

**DR. TIMOTHY A. WOLFE**  
**RETIRED FROM STANTEC CONSULTING**  
**VICE PRESIDENT, EMERITUS**

**EDUCATION:** PhD, Sanitary Engineering, Iowa State University  
MS, Sanitary Engineering, Iowa State University  
Bachelor of Civil Engineering, Cleveland State University

**SUMMARY:**

Since his retirement in 2016 Dr. Wolfe continues to volunteer with the Ohio State University by:

1. Assisting with the Environmental Engineering Capstone courses that expose senior students to real-world projects with the Columbus DOW and DOSD. Tim helped create these courses and has been involved with them for over a decade, and
2. Assisting with Master's degree students:
  - Committee member for M.S. student in Civil Engineering: Megan Patterson, 2019, "Developing Ohio EPA Design Standard for Low-pressure membranes" to enable the use of this technology in Ohio Public Water Systems.
  - Committee member for M.S. student in Civil Engineering: Joshua Fuchs, 2022, "Developing Ohio EPA Design Standard for Ozone" to enable the use of this technology in Ohio Public Water Systems.

Also in retirement Tim continues to volunteer on the Ohio AWWA Technology Committee, working to create:

- A "Simultaneous compliance document", and
- a description for an "Engineer's report" that would allow public water systems and their design consultant to obtain Ohio EPA approval for innovative technologies (i.e., those without design standards in Ten-State Standards) without having to conduct a pilot-scale demonstration study.

During his career as a consultant Tim interacted extensively with municipalities – assisting clients with development of innovative solutions to their drinking water needs. He worked closely with clients to package specific treatment technology(s) that met each client's technical, sustainability, regulatory and political needs in a cost-effective manner. Tim stayed current on emerging regulations and treatment technologies through his active involvement in professional organizations; particularly AWWA. Tim is a Professional Engineer, P.E. (retired in good standing) and a Board-certified Environmental Engineer, BCEE (retired in good standing) with the AAEES. He has forty-five years of diverse experience in environmental engineering. Before joining Stantec as part of a merger in 2016, Tim was a Vice President with MWH, earlier he was a partner in a regional environmental engineering consulting firm

(Havens & Emerson) and an environmental engineering university professor; and even earlier in his career Tim served on the national staff of a professional engineering society.

## **PROFESSIONAL EXPERIENCE:**

### **Municipal Water Treatment**

Dr. Wolfe has been involved with bench-, pilot- and full-scale demonstration studies; and the process design and evaluation of numerous Water Treatment Plants (WTPs). His experiences include:

Columbus, OH – Assisted with completion of a residual solids management plan for the City's Division of Water (DOW). Objectives of the project were to:

- Determine the remaining life of the McKinley Avenue quarry,
- Establish the mass of residual solids produced during water treatment at each of DOW's three water plants (and, at a potential future fourth water plant),
- Evaluate current residuals management strategies, and
- Develop and evaluate residuals management alternatives to identify the most cost-effective strategy for managing DOW residuals in both the short and long term.

Elyria, OH – Worked with the City to produce a Basis of Design table for Ohio EPA approval of the component capacities and the approved capacity of the Elyria WTP. Assisting the City as they prepare to conduct a full-scale demonstration study to high rate its existing WTP so the City has more capacity to supply neighboring communities with finished water.

Warren, OH – Helped the City determine the capacity of both its water filtration plant and distribution system to establish the quantity of water that the City could reliably provide on a regular basis to a new customer. Working with the City to complete design and construction of a water pipeline to supply finished water to a new energy plant being started up in a nearby community.

Aqua Ohio, Struthers, OH – Worked with Aqua Ohio to expand and upgrade its existing Struthers WTP. New solids-contact units are to be installed to enhance the softening process.

Avon Lake Regional Water, Avon Lake, OH – Assisted with a project to upgrade and expand Avon Lake's existing water filtration plant (WFP). The project helps Avon Lake Regional Water address: periodic algal blooms on Lake Erie, occasional winter intake ice issues and ultimately expansion of the WFP to an approved capacity of 60 MGD. Components of the WFP included in the project were:

- construct two new clearwells (7 & 8) and a corresponding South finished-water pump station on the available site south of Lake Road,
- convert existing clearwells 1 – 4 into backwash recycle attenuation basins,

- build a new 3-million gallon (MG) overhead storage tank in Avon Lake's distribution system,
- convert the existing gaseous chlorine system to sodium hypochlorite, and
- replace the existing media in the dual-media filters.

The clearwells are designed to match the next two planned expansions (to first 60 and then 70 MGD) of the 50-MGD WFP to meet growing customer water demands (i.e., clearwell capacity will be 60 MGD based on Ohio EPA criteria, and can be increased in the future to 70 MGD based on successful performance of a full-scale tracer study). The project was implemented using the Construction Manager at Risk (CMAR) alternate project-delivery method to meet the tight deadlines for: receiving zero-percent interest loans from the Ohio EPA, and having the new clearwells on-line prior to the winter of 2016-17.

Aqua Ohio, Struthers, OH – Assisted Aqua Ohio in planning for the future by working with staff to implement a number of data gathering / analyses exercises, that might be rolled out at Aqua America's WTPs across the US. These exercises identified the condition of the water-supply source, treatment and distribution system facilities at various Ohio water systems. Aqua Ohio is leading the national charge and MWH worked with Ohio staff to complete WTP facility plans at its Struthers and Marion WTPs. We also worked with Aqua Ohio to complete facility plans at its Massillon and Ashtabula WTPs. These facility plans took a close look at the condition of Aqua Ohio's existing WTPs – in terms of:

- Remaining useful life of major equipment,
- Single points of failure,
- Ability of the facilities to continue meeting 'water-quantity' commitments, and
- Ability of the facilities to continue meeting 'water-quality' regulations and goals.

Columbus, OH – Assisted the Division of Water (DOW) with full-scale implementation of post-filter UV disinfection at its 125-MGD Hap Cremean Water Plant (HCWP). Worked closely with DOW staff in the preliminary design phase to select: the level of *Crypto* inactivation, design flow, procurement method, type of UV system (i.e., low-pressure high-output or medium-pressure reactors), alternative layout of the UV reactors, and other pertinent design information. The UV system was sized for peak-hour production since DOW chose to install individual reactors on filtered-water piping for each of HCWP's twenty-four filters. MWH provided overall coordination with Ohio EPA for UV-related issues in the pre-design phase at both DOW's HCWP and Dublin Road Water Plant (DRWP). MWH completed detail design of the HCWP UV system and the project has been constructed.

Cleveland, OH – Assisted with completion of a residual solids management plan, including disposal costs, for the Cleveland Division of Water (CWD). Objectives of the report were to:

- Establish the mass of residual solids produced during water treatment at each of CWD's four water works,

- Evaluate current residuals managements strategies, and
- Develop and evaluate residuals management alternatives to identify the most cost-effective strategy for managing CWD residuals.

Residual solids production rates reported from each of CWD's four water works were evaluated and compared to mass-balance estimates to determine reasonable production rates for developing and evaluating alternatives. Alternative residual solids management strategies were then developed and evaluated for each of CWD's water works. Design parameters were established for each of these residuals management options. The required facilities were sized based on these design parameters and the updated solids production rates. Planning-level capital and annual operation and maintenance (O&M) costs were developed for each option. Options were also evaluated based on non-cost criteria. Estimated capital cost, annual cost, equivalent annual cost (EAC), and total present worth (TPW) of each option over a 20-year design period were developed based on a 3-percent annual interest rate.

Avon Lake, OH – Assisted with a full-scale, Demonstration study to ultimately expand the municipal utility's (now Avon Lake Regional Water) existing WFP from an approved capacity of 50 to 60 MGD by further high rating existing pre-treatment facilities and potentially constructing a few new facilities. Worked with Ohio EPA to operate part of the WFP at higher rates Avon Lake demonstrated under future max.-day conditions flocculation at a detention time of 12.5 minutes, a tube-settler rise rate of 2.6 gpm/sf and a dual-media filtration rate of 6 gpm/sf. This is the third full-scale study in which Avon Lake has demonstrated a larger capacity for Ohio EPA for the individual components of its WFP – in this study the entire pre-treatment train received a new component capacity of 60 MGD.

Columbus, OH – Provided assistance to determine which water treatment processes should be included in a standby power project for the DOW, as a sub to ARCADIS, for which MWH is:

- Coordinated preliminary design of the standby power facilities at the 125-MGD, HCWP with preliminary design of the standby power facilities at the 80-MGD, Dublin Road Water Plant (DRWP).
- Conducted evaluations and meetings with DOW staff to evaluate up to two different time/demand scenarios, one scenario being for a time period of three days and a total demand of 100 MGD between HCWP and DRWP.
- Evaluated the option of using the standby power generators at HCWP to “peak shave” during times of high energy demand by outlining cost and non-cost (pros, cons, permitting/regulatory, etc.) considerations associated with “peak shaving” capability.
- Provided preliminary design services to abandon the existing electrical power feed to the Administration Building/PAC Facility at HCWP, and re-feed these loads using a new circuit originating at the plant substation.

Columbus, OH – Was scheduled to assist the DOW with the official Ohio EPA full-scale microbial demonstration studies to determine the most appropriate way to operate the existing split-treatment softening Parsons Avenue Water Plant (PAWP). PAWP is currently a groundwater treatment facility. DOW is considering taking advantage of additional cost-effective water that will become available as near-by mining quarries are abandoned and turned over to DOW for use as a water-supply source. PAWP's source-water classification would then gradually change from ground water to groundwater under the direct influence (GWUDI) of surface water to actual surface water. Surrogate parameters potentially to be used in the studies to indirectly quantify the *Cryptosporidium* removal achieved by the existing groundwater treatment facilities at the PAWP include: endospores, HPC and particle counts > 2 um in equivalent diameter.

Avon Lake, OH – Assisted with preparation of a water master plan to lay out more cost-effective, phased expansions of the municipal utility's existing 50-MGD WFP to meet short- and long-term growing finished-water demands. MWH has assisted Avon Lake municipal utilities (now Avon Lake Regional Water) for decades with cost-effective expansions of the WFP in phases from an approved capacity of 10 to 50 MGD. Most of these expansions have been accomplished by high rating existing components from the rapid-mix units to the clearwells. A (short-term) next expansion from 50 to 60 MGD was evaluated in terms of both further high rating of existing components and constructing new components in parallel with existing ones. Long-term expansions were explored to determine the ultimate capacity of the two Avon Lake owned sites north and south of Lake Road.

