert witness) before the Oklahoma Corporation Commission regarding groundwater remediation (Oryx, ANR and Conoco, Inc.)	OK	Cause PD No. 920024760
1996	Deposition testimony in Indiana Gas vs. Aetna regarding manufactured gas plants (Indiana Gas)	IN	Civil Action 1:95CV101
1996	Deposition testimony (expert witness) in Hickmon vs. Oryx Energy Co. regarding groundwater remediation (Oryx, ANR and Conoco, Inc.)	OK	Case No. CIV94-1524-T
1997	Deposition testimony (expert witness) in EnergyNorth Natural Gas vs. UGI Utilities, Inc. regarding manufactured gas plants (EnergyNorth Natural Gas)	NH	C-95-438-B
1997	Deposition testimony (fact witness) in Penn Fuel Gas vs. Pennsylvania Electric Co. regarding manufactured gas plant site investigations and remediation (1996-1997)	PA	---
1999	Deposition testimony (fact witness) in Penn Fuel Gas vs. Aetna, et al. regarding manufactured gas plant site investigations and remediation (1996-1999)	PA	Chester Co., PA, Court of Common Pleas Civil Division No. 94-07744
2001	Deposition testimony (fact witness) in PSI Energy, Inc vs. Aetna, et al. regarding manufactured gas plant site investigations and remediation (1996-1999)	IN	Hendricks Co., IN, Hendricks Superior Court Cause No. 32DO1 9807 CP 230
2002-03	Deposition testimony (expert witness) in PECO Energy vs. INA, et al. regarding manufactured gas plants (PECO Energy)	PA	Chester Co., PA, Court of Common Pleas Civil Division No. 99-07386

2004	Deposition testimony (expert witness) in Bangor vs. Citizens Communications vs. Barrett et al. regarding manufactured gas plants (Citizens Communications)	ME	USDC, Maine, Civil Docket No. 02-cv-183-B-S
2004	Deposition testimony (30(b)6 witness, rebuttal expert witness) in PECO Energy vs. INA, et al. regarding manufactured gas plants (PECO Energy)	PA	Chester Co., PA, Court of Common Pleas Civil Division No. 99-07386
2005	Deposition testimony (expert witness, rebuttal expert witness) in Puget Sound Energy v. Alba General Insurance Co. et al. regarding manufactured gas plants (Puget Sound Energy)	WA	Superior Court of State of Washington No. 97-2-29050-3 SEA
2005	Trial testimony (expert witness) in Bangor vs. Citizens Communications vs. Barrett et al. regarding manufactured gas plants (Citizens Communications)	ME	USDC, Maine, Civil Docket No. 02-cv-183-B-S
2006	Deposition testimony (30(b)6 witness) in CGCU vs. Aetna Casualty & Surety Co., et al. regarding manufactured gas plants (CGCU)	IN	Marion Co., IN, Superior Court Cause No. 49F12-0407-PL-01986
2007	Deposition testimony (expert witness, 30(b)6 witness) in CGCU vs. Aetna Casualty & Surety Co., et al. regarding manufactured gas plants (CGCU)	IN	Marion Co., IN, Superior Court Cause No. 49F12-0407-PL-01986
2010	Deposition testimony (expert witness) in SIGECO vs. Admiral Ins. Co., et al. regarding manufactured gas plants (SIGECO [Vectren])	IN	Marion Co., IN, Superior Court Cause No. 49D05-0411-PL-2265
2011	Deposition testimony (rebuttal expert witness) in SIGECO vs. Admiral Ins. Co., et al. regarding manufactured gas plants (SIGECO [Vectren])	IN	Marion Co., IN, Superior Court Cause No. 49D05-0411-PL-2265
2011	Pre-filed direct testimony (expert witness) before Public Utility Commission of Oregon regarding manufactured gas plants (NW Natural)	OR	UG 221
2012-13	Pre-filed direct (expert witness) and cross examination testimony before Public Utility Commission of Ohio regarding manufactured gas plants (Duke Energy Ohio)	OH	Case No. 12-1685-GA-AIR
2013	Deposition testimony (expert witness) regarding the Orlando, FL manufactured gas plant (Confidential Client)	FL	Settlement proceedings pursuant to a confidentiality agreement
2017	Deposition testimony (30(b)6 witness) in King Co. vs. Travelers et al regarding Metro (King Co.)	WA	USDC, Seattle, 2:14-cv-01957
2017	Deposition testimony (expert witness) regarding the Olympia, WA, manufactured gas plant (Puget Sound Energy)	WA	Thurston Co., WA Superior Court Cause No. 11-2-02601-6
2018	Deposition testimony (expert witness) regarding Cincinnati, OH, manufactured gas plant (Duke Energy Ohio)	OH	Duke Energy Ohio v. AEGIS, et al, Hamilton Co., OH, Court of Common Pleas, Case No. A160405