**Columbus, OH – Assisted DOW with full-scale implementation of intermediate-ozonation and biologically-active carbon (BAC) filtration at the HCWP using one of the four implementation options developed during the HCWP Master Plan. This capital improvement project was selected from among five treatment alternatives that were demonstrated at either the bench or pilot scale. New recarbonation and ozone contact chambers were retrofitted into an over-sized existing recarbonation basin (i.e., originally a sedimentation basin) and the ozone generators and related equipment are being retrofitted in a second over-sized recarbonation basin to avoid the need for intermediate pumping. Computational fluid dynamics modeling was used to verify that there was minimal short circuiting in the retrofitted contact basins. The ozone and BAC filtration are being used to remove additional total organic carbon (TOC) prior to addition of chlorine for disinfection. Construction has been completed and the project is currently in operation.**

Cleveland, OH – Assisted with CWD's investigation of treatment alternatives for water from the Lake Erie Dead Zone in the summers of 2009, 2012 and 2013. The 2009 study indicated potassium permanganate (KMnO<sub>4</sub>) pretreatment is the most effective method for removing the higher iron and especially manganese concentrations from dead-zone water, and that the optimal permanganate dose corresponds to stoichiometric requirements for iron and manganese oxidation.

CWD staff was interested in developing a standard operating procedure (SOP) and an analytical method that could be used to quickly sample source water and adjust the KMnO<sub>4</sub> dose when dead-zone water reached one of CWD's four intakes. A follow-up study was

conducted in September 2013 to evaluate and confirm use of the Hach DR/890 testing kit as an operational tool for treatment of Lake Erie dead-zone water. This study built upon the methods and results from previous dead-zone investigations, including the summer 2012 evaluation of the Hach kit.

Columbus, OH – Assisted Division of Power and Water (DOPW), now DOW, with development of general procedures to be followed in an emergency response plan during the approaching period in which its three existing water plants (WPs) will be under construction. DOPW is systematically implementing a water system master plan to expand and upgrade its three WPs. It might not be possible to avoid two or more of these WPs being under construction at the same time. Several potential emergency and maintenance service outages were developed for DOPW's water system. A pair-wise comparison workshop was used to assist DOPW staff in determining the three service outages most likely to occur. A second workshop was convened to develop actions to be taken to mitigate risk if any of these three service outages were to occur while planned construction is ongoing at DOPW's water plants. This exercise was intended to prepare DOPW staff should these or similar service outages occur during the construction period to upgrade and expand its WPs.

Lima, OH – Assisted the City with full-scale implementation of post-filter granular activated carbon (GAC) adsorption units to: 1) mitigate periodic taste-and-odor episodes, and 2) provide a comfort level for continued compliance with the locational running annual average (LRAA) associated with Stage 2 of the DBPR. Intermediate pumping associated with post-filter GAC adsorption also provided the opportunity to reroute flow through the existing clearwell system. Also assisted City staff with changing flow patterns through the existing clearwell system at Lima's 30-MGD WTP to provide operational flexibility and to enhance disinfection efficiency and maximize regulatory CT credit. Construction of this project was completed and the new facilities went on-line in the summer of 2012.

**Columbus, OH – Served on a Blue-ribbon panel to perform a comprehensive peer review of how the Columbus DOPW should proceed with upgrading and expanding the Dublin Road Water Plant (DRWP). The DRWP is one of three existing DOPW WPs and is the only one currently located on the Scioto River. The River is challenged with infrequent source-water nitrate and atrazine events, as well as the continual presence of disinfection by-product (DBP) precursor materials. DOPW's other surface-water facility, the Hap Cremean WP (HCWP), and its ground-water facility, the Parsons Avenue WP (PAWP) do not experience nitrate or atrazine events. To maintain nitrate levels at acceptable levels in the distribution system - the blue-ribbon panel evaluated treatment and source-water blending at the DRWP, and moving finished-water around the distribution system from DOPW's other two WPs. Several means to remove total organic carbon (TOC) were evaluated to develop a pilot-scale demonstration program to determine the most appropriate technology(s) to manage DBPs.**

Columbus, OH - Assisted with preparation of a Water Master Plan for the Columbus DOPW. This project involved generating both a Distribution System Master Plan and a Comprehensive Master Plan in which individual Master Plans for DOPW's three existing water plants (WPs) and associated sources were compiled. Extensive population forecasting was completed both

inside and outside DOPW's existing service boundary. Population and land-use designations were used to project future water demands at five-year intervals to determine where and when additional drinking water might be needed. A 30-year CIP was developed for source and existing WP facilities, and a potential future fourth WP – and, a 15-year CIP was developed for DOPW's extensive distribution system. Master Plan results were used to help prioritize DOPW's CIP so it could be compared with and integrated with the CIP for the Division of Sewers and Drains (DOSD). Criterium Decision-Plus (CDP) software was used to facilitate a workshop to help obtain DOPW's staff buy-in for the timing and sizing associated with a potential fourth WP – the second DOPW surface-water facility on the Scioto River.

Columbus, OH - Assisted with preparation of a Master Plan for DOPW's Parsons Avenue Water Plant (PAWP). This facility currently processes ground water that may be influenced or replaced by surface water in the next few decades. MWH provided oversight of: 1) new vs. baffled existing clearwells to meet future CT disinfection requirements, 2) enhanced recarbonation to minimize deposition related to split-treatment softening, and 3) potential surface water treatment technology to precede softening. Results of these studies and workshops will also determine capital and/or O&M improvements that would best position PAWP as a 50-MGD surface-water facility.

**Columbus, OH - Assisted with preparation of a Master Plan for DOPW's HCWP. A report of a universe of technologies was prepared for 30+ technologies that could reduce DBP levels, and a pair-wise comparison workshop was used to narrow the list to a half-dozen feasible technologies. These feasible technologies were used to generate ten treatment alternatives. A CDP workshop was conducted to select up to three alternatives to demonstrate in one-year pilot-scale studies. The workshop resulted in the selection of two pilot-scale and four bench-scale demonstration studies that were completed to gather the appropriate data to set the CIP for DOPW's HCWP for the next decade. A second CDP workshop was used to select intermediate-ozonation and BAC filtration as the treatment alternative for full-scale implementation at the HCWP. Three initial implementation options and a subsequent fourth option were developed for potential use at the HCWP.**

Lima, OH – Assisted the City in determining the most appropriate and cost-effective means for Lima to: 1) mitigate periodic taste-and-odor episodes, and 2) prepare for continued compliance with the LRAA associated with Stage 2 of the DBPR. Bench-scale and desk-top studies were conducted to select post-filter GAC adsorption units, over intermediate-ozonation combined with biologically-active filtration (BAF), for full-scale implementation at the WTP. A half-day interactive workshop proved to be valuable in soliciting input from Lima WTP staff of all levels, and achieving buy-in on the selected capital improvement. Suggestions were made for modifying flow patterns through the existing clearwell system to provide flexibility and to enhance disinfection efficiency and regulatory approval at the City's 30-MGD WTP.

New Philadelphia, OH – Served as Principal-in-Charge for project to assist the City in determining the cause of manganese (Mn) deposition in New Philadelphia's distribution system, particularly in customer water meters. Water quality data were analyzed and compared with various chemistry models to determine the most appropriate and cost-effective means to

mitigate the Mn precipitation issue. Intermediate aeration, and the associated stripping of carbon dioxide, was determined to most likely be the reason for the rise in pH values and the resulting saturated conditions affiliated with calcium carbonate and manganese dioxide. Simple carbon dioxide addition was evaluated in a partial, full-scale demonstration study prior to proceeding with design and construction of a permanent full-scale carbon dioxide storage-and-feed facility.

Cincinnati, OH - Assisted with preparation of the 2008 Master Plan for Greater Cincinnati Water Works (GCWW). Project included evaluation of both the 240-MGD Richard Miller Treatment Plant (RMTP) that processes Ohio River water, and 40-MGD Charles M. Bolton Treatment Plant (CMBTP) that processes groundwater. The evaluation involved: 1) a situation audit to address regulatory compliance, 2) a capacity audit to determine both the process and hydraulic capacities, and a 3) facilities audit to establish the useful life-costing analysis for major equipment. Focus for MWH was the capacity audit and oversight for development of the Master Plan. MWH also facilitated a CDP workshop that was used to help prioritize improvement projects for both of GCWW's Treatment Plants.

Columbus, OH – Assisted DOPW, as part of the SAIC Team, in implementing the security-enhancement improvements that were identified in the Vulnerability Assessment (VA) previously completed for the Columbus' water system (i.e., source, treatment and distribution facilities). Specifically worked with DOPW staff to determine the potential need for additional monitoring of the distribution system.

Struthers, OH – Served as Principal-in-Charge on a WTP expansion/upgrade project for Aqua Ohio that involved working with Aqua personnel to conduct a pilot-scale demonstration study, prepare a preliminary engineering report, and develop detailed design documents to upgrade several elements of the existing WTP and increase the approved capacity of the treatment facility from 5.75 to 7.1 MGD. The preliminary engineering report developed several alternatives for Aqua to expand/upgrade their existing lime/soda ash softening facility by replacing existing conventional sedimentation with solids-contact units. These alternatives, and several other WTP improvements, were evaluated on both a cost and non-cost basis. The detailed design documents have been developed and approved by Ohio EPA.

Warren, OH – Served as Principal-in-Charge on a design project for the City involving sodium hypochlorite, storage-and-feed facilities. Assisted the City in obtaining Ohio EPA plan approval for these facilities. Preliminary engineering, detailed design and construction have all been completed. The City of Warren is now able to feed hypochlorite in lieu of gaseous chlorine to the benefit of operator safety.

Toledo, OH - Served as Principal-in-Charge on a project in which a series of bench-scale tests were performed to evaluate the efficacy of potassium permanganate and powdered activated carbon (PAC) for reducing the formation of regulated disinfection by-products in the City's distribution system.

Trenton, NJ – Assisted the City with a comprehensive evaluation of Trenton's Water Works to enhance their ability to meet existing drinking water regulations, and to prepare the City for



compliance with anticipated ones. The evaluation involved: a Situation audit that addressed regulatory compliance, a Capacity audit that determined both the process and hydraulic capacities, and a Facilities audit that established the useful life-costing analysis for major equipment. Assisting the City with development of a Master Plan to prioritize, schedule and implement the required capital improvements that were identified in the WTP audit.

Warren, OH – Served as Principal-in-Charge on a design project for the City involving aqueous ammonia, storage-and-feed facilities. Construction of these facilities has been completed and the City of Warren is feeding ammonia – i.e., converted secondary disinfection in the water distribution system from free chlorine to chloramines. Chloramination is helping the City reduce the formation of regulated disinfection by-products in the distribution system.

Columbus, OH – Assisted the Columbus DOPW, as part of the SAIC Team, in completing a VA for the Columbus' water system (i.e., source, treatment and distribution facilities). The SAIC/MWH Team used the Risk Assessment Methodology developed by Sandia for Water systems (RAM-W) to develop recommendations for enhancing the security systems at the DOW's critical facilities and reducing the consequences of a potential malevolent act.

US Bureau of Reclamation – Assisted the Bureau, as part of the MWH/SAIC team, in completing VAs for twenty of the Bureau's dams in the western part of the US. The comprehensive RAM developed by Sandia for Dams (RAM-D) was used to lead one of the MWH/SAIC Teams that developed recommendations for enhancing the security systems at the dams and reducing the consequences of a potential malevolent act.

Warren, OH – Assisted the City with conversion to chloramination at Warren's existing water filtration plant. The City conducted bench and pilot-scale testing to determine the most appropriate and cost-effective means of meeting the requirements for both Stages 1 and 2 of the D/DBPR. The selected alternative was to switch the secondary-disinfection approach from free chlorine to chloramines. The Ohio EPA "Guideline for Evaluation and Implementation of Chloramination" was followed to obtain the Agency's approval for Warren to convert from chlorination to chloramination.

Butler Co., OH – Assisted the County in obtaining Ohio EPA approval to feed liquid soda ash at an entry point into the County's water system from which it receives drinking water from the City of Hamilton. The soda ash is being added to increase the buffering capacity of the water entering the County's system; leading to more consistent water quality (particularly water stability) throughout the County's system. The soda ash addition is one of several alternatives being undertaken by the County to mitigate pinhole leaks that periodically occur in the copper plumbing of homes.

New Lexington, OH – Assisted the City with bench-scale studies to determine the most cost-effective means of meeting the requirements for both Stages 1 and 2 of the D/DBPR. Alternatives evaluated include: a) chemical optimization (e.g., enhanced coagulation and enhanced softening scenarios), b) granular activated carbon (GAC) adsorption, and c) alternate disinfectants (e.g., chlorine dioxide and chloramines). The City selected post-filter GAC

adsorption units as the means to comply with current and future disinfection by-product regulations.

Struthers, OH – Assisted the Consumers Ohio Water Company (now Aqua Ohio) with conversion to chloramination at the Poland WTP in the Water Company's Struthers Division. The Water Company determined that the most appropriate and cost-effective means of meeting the requirements of the LT-2-ESWTR and Stage-2-DBPR was to switch the secondary-disinfection approach from free chlorine to chloramines. The Ohio EPA "Guideline for Evaluation and Implementation of Chloramination" were followed by the Water Company to obtain the Agency's approval to convert to chloramination.

Steubenville, OH – Assisted the City with the design and construction of a new 6.0-MGD WTP using high-rate clarifiers and dual-media filters at a filtration rate of 4 gpm/sf. An alternative project delivery (design-build) was used to expedite completion of this project. The new WTP processes water from raw-water reservoir that receives water pumped from the Ohio River. Flexibility was provided in the design for the future installation of UV disinfection should the City have to inactivate *Cryptosporidium* after Steubenville has conducted source-water monitoring to determine the density of *Crypto* that might be present in the Ohio River.

West Carrollton, OH – Assisted with performance of a pilot-scale study to: a) define the design parameters for a 1.5-MGD nanofiltration plant, and b) obtain Ohio EPA approval for the WTP. A key part of this study was to seek Ohio EPA approval for the nanofiltration process in general, not just approval of the membrane element evaluated during the study. It was negotiated with the Agency that the City would perform a 30-day performance test to obtain Ohio EPA approval of the membrane element selected following the bidding process.

Steubenville, OH – Assisted the City with a pilot-scale, Demonstration study to obtain Ohio EPA approval of high-rate clarification and dual-media filtration for processing Ohio River water. A Superpulsator clarifier was evaluated for high-rate clarification, and dual-media filters were evaluated at a filtration rate of 4 gpm/sf.

Hamilton, OH – Assisted the City with implementation of full-scale, Demonstration Studies to obtain Ohio EPA approval for increasing the approved capacity of Hamilton's South WTP first from 28 to 30 MGD, and then from 30 to 40 MGD. The two-week Studies were used to document that the existing solids-contact clarification/softening units and filtration facilities could be operated effectively at the higher rates.

Dayton, OH – Assisted the City in obtaining Ohio EPA approval to operate Dayton's two WTPs without adding a coagulant. Addition of a coagulant would cause the shutdown of the City's lime-reclamation facilities. Full-scale, Microbial Challenge studies were conducted to demonstrate for the Agency that lime softening is equivalent to coagulation for the removal of microbials of concern (i.e., *Giardia* and *Cryptosporidium*), since Dayton's two groundwater supplies have been classified by the Ohio EPA as groundwater under the direct influence of surface water. Heterotrophic plate count (HPC), endospores and particle counts were used as potential surrogates for the microbials of concern. Log removals of these three surrogate parameters were monitored between the recharge channels of the City's Miami well field and

the full-scale, filter effluent at the Miami WTP. A similar Microbial Challenge study was undertaken at Dayton's Ottawa well field and WTP.

Avon Lake, OH – Assisted the municipal utility with the performance of fluoride tracer studies to obtain Ohio EPA approval of higher effective-volume factors for the existing clearwell system at the WFP. Results of the studies allowed for expansion of Avon Lake's existing WFP from an Agency-approved capacity of 24 MGD to roughly 40 MGD without having to construct additional clearwells.

East Liverpool, OH – Assisted the City with the performance of a desk-top evaluation study to determine continued compliance with the LCR. The City's WTP is a surface-water facility, and finished water in the distribution system resulted in a one-time exceedance of the Action Level for lead. The desk-top study concentrated on the evaluation of both precipitation and passivation, corrosion-control alternatives. The City decided to switch from high pH carbonate passivation to a lower pH phosphate passivation – helping the City in complying with forthcoming regulatory requirements for disinfection by-products.

Warren, OH - Preparation of detail plans for upgrading the City's existing water filtration plant to provide continued compliance with evolving drinking water regulations (particularly the IESWTR and Stage 1 of the D/DBPR). Processes included in the design consist of raw-water pumping, expansion of the raw-water pump station, extension of a finished-water line to the raw-water pumping station, several chemical storage/feed facilities and rehabilitation of flocculation. Providing overall coordination of the design and construction of these water filtration plant improvements with a filter rehabilitation project being designed by others.

Avon Lake, OH – Preparation of detail plans for expansion of the municipal utility's existing WFP from an approved capacity of 27 to 40+ MGD. Processes included in the design consist of source-water pumping, source-water piping, modification of three of the four existing settling basins, high-service pumping, electrical supply and chemical-storage/feed facilities. Tracer studies were conducted on the existing clearwell system to obtain Ohio EPA approval for increased effective volume factors (i.e., higher clearwell component capacity). Construction of the WFP improvements has been completed.

Cleveland, OH – Assisted the Cleveland Division of Water with the performance of a comprehensive evaluation of existing filter media at the Division's four water treatment facilities. Most of the Division's 108 filters were evaluated by conducting: 1) visual inspections of each filter; 2) measurement of filter-media depth and depth to gravel; 3) a filter coring of each filter before backwashing; 3) an assessment of the backwash procedures, including measurement of bed expansion and spent washwater turbidity during backwashing; 4) a filter coring of each filter after backwashing; and measurement of filter-effluent turbidities and particle counts during filter ripening when the filter is returned to service. Filter-coring samples were analyzed in the laboratory to develop solids-retention profiles and grain-size distributions for the existing media. This project included classroom interaction with operators to discuss results of each filter evaluation, and separate presentations of the theory and practice of regulatory impacts, filtration, filter coring, on-line turbidity monitoring and on-line particle monitoring.

Toronto, CANADA – Assisted the York Region with the selection of low-pressure, membrane filtration facilities for the Region’s Georgina Water Supply project. The Region, in conjunction with North West Water of Canada, is constructing a 30 ML/day WTP (expandable to 50 ML/day) to process water from Lake Simcoe. The process train of the WTP consists mainly of low-pressure membranes followed by granular activated carbon adsorption facilities. Montgomery Watson prepared a comprehensive performance specification for the Region to use in selecting the low-pressure membrane system that best fits its needs. We also provided assistance to the Region with selection of the preferred low-pressure membrane system.

Cleveland, OH – Assisted with a pilot-scale demonstration study at the Cleveland Division of Water’s Baldwin treatment facility. This study was conducted to: a) obtain Ohio EPA approval for a filtration rate of 4.4 gpm/sf; b) select from among four filter-media configurations for installation at the Division’s Baldwin, Morgan and Nottingham treatment facilities; and c) compare pressure-driven ultrafiltration with vacuum-driven microfiltration for processing raw Lake Erie water. A full-scale study was also performed by monitoring for aerobic endospores to conduct mass balances and determine potential alternatives for handling residual streams at Baldwin, Morgan and Nottingham.

Montgomery Co., OH – Assisted with the performance of a pilot-scale demonstration study to: a) define the design parameters for a 15-MGD nanofiltration plant, and b) obtain Ohio EPA approval for the WTP. A key part of this study was to seek Ohio EPA approval for the nanofiltration process in general, and not approval of the specific membrane element used during the study. It was negotiated with the Agency that Ohio PWSs could then use a 30-day performance test to approve the membrane element with the winning bid. The 15-MGD nanofiltration facility is being designed as a redundant supply to supplement the finished water the County currently receives from the City of Dayton.

Cleveland, OH – Assisted with a full-scale demonstration Study at the Division’s Crown treatment facility. This study was conducted to obtain Ohio EPA approval for a filtration rate of 6.25 gpm/sf. One full-scale filter (72 in. depth of 1.0 mm ES anthracite) was operated at the current filtration rate (i.e., 5.4 gpm/sf) and a second one at the higher proposed rate.

Dayton, OH – Assisted the City with a bench-scale study to determine alternate means of providing coagulation, etc. at their two groundwater softening facilities. The City’s groundwater sources were classified as being under the direct influence of surface water by the Ohio EPA.

Sandusky, OH – Assisted with process selection in preparation for creating detail plans for upgrading the twelve filters and one of two clearwells at the City’s Big Island WTP.

Mahoning Valley Sanitary District, OH – Directed a bench-scale study to determine both: a) the cause(s) of taste-and-odor episodes periodically encountered in the finished water of the MVSD’s WTP, and b) potential treatment alternatives to mitigate these taste-and-odor events. Treatment alternatives evaluated to minimize taste and odor in the finished water included: powdered activated carbon, potassium permanganate, break-point chlorination, ozonation and

chlorine dioxide. The recommended short-term solution was to increase the capacity and flexibility to feed powdered activated carbon (PAC) at the MVSD's WTP.

Warren, OH – Assisted with the production of a Risk Management Plan for the City's water filtration plant and in bringing the water filtration plant into compliance with process safety standards.

Cincinnati, OH – Engineering study to evaluate the potential impacts of blending finished water from the City's Richard Miller Treatment Plant with finished water from the Northern Kentucky Water District. Issues investigated included corrosion control, disinfection by-product formation and disinfectant residuals.

Butler County, OH - Engineering study to evaluate the potential impacts of blending finished water from the City of Cincinnati's Richard Miller Treatment Plant with finished water from the City of Hamilton's groundwater softening plant. Issues investigated included corrosion control, disinfection by-product formation and disinfectant residuals.

Avon Lake, OH - Preliminary engineering design study to expand the municipal utility's existing WFP from roughly 27 MGD to 40+ MGD. A 40-MGD facility was achieved by: a) high rating the existing Flocculation Basins for Sedimentation Basins No. 1 through 3 and adding tube-settler modules to the effluent portion of these three existing Sedimentation Basins, b) high rating the twenty existing filters from a currently approved filtration rate of 3 or 4 gpm/sf to a rate of 5 or 6 gpm/sf, and c) performing a tracer study to improve the approved effective-volume factor for the existing Clearwells. A full-scale, Demonstration Study was conducted to achieve Ohio EPA approval for high-rate rapid mixing, flocculation, clarification and filtration. Bench-scale ozonation studies were performed to determine the benefits of potentially incorporating pre- or intermediate-ozonation into the existing treatment train in a future expansion/upgrade. The study concluded a 50-MGD WFP could be achieved cost-effectively in the future by adding additional dual-media filters at a filtration rate of 5 or 6 gpm/sf and implementing a few other process improvements.

Indianapolis Water Co., IN - Evaluation of ways to increase the raw-water supply for the Water Company's extensive water system. A comparison was made between using surface WTPs to process water taken directly from gravel pits, with using ground WTPs to process water obtained from wells installed around gravel pits.

Waukegan, IL - Assisted with an evaluation of the City's existing WTP to determine its ability to meet current, proposed and anticipated drinking water regulations; and made recommendations of potentially needed modifications at the City's WTP.

Cincinnati, OH - Assisted with a one-year Demonstration Study to obtain Ohio EPA approval for high-rate clarification and filtration at the City's Richard Miller Treatment Plant. The Demonstration Study for high-rate clarification was conducted at full scale, and for high-rate filtration at pilot scale. Primary result of the study was Ohio EPA approved an increase in the approved capacity of the RMTP from 175 to 220 MGD. Microfiltration was also evaluated at the pilot scale. Helped summarize results of the Study and assisted the City in developing a

comprehensive short-term and long-term capital improvements program for the Richard Miller Treatment Plant.

Warren, OH - Assisted with bench-scale studies and a three-month, pilot-scale study at the City's Water Filtration Plant. Bench-scale studies evaluated enhanced coagulation, ozonation and granular activated carbon (GAC) adsorption. The pilot-scale study evaluated intermediate ozonation/biologically-active filtration to reduce disinfection by-product precursors present in the City's source water. The results of the studies were summarized and used to assist Warren in developing a capital improvements program for the City's Water Filtration Plant.

Sandusky, OH - Assisted with the preparation of a Water Master Plan for the City. The emphasis of the Plan was to both increase the capacity of the City's existing WTP, and to examine improvements that would allow the City to remain in compliance with applicable drinking water regulations.

Butler County, OH - Evaluated potential causes of pinhole leaks that had developed in the copper plumbing of homes. The possible causes, as well as recommended solutions, were identified and prioritized. Assisted the County in determining both short- and long-term, cost effective courses of action to mitigate the problem.

Dayton, OH - Evaluated the City's Miami and Ottawa WTPs. Both of the City's WTPs are lime-softening facilities which process raw water from aquifers that are artificially recharged with channels fed by river water. The Ohio EPA classified both sources of supply as groundwater under the direct influence of surface water, and the study evaluated the short- and long-term operational changes and capital improvements necessary to meet requirements of the SWTR and the Interim Enhanced and Long-Term SWTRs.

Hamilton, OH - Evaluated both the City's North and South WTPs. Both of the City's WTPs are lime-softening facilities. The evaluation involved: a Situation audit that addressed regulatory compliance, and a Capacity audit that determined both the process and hydraulic capacities of the WTPs. Based on results of the audits, assisted the City with the development of an experimental plan for full-scale demonstration studies required by the Ohio EPA to increase the approved capacity of the City's two WTPs.

Cuyahoga Falls, OH - Prepared the preliminary engineering study and detailed basis-of-design to expand the capacity of the existing iron/manganese-removal gravity filters at the City's WTP. The three, existing Fe/Mn-removal filters were retrofitted with anthracite/greensand; and three, new similar Fe/Mn-removal filters were constructed above grade to match the hydraulic profile of the existing gravity filters. The approved capacity of the WTP was increased from 5.6 MGD to 11.2 MGD. Provisions were made with Ohio EPA to ultimately high rate the Fe/Mn-removal filters to 12+ MGD to match the component capacity of the subsequent ion-exchange, upflow/downflow, softening facilities that are used to soften a portion of the water processed through the Fe/Mn-removal filters.

Pennichuck Water Works, NH - Assisted with bench- and pilot-scale studies for the Pennichuck Water Works to compare the costs and benefits of pre- and intermediate-ozone

and chlorine dioxide. In addition to capital and O&M costs, water-quality parameters evaluated included Disinfection By-Products (DBPs), manganese oxidation, taste and odor control, and particulate removal with and without biologically-active filtration (i.e., filtration preceded with and without intermediate ozonation).

Mansfield, OH - Assisted with an evaluation of the City's existing WTP to determine its ability to meet current, proposed and anticipated drinking water regulations; and made recommendations of potentially needed modifications at the City's WTP.

Massillon, OH – Assisted Consumers Ohio Water Company with performance of a full-scale demonstration study to high rate an existing WTP used to soften groundwater. An existing solids-contact unit was high rated from a component capacity of 3 MGD to a 5 MGD capacity, and the filters were high rated from a filtration rate of 2 gpm/sf to 4 gpm/sf. A similar new 3-MGD solids-contact unit was then installed at a capacity of 5 MGD - allowing the WTP to cost-effectively be expanded by 7+ MGD, and the softening process to be upgraded to more appropriate technology. A new recarbonation basin was constructed to provide necessary pH adjustment and to feed the existing filters from the opposite end; eliminating an existing hydraulic bottleneck.

Cincinnati, OH - Evaluated the City's Richard Miller Treatment Plant to meet both existing drinking water regulations and ones anticipated early in the 21st century. The evaluation involved: a Situation audit that addressed regulatory compliance, a Capacity audit that determined both the process and hydraulic capacities, and a Facilities audit that established the useful life-costing analysis for major equipment.

Cleveland, OH - Assisted with the design and operation of an extensive Demonstration Study conducted at the Cleveland Division of Water's Crown treatment facility. Key unit treatment processes evaluated at the pilot scale included: tube-settler clarification, intermediate ozonation and high-rate filtration. The study was performed to obtain Ohio EPA approval for high-rate clarification and filtration at the Crown facility. The information obtained from the pilot-scale units contributed to the data utilized to conduct a comprehensive preliminary engineering study to develop a cost-effective alternative for expanding the Crown facility from a capacity of 50 MGD to one in excess of 100 MGD. Current, proposed and anticipated drinking water regulations were considered in upgrading treatment provided by the Crown facility.

PVWC, NJ - Designed a permanent pilot-scale plant for the Passaic Valley Water Commission. This plant was designed as a dual train system. One train is used to simulate treatment provided by the Commission's Little Falls WTP. The second train has the capability to evaluate alternate treatment schemes, including ozonation and granular activated carbon adsorption.

NJAWC, NJ - Overall responsibility for an extensive water quality monitoring program and comprehensive pilot-scale study for a new WTP for the Western Division of the New Jersey-American Water Company. The water quality monitoring program consisted of surveys designed to help locate the raw water intake site. The pilot-scale study compared several unit treatment processes, as well as different pre-oxidants and other chemicals.

Mahoning Township, PA - Evaluated various types of membrane processes to lower the levels of total dissolved solids (TDS) and other secondary contaminants in the water from groundwater aquifers and surface water supplies located in the vicinity of the Township. The project was performed for Browning-Ferris Industries who, as a public service, was assisting residents in finding suitable potable water.

Mentor, OH - Performed a desk-top evaluation study in compliance with the LCR. The Consumers Ohio Water Company's WTP for its Lake Erie West District is a large public water system under the LCR. Therefore, a comprehensive evaluation of both precipitation and passivation techniques was conducted for optimal corrosion control, even though neither the lead nor copper Action Level (AL) was violated during the two, initial six-month monitoring periods.

Mansfield, OH - Performed a desk-top evaluation study in compliance with the LCR. The City's WTP and distribution system are classified as a large public water system. Therefore, a comprehensive evaluation of both precipitation and passivation techniques was conducted for optimal corrosion control, even though neither the lead nor copper AL was violated during the two, initial six-month monitoring periods.

Cuyahoga Falls, OH - Performed a desk-top evaluation study in compliance with the LCR. The City's WTP is an ion-exchange facility, and the desk-top study concentrated on the evaluation of both precipitation and passivation corrosion-control alternatives. The principal objective was to lower copper levels throughout the distribution system served by the City, while also minimizing red water problems.

Struthers, OH - Evaluated the impacts of Drinking Water Regulations on the Consumers Ohio Water Company's WTP for its Struthers Division. An extensive study was conducted to determine potential impacts of the regulations being developed as a result of the 1986 Amendments to the Safe Drinking Water Act. The drinking water regulations already promulgated, as well as those that have been proposed or are anticipated, were included in the study. Not only were impacts on the current operation evaluated, but the costs were assessed with regard to using several different raw water sources while still maintaining compliance with the applicable regulations.

Warren, OH - Evaluated the impacts of Drinking Water Regulations on the City's WTP. An extensive study was conducted for potential impacts of regulations being established as a result of the 1986 Amendments to the Safe Drinking Water Act. The drinking water regulations already promulgated, as well as those that have been proposed or are anticipated, were included in the study.

Bellevue, OH - Evaluated stability of the finished water for the City's WTP. The study involved evaluation of several standard stability indices, including determining the Calcium Carbonate Precipitation Potential (CCPP) of the water using C-L diagrams and our in-house computer programs for water stability. Recommendations were made to minimize the occurrence of red water experienced periodically in the City's distribution system. Various



sequestering agents and corrosion inhibitors were evaluated both in terms of controlling red water problems and in terms of minimizing lead and copper ALs at consumers' taps.

Medina, OH – Assisted with a comprehensive study of the water system; including the City's source waters, current and future finished-water demands, and WTP. The safe yield of the water-supply sources (e.g., an off-line reservoir (Lake Medina) and wells) were evaluated and compared to determine whether the City had adequate capacity to continue to meet projections for long-term water demands that were generated as part of the study. A detailed evaluation of the City's WTP was performed to define its hydraulic and treatment capacity, and to develop cost-effective alternatives for upgrading/expanding the existing facilities. Current, proposed and anticipated drinking water regulations were considered carefully in the development of upgrade/expansion alternatives for the WTP.

Bloomsburg, PA – Responsible for process design of an upgrade/expansion for the City's WTP for the General Water Works Service Company. Modifications were made to an existing rectangular concrete sedimentation basin to incorporate flocculation facilities, an existing steel circular tank was modified to provide additional flocculation and sedimentation and improved rapid mix facilities were added.

Ridgewood, NJ - Evaluated alternate unit treatment processes for removing volatile organic chemicals (VOCs) and radon from the City's groundwater supply. Packed towers, in-well injection techniques and several proprietary treatment processes were considered.

Zanesville, OH - Evaluated alternate means to handle the backwash water generated from cleaning the pressure, iron/manganese removal filters at the City's WTP. The iron/manganese filters are of the anthracite/greensand type. The red-water filters (sand beds) used for the backwash water experience clogging due to the high concentration of manganese. Sand beds, with and without backwash clarifiers in front of the beds, and lagoons were investigated to develop cost-effective alternatives for improving the performance of the City's existing sand beds.

Oberlin, OH – Assisted with conducting bench- and pilot-scale studies and developing recommendations of alternative treatment schemes for the City's WTP. Items addressed include reduction of trihalomethanes (THMs) in the finished water by ozonation and excess lime softening with limited solids recycle, providing filtered water turbidities below 0.1 NTU and production of a potable water to meet maximum contaminant levels (MCLs) for regulated compounds. Responsible for the design of subsequent Phase I improvements that included rehabilitation of the filters and modification of the recarbonation facilities.

Avon Lake, OH – Assisted with development of a preliminary engineering design study for expansion of the municipal utility's WTP from 10 MGD to 27 MGD. New flocculation facilities, an additional sedimentation basin equipped with tube settlers, four new dual-media filters, baffled clearwells and high-service pumps were included in the design. Flexibility was incorporated in the design for the possible addition of ozonation, and granular activated carbon adsorption or ion-exchange columns.

WCRWSA, FL – Conducted a pilot-scale study of THM reduction for well water of the West Coast Regional Water Supply Authority. Preliminary evaluation of air stripping and ozonation to determine cost-effective means of lowering Terminal THM levels in the Authority's transmission lines.

Berea, OH - Overall evaluation of the City's ozonation/softening WTP and water distribution system.

Involved with bench-scale studies to assess the effects of ozonation on THM levels in Akron, Warren, Elyria, and Avon Lake, Ohio.

Twin Cities, OH - Investigation and evaluation of the Twin Cities WTP, including recommending solutions to mitigate severe taste-and-odor problems and modifications for improving stability of the finished water.

San Bernadino, CA - Overall evaluation of the City Creek WTP for the East Valley Water District, with recommendations concerning expansion/replacement of the plant to meet future water demands.

Zanesville, OH - Conducted a review of pilot-scale test data and provided recommendations for design of the 7.5-MGD anthracite/greensand, pressure filtration WTP for iron and manganese removal.

Directed research study, while at Cleveland State Univ., in which zeta potential measurements were investigated as a controlling parameter for metal salts operating under the charge neutralization mode in the treatment of surface water supplies. Alum, ferric chloride, and polyaluminum chlorides with and without sulfate were evaluated, and particle size distributions were monitored throughout the coagulation and sedimentation stages of treatment.

Was involved, while at Iowa State Univ., with several pilot-scale water treatment projects using pilot-scale facilities located at the university and a trailer-mounted unit at WTPs. Included were direct filtration and variable declining-rate filtration projects.

Designed and had responsibility for construction of a 10-gpm, direct-filtration pilot-scale plant capable of treating prepared water or waters brought to Cleveland State Univ. by tanker truck. Rapid mix, staged flocculation and filtration facilities were included with the flexibility to operate the variable declining-rate plant in either the direct or in-line filtration mode.

Has taught the following graduate and undergraduate courses at either Iowa State or Cleveland State University:

- Water Treatment Plant Design - Elements of design and operation of water treatment systems including physical and chemical methods for purifying the water, and treatment and handling of residuals produced.

- Process Chemistry for Water Treatment - Advanced chemistry for engineers as related to the production of potable water.
- Physical/Chemical Principles - Advanced concepts of physical/chemical processes used in water treatment.

### **Municipal Wastewater Treatment**

Dr. Wolfe has been involved in the planning, design and evaluation of several Wastewater Treatment Plants (WWTPs). His experiences include:

Dover, OH - Performed an overall evaluation of the City's WWTP. Mass-balance calculations were used to determine the process capacity of individual unit treatment processes, to assess the impacts of operating the WWTP in various modes, and to develop the basis for preliminary cost estimates for expanding the plant to accept industrial flows and/or additional domestic flows.

Vermilion, OH - Involved with an overall evaluation of the City's WWTP. Mass-balance calculations were used to determine the process capacity of individual unit treatment processes, and to assess the impacts of operating the WWTP in various modes.

North Royalton, OH - Performed a detailed evaluation of the City's WWTP-A. The process and hydraulic capacities of the existing WWTP were evaluated to determine the capability of the facility to meet both current and anticipated NPDES permit requirements. This evaluation included also assisting the City in its efforts to negotiate a Consent Decree with the Ohio EPA by deriving interim effluent limits that could be met consistently with the existing facilities. Modifications were recommended for improving the performance of the existing facilities, and for expanding/upgrading the facilities to increase the rated capacity of the WWTP. The modifications included converting certain facilities to perform a different function and adding facilities to process projected increases in flow.

Amherst, OH - Performed an extensive analysis of the process capability of the City's existing WWTP. The plant's performance was compared with current and proposed effluent limits in the NPDES permits. Interim effluent limits were determined that could be met consistently with existing facilities. Several modifications to the existing operation of the WWTP were recommended to provide an effluent quality that could meet consistently more stringent NPDES permit limits.

Akron, OH - Performed an extensive analysis of the hydraulic and process capability for the City's 100-MGD Water Pollution Control Facilities. Work included comparison of NPDES permit limits with plant performance and delineation of improvements required to meet various present and future permit limits. Technical assistance was provided to assist the City in its efforts to negotiate a Consent Decree with the U.S. EPA. This assistance included development of interim limits for the final effluent, obtaining authorization for a second monitoring point for wet weather flows from the City's combined sewer system that do not receive complete treatment, derivation of appropriate NPDES limits for this additional

monitoring point and development of a reasonable phased schedule for the construction of the necessary modifications/improvements.

Lima, OH - Provided technical assistance to the City in its efforts to negotiate modifications to a draft NPDES permit issued by the Ohio EPA. Information was developed to support higher effluent limits for certain metals that were proposed at low levels in the draft permit based on the State's anti-backsliding and anti-degradation policies.

Elyria, OH - Conducted a mass-balance study of the City's WWTP concerning removal of metals in the liquid treatment train and the effects of recycle flows from the solids handling processes. Included was the impact of potential changes in water quality standards for the Black River on future NPDES permit limits.

Euclid, OH - Conducted process evaluation for the 22-MGD advanced WWTP with a pure oxygen system. Performed full-scale testing program to determine level of performance expected with improved residuals handling.

Cincinnati, OH - Responsible for process evaluation of the 38-MGD Little Miami advanced secondary WWTP. Residuals are thickened by dissolved air flotation, mixed with primary residuals, and treated with thermal conditioning followed by incineration.

Assistance with preparation of Section 201 Facilities Plan for the Western Branch WWTP for the Washington Suburban Sanitary Commission, Hyattsville, MD.

Overall evaluation of the Woodbran WWTP in Woodmere (OH) for a law firm concerning the ability of the plant to meet its effluent guidelines.

Evaluation of contact stabilization at the Twinsburg (OH) WWTP.

Performed a study in which the U.S. EPA computer program, CAPDET, was used extensively as a preliminary screening of potential alternatives for the Macedonia (OH) WWTP.

Directed a research project related to adsorption of priority pollutants using Silicalite and aluminophosphate, two novel molecular sieves.

Participated in various research projects concerning biological and physical/chemical nutrient removal.

Was involved while at Iowa State with pilot-scale wastewater treatment projects at several wastewater treatment plants.

Conducted research related to adsorption of organic materials from water and wastewater. Aliphatic amines were added to montmorillonite clay to determine if the adsorptive capacity of the naturally occurring clay could be improved. A working knowledge of x-ray diffraction, gas chromatography, differential thermal analysis, infrared spectroscopy, and scanning

electron microscopy was required. This work led to a Doctor of Philosophy degree in Sanitary Engineering.

Has taught the following graduate and undergraduate courses at either Iowa State or Cleveland State University:

- Wastewater Treatment Plant Design - elements of design and operation of wastewater treatment systems including preliminary, primary, secondary and advanced treatment methods, as well as treatment and handling of wastewater residuals.
- Process Chemistry for Wastewater Treatment - Advanced chemistry for engineers as related to wastewater treatment.
- Physical/Chemical Principles - Advanced concepts of physical/chemical processes used in wastewater treatment.

### **Operator Training and Plant Start-Up**

Dr. Wolfe has conducted training courses for water and wastewater treatment plant operators in several states. His experiences include:

Regular contributor of technical material to the Ohio Section AWWA "Newsletter", and frequent speaker at seminars and training sessions sponsored by the Ohio Section AWWA.

Regular speaker at seminars and training sessions sponsored by the Operator Training Committee of Ohio (OTCO), Inc.

Operator training for Cleveland (OH) Division of Water (CWD). Developed and assisted with presentation of a seven-session training program for operators and administrative personnel at CWD's four water treatment facilities. Topics covered ranged from CWD source water, through the treatment processes at four water treatment facilities, and into CWD's distribution system.

Operator training for CWD. Developed and assisted with presentation of a chemical dosing/feed, training module for use by operators at CWD's four water treatment facilities.

Operator training for CWD. Developed and assisted with presentation of a math, training module for use by operators at CWD's four water treatment facilities.

Operator training for CWD. Developed and presented a video and accompanying training module for use by operators and administrative personnel in optimizing filter performance at CWD's four water treatment facilities.

Operator training for Trenton (NJ) Water Works. Developed and presented several training modules to the operations staff of Trenton. Principal topics involved start-up, periodic

evaluation and maintenance of the newly-rehabilitated filters being completed at the Water Works. The range of topics covered most aspects of water treatment and residuals handling at the Trenton Water Works.

Operator training for CWD. Developed and assisted with presentation of a filter-evaluation, training program for operators and administrative personnel at CWD's four water treatment facilities.

Operator training for Baltimore, MD. Developed and assisted with presentation of a ten-session training program for operators and maintenance personnel at the City's three water treatment facilities.

Operator training for CWD. Developed and assisted with presentation of a seven-session training program for operators and administrative personnel at CWD's four water treatment facilities.

Operator training Cincinnati (OH) Metropolitan Sewer District. Developed and presented training modules at the Little Miami Wastewater Treatment Plant, with emphasis on converting from single to two-stage nitrification.

Part of the team at Iowa State University that regularly provided training on all aspects of water and wastewater treatment plant operations for operators in the western half of Iowa.

### **Water Resources Engineering**

Dr. Wolfe has been involved in the planning and design of several water resources projects. His experiences include:

Warren, OH - Served as Principal-in-Charge of a hydraulic and water quality modeling study of the City's distribution system. The model was implemented to develop a Master Plan of distribution storage improvements, and to assist the City in its conversion from free chlorine to chloramines as the secondary disinfectant.

Erie County, OH – Served as Principal-in-Charge for a hydraulic modeling study of the County's water distribution system; and the preparation of detail plans for a new elevated storage tank and booster pumping stations.

Medina, OH - Directed a study of the water demands in relation to the available water supply for the City. Projections of average-day, maximum-day and peak-hour demands were made; as well as water required to satisfy the fire-fighting requirements. The capacity of the City's water supply system was determined based on the safe yield of the two existing sources available (i.e. - Lake Medina and a system of wells). The safe yield of the Lake had to be evaluated based on the flow characteristics of the stream from which water is pumped into the Lake and for various Lake levels studied to minimize potential shore erosion.

Parma, OH - Directed a study of the City's water distribution system. The principal emphasis of the study was to determine a long-term capital improvements plan for replacing/rehabilitating water mains throughout the City's system. A unique approach had to be used because the City does not have its own water treatment plant and the distribution system is supplied with water through several interconnects.

Cuyahoga Falls, OH - Directed a study of the City's water distribution system. The City's system was evaluated in terms of pressure and flow characteristics under maximum day, peak hour and fire flow conditions. The study included analyzing the adequacy and location of finished water storage in the system. Recommendations were made for improving existing storage capabilities and for locating additional storage to provide better flow characteristics throughout the City's system.

Cuyahoga Falls, OH - Directed a project concerning the artificial recharge of the City's water supply aquifer. The effectiveness of existing recharge channels and basins was studied and a maintenance/operation program was recommended. Recommendations were made for additional recharge channels to increase artificial infiltration into the aquifer which supplies water to the City's 10 MGD WTP.

Youngstown, OH - Directed a study for Akzo Salt to determine the safe yield of the Meander Creek Reservoir. Akzo requested a 3 MGD allocation from the Mahoning Valley Sanitary District who operates the Reservoir. Previous drought conditions presented concerns about the actual safe yield of the Reservoir. The safe yield was estimated using a few different hydrologic approaches. This provided more confidence that the actual safe yield was at least as large as the frequently quoted (but unsubstantiated) safe yield, since all of the calculated values were much larger than the quoted safe yield.

Lorain, OH - HEC-2 hydraulic analysis of the East Branch of Beaver Creek to define the floodway so a parking lot could be expanded into the fringe of the floodway.

Vermilion, OH - Several HEC-2 hydraulic analyses of the Vermilion River to evaluate effects of various construction projects in the floodway.

Eastlake, OH - HEC-2 hydraulic analysis of Chagrin River to determine the impact of construction of a proposed home in the floodway.

Directed a research project comparing the predicted movement of heavy metals from a disposal site leachate through groundwater in an aquifer. Both a one-dimensional analytical computer model (USDA1) and a two-dimensional finite-element model (SUTRA) were used to evaluate patterns and rates of heavy metals migration through the aquifer.

Has taught the following graduate and undergraduate courses at both Iowa State and Cleveland State University:

- Design of Water Distribution Systems - Engineering concepts of the pumping, distribution and storage aspects of water distribution systems; including the use of computer models to simulate existing systems.
- Surface and Groundwater Hydrology - Elements of descriptive and quantitative hydrology, groundwater flow in aquifers, well hydraulics for equilibrium and non-equilibrium conditions with and without boundary effects, culvert design, open channel hydraulics, and reservoir and dam design.

### **Sewerage and Drainage**

Dr. Wolfe has been involved with several projects dealing with piping systems, surface runoff, and stream flows. His experiences include:

Served as Principal-in-Charge for modeling of the Butler County (OH) wastewater collection system. Assisted the County with selection of the most appropriate modeling software, and presently directing the modeling of the County's collection system to: a) develop a prioritized list of capital improvement projects, and b) provide the basis for the preparation of a wastewater Master Plan.

Provided assistance to Avon Lake (OH) with the City's re-study of the Flood-insurance study (FIS) that had previously been completed for Avon Lake. The U.S. Army Corps of Engineers' HEC-2 computer program was used to re-define the floodway and floodway fringe for several segments of three small waterways located in Avon Lake.

Investigation and evaluation of pollution problems on a property in Geauga County (OH) resulting from leachate from septic tank systems in a neighboring subdevelopment. Estimates for alleviating the problem were provided for a law firm representing the offended party in litigation.

Investigation of flooding of homes in Lorain County (OH) as a result of surface runoff from neighboring farmland and elimination of natural drainage ditches. This technical assistance was provided to a law firm involved in litigation.

Provided technical assistance to a law firm involved with litigation concerning the flooding of homes in Lorain (OH) as a result of relocation of a stream.

Analysis of Heights/Hilltop interceptor system for the Northeast Ohio Regional Sewer District (NEORS) using the U.S. EPA - Stormwater Management Model (SWMM).

Has taught the following course at both Iowa State and Cleveland State University:

- Design of Wastewater Collection Systems - Engineering aspects of collection, pumping and storage of wastewater and stormwater; including the use of computer models to simulate existing systems.



## **Residuals Management**

Dr. Wolfe has been involved in the planning, design and evaluation of systems for the handling, treatment and disposal/beneficial reuse of residuals generated at both water and wastewater treatment plants. His experiences include:

Performance of solids mass-balance evaluations for several water and wastewater treatment plants, using in-house computer programs. The programs were developed based on an iterative procedure that arrives at a perfect closure for solid and soluble substances. The mass-balance evaluations were conducted to define reasonable values for missing data for certain process streams, to determine the performance capability of unit treatment processes, to determine the impacts of recycles from solids treatment processes on liquid treatment processes, etc.

Preparation of an engineering study for the Metropolitan Sewer District (MSD) of St. Louis. A detailed evaluation of the MSD's two existing air pollution control (APC) systems was performed to identify modifications/improvements necessary to comply with state and local emission requirements, as well as those proposed by the U.S. EPA in the 40 CFR Part 503 Sewage Sludge Regulations. The incorporation of afterburners as part of the APC equipment to lower total hydrocarbon (THC) emissions led to a comparison of several waste heat recovery systems for energy recovery/reuse.

Preparation of a Residuals Solids Management (RSM) Plan for Elyria, OH. Several alternatives for the disposal/beneficial reuse of sludge from the City's Water Pollution Control Plant (WPCP) were evaluated. A RSM Plan was developed based on the proposed 503 Sewage Sludge Regulations with one major option (chemical stabilization) and one backup option (landfilling).

Assisted with the process evaluation of a septage receiving/processing facility for the Louisville and Jefferson County MSD (KY). A complete process evaluation of the MSD's Morris Forman Wastewater Treatment Plant (WWTP) was performed using in-house mass-balance programs to determine whether septage should be introduced to the liquid and/or solids streams at the WWTP, or whether septage should be received and processed at a separate facility. A testing program was also established for use by the MSD in determining the types of septage that should be accepted at the facility.

Assisted with the process evaluation of several RSM alternatives for the disposal/beneficial reuse of residual solids from the Metro and Regional WWTPs of the Metropolitan Waste Control Commission (MWCC), St. Paul, Minn. A RSM Plan was developed to provide the MWCC with sufficient flexibility to handle residual solids effectively on a long-term basis.

Preparation of an engineering study for the Wyoming Valley Sanitary Authority. An evaluation of incineration alternatives for the Authority's WWTP in Wilkes-Barre (PA). Rehabilitation of the existing multiple hearth incinerator and APC equipment was compared with a new fluidized bed incinerator with APC and waste heat recovery equipment.

Evaluation of alternate means to handle the backwash from the pressure, iron/manganese removal filters at the Zanesville (OH) WTP. Sand beds, with and without backwash clarifiers in front of the beds, and lagoons were investigated to develop a cost-effective alternative for upgrading the City's existing sand beds.

Involved with the preliminary design of solids removal equipment for sedimentation basins at the New Castle Water Treatment Plant for the Pennsylvania-American Water Company. Included was an evaluation of existing residuals handling, thickening and dewatering unit processes.

Evaluation of sand drying beds for the Pennsylvania-American Water Company. Provisions were provided for treating and dewatering backwash water containing high concentrations of iron and manganese.

Has taught several courses dealing with the handling, treatment and disposal/beneficial reuse of water and wastewater residuals. He has also conducted research of bench-scale tests used for evaluation of the filterability of residuals, in which a laboratory comparison was made between the capillary suction time (CST) device and the Buchner funnel using field collected wastewater residuals. This work led to a Master of Science degree in Sanitary Engineering.

### **Solid Waste Management**

Dr. Wolfe has taught the following course at Cleveland State at both the graduate and undergraduate level:

Solid Waste Management - Engineering aspects of solid waste generation, on-site storage, collection and transfer; central resource and energy recovery systems which included compaction and shredding, mechanical separation, magnetic and electromagnetic separation, biochemical energy recovery, incineration and pyrolysis processes; and the ultimate disposal of wastes and residues.

He also directed an extensive student project in which the U.S. EPA - Waste Resource Allocation Program (WRAP) was used to develop a cost-effective plan for the transfer of, and central resource and energy recovery from, solid waste generated in Cuyahoga County, OH.

Dr. Wolfe also directed the following research project:

Directed a study in which modified bentonite pillared with organic and inorganic cations was tested as a potential secondary liner for disposal sites. The saturated hydraulic conductivity, or permeability, of the clay was monitored under various conditions using a modified, constant elevated pressure permeameter.

### **PROFESSIONAL SERVICE:**

American Water Works Association (AWWA)

Honorary Member, AWWA  
Fuller Awardee, AWWA  
Past-Chair, Plant Operations and Energy Management Committee  
AWWA, Ohio Section  
Member, Technology Committee  
    Past-Chair, Approved Capacity Subcommittee  
    Past-Chair, Guideline Review Subcommittee  
    Member, Multi-barrier Microbial Reduction Subcommittee  
    Member, Emerging Technology Subcommittee  
Past-Chair, Technical Program Committee  
Past-Chair, University Activities Committee (preceded Young Professionals Comm)  
Member, Ohio Section  
Water Environment Federation (WEF)  
    Retired member, WEF  
Ohio Water Environment Association (WEA)  
    Past-Chair, Student Activities Committee (preceded Young Professionals Comm)  
    Retired Member, Ohio WEA  
American Society of Civil Engineers (ASCE)  
    Past-President and Past-Treasurer, Cleveland Section  
    Retired Member, Central Ohio Section  
Cleveland State University  
    Past-Member, Civil Engineering Advisory Board  
    Past-President, Engineering Alumni Association  
Ohio University  
    Past-Member, Environmental Health Science Advisory Committee  
Chi Epsilon (Civil Engineering Honorary)  
    Retired Member  
Sigma Xi (Scientific Research Society)  
    Retired Member

**PRESENTATIONS:** (Past 20 years)

J. D. Fuchs, L. K. Weavers, Z. Bohrerova, T. Wolfe, “Developing an Ozone-Biofiltration Design Standard for Ohio Public Water Systems,” 2022 International Ozone Association-Pan American Group (IOA-PAN) Conference, Las Vegas, NV, August 15-18, 2022 (Abstract)

Tim Wolfe, Linda Weavers, Zuzana Bohrerova, Megan Patterson, “Using the Right Technology for the Right Reason,” OTCO Water Workshop, March 10, 2020.

L.K. Weavers, M. Patterson, Z. Boherova, T.A. Wolfe, “Development of Design Criteria to Supplement Ten State Standards in Ohio.” Ohio American Water Works Association Annual Conference, 2019, Cleveland, Ohio, September 9-13, 2019, (Abstract)

L.K. Weavers, Z. Boherova, T.A. Wolfe, M. Patterson, “Development of Design Criteria to Supplement Ten State Standards for Low-Pressure Membranes in Ohio,” American Water Works Association Annual Conference and Exposition, Denver, CO, June 9-12, 2019 (Abstract)

L.K. Weavers, T.A. Wolfe, M. Eppich, J. Sanson, “Providing an environmental engineering capstone experience by partnering with City of Columbus and consulting engineers,” 2019 AEESP Biennial Conference, Phoenix, AZ, May 16, 2019 (Abstract)

L.K. Weavers, T.A. Wolfe, M. Eppich, J. Sanson, “Environmental Engineering Capstone: Partnering with practicing environmental engineers to train the next generation,” 2019 Community Engagement Conference: Partnering for a Resilient and Sustainable Future, Columbus, OH, January 23-24, 2019 (Abstract)

M. Patterson, Z. Bohrerova, L. Weavers, T. Wolfe, “Development of Design Criteria to Supplement Ten States Standards for Low-Pressure Membranes in Ohio,” 2019 Community Engagement Conference: Partnering for a Resilient and Sustainable Future, Columbus, OH, January 23-24, 2019 (Abstract)

M. Patterson, Z. Bohrerova, T. A. Wolfe, L.K. Weavers, Ohio Section AWWA Southeast District Fall Meeting, Columbus, OH, October 23, 2018, “Developing Design Criteria for Membrane Filtration.” **Invited.**

M. Patterson, Z. Bohrerova, L.K. Weavers, T. Wolfe, “Developing Design Criteria for Low-Pressure Membranes,” WaterSmart Innovations 2018 Conference, Las Vegas, NV, October 3-5, 2018 (Abstract)

Z. Bohrerova, M. Patterson, T. Wolfe, L.K. Weavers, “Development of Design Criteria to Supplement TSSs for a Selected Ohio EPA Emerging Technology,” One Water Conference, Columbus, OH, August 28-30, 2018. (Abstract)

Wolfe, T.A. – “Precipitative Softening Calculations.” OTCO Six-hour Training Program, Meander Water, Youngstown Ohio, December 13, 2017.

Wolfe, T.A. – “Latest and Greatest of the Ohio AWWA Technology Committee Activities, etc.” AWWA Ohio Section N.E. District Meeting, Mentor, Ohio, October 26, 2017.

Wolfe, T.A. and Schell, Susan – “Ohio AWWA Technology Committee Update.” One Water – AWWA Ohio Section Conference, Nationwide Conference Center, Lewis Center, Ohio, March 9, 2017.

Wolfe, T.A. – “Optimizing Water Treatment Plants.” Operator Training Committee of Ohio (OTCO) Class III & IV Workshop, Deer Creek Lodge, Ohio, August 3, 2016.

Wolfe, T.A. – “Today’s Water Treatment Challenges.” ASCE Central Ohio Section, Spring Water Quality Seminar, Fawcett Center, The Ohio State University, April 20, 2016.

McWhirter, M., Weaver, C.R., Amoah, K. and Wolfe, T.A. – “Defining UV Design Parameters in 2015, A Few Things Have Changed.” International UV Assoc. World Congress, Vancouver, British Columbia, Canada, February 1, 2016.

Wolfe, T.A. – “Water and Wastewater Treatment Sharing.” OTCO Procrastinators’ Workshop, Columbus, Ohio, December 10, 2015.

Kusky, P. and Wolfe, T.A. – “Aqua Ohio Plans for the Future.” AWWA Ohio Section Conference, Cleveland, Ohio, September 17, 2015.

Wolfe, T.A. and Danielson, T. – “Using What You’ve Got: Cost-effective Management & Expansion of a Water System.” OTCO Water Workshop, Columbus, Ohio, March 16, 2015.

Wolfe, T.A. and Eberle, R. – “ALMU, Doing More for Less for Four Decades.” OTCO Water Workshop, Columbus, Ohio, March 5, 2014.

Wolfe, T.A. – “Precipitative Softening.” OTCO Six-hour Training Program, Dayton, Ohio, October 25, 2013.

Wolfe, T.A. – “Filter Coring.” OTCO Six-hour Training Program, Dayton, Ohio, October 24, 2013.

Wolfe, T.A. and Heimlich, S. - “ALMU Successfully High Rates its WFP (i.e., WTP) a Third Time.” OTCO Class III and IV Workshop, Deer Creek Lodge, Ohio, July 31, 2013.

Wolfe, T.A. and Caprella, M. - “Initial Benefits of Post-filter GAC Adsorption in Lima.” OTCO Water Workshop, Columbus, Ohio, March 5, 2013.

Arduini, J. and Wolfe, T.A. – “Revised Ohio EPA Guidelines Make Approval of High-rate and Emerging Technologies More Efficient.” OTCO Class III and IV Workshop, Deer Creek Lodge, Ohio, August 15, 2012.

Wolfe, T.A. – “Simple Ways to Enhance Your WTP’s CT Capacity.” OTCO Class III and IV Workshop, Deer Creek Lodge, Ohio, August 18, 2011.

Wolfe, T.A. – “Ohio EPA Guideline Update.” AWWA Ohio Section N.E. District Meeting, Avon Lake, Ohio, May 19, 2011.

Arduini, J. and Wolfe, T.A. – “Obtaining Ohio EPA Approval for High-rate and Emerging Technologies.” OTCO Water Workshop, Columbus, Ohio, March 22, 2011.

Wolfe, T.A. and Pizzi, N.G. – “Stories from the Road.” OTCO Class III and IV Workshop, Columbus, Ohio, August 18, 2010.

Wolfe, T.A. and Pizzi, N.G. - “Make Sure the Clearwells are not Limiting Your WTP’s Approved Capacity.” OTCO Water Workshop, Columbus, Ohio, March 23, 2010.

Davidson, J., Pohlman, R. and Wolfe, T.A. – “Approved Capacity Plans.” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 10, 2009.

Pizzi, N.G. and Wolfe, T.A. – “Jar Testing – Making Jar Tests Operator Friendly.” OTCO Class III and IV Workshop, Columbus, Ohio, August 13, 2009.

Davidson, J., Pohlman, R. and Wolfe, T.A. – “New Approach for Determining Approved Capacity during the Plan-approval Process.” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 10, 2008.

Caprella, M. and Wolfe, T.A. – “Study and Design for Post-Filter GAC Adsorption Units in Lima.” OTCO Class III and IV Workshop, Columbus, Ohio, August 13, 2008.

Wolfe, T.A. – “Getting the Best Production Out of Your Existing Filters.” OTCO Water Workshop, Columbus, Ohio, March 25, 2008.

Wolfe, T.A. – “Water and Wastewater Treatment for Administrators.” OTCO Procrastinators’ Workshop, Columbus, Ohio, December 14, 2007.

Bisson, B. and Wolfe, T.A. – “Demo Study Saves Aqua Ohio Money, Space and Time.” OTCO Water Workshop, Columbus, Ohio, March 21, 2006.

Wolfe, T.A. – “LT-2-ESWTR & Stage-2-DBP Rule.” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 17, 2005.

Wolfe, T.A. – “Stage-2-DBPR and LT-2-ESWTR Requirements.” AWWA Ohio Section Conference, Columbus, Ohio, September 22, 2005.

Wolfe, T.A. – “High-Rate and Emerging Technologies in Ohio.” AWWA Ohio Section Conference, Columbus, Ohio, September 21, 2005.

Wolfe, T.A. – “Optimization of Disinfection.” OTCO Class III and IV Workshop, Columbus, Ohio, August 17, 2005.

Wolfe, T.A. – “Optimization of Filtration.” OTCO Class III and IV Workshop, Columbus, Ohio, August 17, 2005.

Wolfe, T.A. – “Optimization of Rapid Mix and Flocculation.” OTCO Class III and IV Workshop, Columbus, Ohio, August 17, 2005.

Pizzi, N.G. and Wolfe, T.A. – “Stories from the Road: On-the-Job Experiences of Water Treatment Operators.” OTCO Water Workshop, Columbus, Ohio, March 16, 2005.

Wolfe, T.A. – “Alternatives to Meet Regulations Effectively.” OTCO Class III and IV Workshop, Columbus, Ohio, July 13, 2004.

Bird, A. and Wolfe, T.A. – “Redundancy, Reliability and Rated (Approved) Capacity of WTPs.” OTCO Water Workshop, Columbus, Ohio, February 10, 2004.

Wolfe, T.A. – “Monitoring, Profiling and Treatment Techniques Associated with the LT-2-ESWTR.” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 5, 2003.

Wolfe, T.A. – “Chloramination in Ohio.” AWWA Ohio Section N.E. District Meeting, Youngstown, Ohio, October 9, 2003.

Wolfe, T.A. – “Overview of LT-2-ESWTR.” AWWA Ohio Section Conference, Cincinnati, Ohio, September 24, 2003.

Wolfe, T.A. – “Bench-scale Testing for Small Systems.” AWWA Ohio Section Conference, Cincinnati, Ohio, September 23, 2003.

Wolfe, T.A. – “Water and Wastewater Fundamentals for Administrators.” OTCO Customer Service Workshop, Columbus, Ohio, August 8, 2003.

Wolfe, T.A. – “Filtration Part Two.” 46th Annual Kentucky Water and Wastewater Operators’ Conference, Fort Mitchell, Kentucky, March 24, 2003.

Wolfe, T.A. – “Filtration Part One.” 46th Annual Kentucky Water and Wastewater Operators’ Conference, Fort Mitchell, Kentucky, March 24, 2003.

Bryant, S. and Wolfe, T.A. – “New Lexington’s Approach to Compliance with Stages 1 and 2 of the D/DBPR.” AWWA Ohio Section Specialty Conference, Columbus, Ohio, February 12, 2003.

Wolfe, T.A. - “High-Rate and Emerging Technologies in Ohio.” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 5, 2002.

Wolfe, T.A. – “Water Collection, Treatment and Distribution for Non-Technical People.” AWWA Ohio Section Conference, Columbus, Ohio, September 16-19, 2002.

Wolfe, T.A. – “Advanced Disinfection Practices (ADPs) – Overview/Regulatory Implications.” AWWA Ohio Section Conference, Columbus, Ohio, September 16-19, 2002.

Wolfe, T.A. – “What is the Risk Assessment Methodology Used in the Vulnerability Assessment Process?” AWWA Ohio Section Specialty Seminar, ‘Vulnerability Assessments’, Columbus, Ohio, July 18, 2002.

Wolfe, T.A. – “Optimizing Your Clearwells to Maximize CT Credit.” AWWA Ohio Section Specialty Seminar, ‘Treatment Process Optimization’, Columbus, Ohio, July 18, 2002.

Wolfe, T.A. – “Treatment Schemes Available to Meet the DBP Rules and Enhanced-SWTRs.” 45th Annual Kentucky Water and Wastewater Operators’ Conference, Owensboro, Kentucky, March 20, 2002.

Wolfe, T.A. - “Treatment Alternatives to Comply with the Evolving Microbial/DBP Package.” OTCO Water Workshop, Columbus, Ohio, February 28, 2002.

Wolfe, T.A. - “Overview of Long-Term 1 ESWTR, Long-Term 2 ESWTR and Stage 2 of D/DBPR.” Ohio Section AWWA Safe Drinking Water Act Seminar, Columbus, Ohio, November 1, 2001.

Stevenson, R. and Wolfe, T.A. - “Ohio AWWA/EPA Technology Committee.” AWWA Ohio Section Conference, Cleveland, Ohio, August 29-31, 2001.

Wolfe, T.A. – “Chloramination.” AWWA Ohio Section, N.E. District Meeting, Wickliffe, Ohio, July 19, 2001.

Wolfe, T.A. – “Minimizing DBPs While Maximizing CTs.” OTCO Water Workshop, Columbus, Ohio, March 29, 2001.

Wolfe, T.A. – “Impacts of *Cryptosporidium* on Ohio’s PWSs.” OTCO Water Workshop, Columbus, Ohio, March 28, 2001.

Wolfe, T.A. – “Alternative Disinfectants – the Local Perspective.” AWWA Ohio Section Pre-Satellite Teleconference Local Program, ‘Alternative Disinfectants: Choices for the Future’, Canton, Ohio, March 8, 2001.

Wolfe, T.A. – “Enhanced Coagulation Made Fun!” AWWA Ohio Section Safe Drinking Water Act Seminar, Columbus, Ohio, November 1, 2000.

Wolfe, T.A. – “Enhanced Coagulation/Enhanced Softening.” Presented a four-hour, training program to the Central office and District office staffs of the Ohio EPA, Columbus, Ohio, October 24, 2000.

Wolfe, T.A. – “Enhanced Coagulation.” 43rd Annual Kentucky Water and Wastewater Operators’ Conference, Ft. Mitchell, Kentucky, March 29, 2000.



Tabak, D. and Wolfe, T.A. – “MVSD’s Taste & Odor Mitigation Study.” Presented at the AWWA Ohio Section Pre-Satellite Teleconference Local Program, ‘Tastes and Odors in Drinking Water: Operational Tools and Techniques for Identification and Control’, Canton, Ohio, March 9, 2000.

Wolfe, T.A. – “High-Pressure and Low-Pressure Membranes.” OTCO Water Workshop, Columbus, Ohio, February 23, 2000.

Wolfe, T.A. – “Disinfectants/Disinfection By-Products Rule (D/DBPR) – Overview.” Ohio Section AWWA Safe Drinking Water Act Seminar, Columbus, Ohio, December 3, 1999.

Wolfe, T.A. – “The New Disinfection By-Product and Surface Water Treatment Rules – Operational Issues and Treatment Strategies.” AWWA Ohio Section Pre-Satellite Teleconference Local Program, Canton, Ohio, November 9, 1999.

Wolfe, T.A. – “Preparing Your Filters for the Interim Enhanced Surface Water Treatment Rule (IESWTR).” OTCO Water Workshop, Columbus, Ohio, February 24, 1999.

DeMarco, J. and Wolfe, T.A. – “Ohio AWWA/EPA Technology Committee.” OTCO Water Workshop, Columbus, Ohio, February 24, 1999.

**(45 additional Presentations from 1983 to 1998 available upon request)**

## **PUBLICATIONS:**

M.E. Patterson, Z. Bohrerova, T.A. Wolfe, L.K. Weavers, “Developing Design Criteria for Emerging Technologies in Ohio,” *Journal AWWA*, 2021, 113(7), 24-34.  
<https://doi.org/10.1002/awwa.1765>

M. E. Patterson; L. K. Weavers; Z. Bohrerova; T. A. Wolfe. “Creating Ohio Low-Pressure Membrane Filtration Design Criteria for Ohio,” *Ohio Section American Water Works Association Newsletter*, Spring 2020, 36-38.

L.K. Weavers, M. Patterson, Z. Boherova, T.A. Wolfe, 16<sup>th</sup> Annual EPA Drinking Water Workshop: Small Systems Challenges and Solutions, 2019, Cincinnati, Ohio, September 24-26, 2019, “Development of Design Criteria to Supplement Ten State Standards in Ohio.”

L.K. Weavers, M. Patterson, Z. Boherova, T.A. Wolfe, Engineering Sustainability 2019, Pittsburgh, PA, April 7-9, 2019, “Development of Design Criteria to Supplement Ten State Standards in Ohio.” (Extended Abstract) **Invited Keynote**

Hayes, S.E., Amoah, K., Wolfe, T.A. and Weaver, C.R. – “City of Columbus, Ohio Prepares to Install UV Disinfection Technology at Hap Cremean Water Plant.” Ohio Section Newsletter, American Water Works Association, Spring 2018, 1 (cover) and 8-13.

Wolfe, T.A. – “OSU Students Present Preliminary Engineering Report to Columbus DPU on Proposed HCWP and DRWP UV Facilities.” Ohio Section Newsletter, American Water Works Association, Summer 2017, 58-59.

Wolfe, T.A. – “City of Columbus Holds Tenth (10<sup>th</sup>) Annual Central Ohio Children’s Water Festival.” Ohio Section Newsletter, American Water Works Association, Summer 2017, 64-66.

Wolfe, T.A. – “OSU Students Present Preliminary Engineering Report to Columbus DPU on DRWP Ozone / BAC Filtration Facilities.” Ohio Section Newsletter, American Water Works Association, Summer 2016, 52-53.

Wolfe, T.A. – “City of Columbus Holds Ninth Annual Central Ohio Children’s Water Festival.” Ohio Section Newsletter, American Water Works Association, Summer 2016, 62-64.

Danielson, T., Eberle, R., Heimlich, S., Suehrstedt, C., Hammer, I. and Wolfe, T.A. – “Cost-effectively Addressing a Prudent Level of Reliability – While Continuing to Meet Increasing Finished-water Demands.” Ohio Section Newsletter, American Water Works Association, Spring 2016, 40-44.

Wolfe, T.A. – “Columbus DPU Shares Design Concepts with OSU Students for Ozone / BAC Filtration Facilities at the City’s HCWP.” Ohio Section Newsletter, American Water Works Association, Summer 2015, 70-71.

Wolfe, T.A. – “City of Columbus Holds Eighth Annual Central Ohio Children’s Water Festival.” Ohio Section Newsletter, American Water Works Association, Summer 2015, 74-75.

Wolfe, T.A. – “Columbus DPU Shares Design Concepts with OSU Students for Ozone / BAC Filtration Facilities at the City’s HCWP.” Ohio Section Newsletter, American Water Works Association, Summer 2014, 52-54.

Wolfe, T.A., et. al. – “Ohio AWWA Section’s Technology Committee helps utilities save millions.” Journal, American Water Works Association, Vol. 106, No. 2, 2014, 54-57.

Wolfe, T.A. – “City of Columbus DPU Interacts with OSU Students to Design Ozone / BAC Filtration Facilities at DRWP.” Ohio Section Newsletter, American Water Works Association, Summer 2013, 40-43.

Wolfe, T.A. – “City of Columbus, Ohio EPA, GCWW, ARCADIS and MWH Assist OSU Students with Design of NaOCl Facilities at DRWP.” Ohio Section Newsletter, American Water Works Association, Summer 2012, 48-51.

Wolfe, T.A., LeGouellic, Y., Hopkins, G., Rodgers, M. and Whitteberry, B. – “Technology Committee Activities Have Saved Ohio PWSs Hundreds of Millions in Capital Costs.” Proceedings of American Water Works Association, ACE-12, Dallas, Texas, June 2012.

Wolfe, T.A. – “Columbus Hosts Fourth Annual Central Ohio Children’s Water Festival.” Ohio Section Newsletter, American Water Works Association, Summer 2011, 52-54.

Wolfe, T.A. – “City of Columbus, Ohio EPA, CH2MHill and MWH Assist OSU Students with Design of Ion-exchange Facilities at DRWP.” Ohio Section Newsletter, American Water Works Association, Summer 2011, 42-45.

Wolfe, T.A. – “Columbus Holds Third Annual Central Ohio Children’s Water Festival.” Ohio Section Newsletter, American Water Works Association, Summer 2010, 58-59.

Wolfe, T.A. – “City of Columbus, Ohio EPA, B&N and MWH Introduce OSU Students to the Design of Ozone/BAF Facilities.” Ohio Section Newsletter, American Water Works Association, Summer 2010, 52-55.

Wolfe, T.A. – “Lima, Ohio EPA and MWH Help OSU Students Prepare for Design World.” Ohio Section Newsletter, American Water Works Association, Summer 2009, 38-41.

Caprella, M. and Wolfe, T.A. – “Lima Chooses Post-Filter GAC Adsorption to Consistently Meet Water Quality Goals.” Ohio Section Newsletter, American Water Works Association, Spring 2009, 1-13.

Wolfe, T.A., Pizzi, N.G., Raimann, M., Kashinkunti, R. and Arnette, V., Water Course II Workbook. Columbus, Ohio: Operator Training Committee of Ohio (OTCO), Inc., 2004.

Bryant, S. and Wolfe, T.A. “New Lexington’s Approach for Complying with Stages 1 & 2 of D/DBPR.” Ohio Section Newsletter, American Water Works Association, Spring 2003, 1.

Wolfe, T.A. and Pizzi, N.G. “Assessing Treatment Schemes to Comply with the Evolving M/DBP Regulations.” Ohio Section Newsletter, American Water Works Association, Spring 2002, 12-15.

Wolfe, T.A. “Optimizing Enhanced Coagulation.” Ohio Section Newsletter, American Water Works Association, Vol. XXXXI, No. 1, 2000, 16-21.

Wolfe, T.A. “Simultaneously Complying with Stage 1 of the D/DBPR and the IESWTR.” Ohio Section Newsletter, American Water Works Association, Vol. XXXX, No. 3, 1999, 6-10.

Wolfe, T.A. "Impacts of Stage 1 of the Disinfectants/Disinfection By-Products Rule." Ohio Section Newsletter, American Water Works Association, Vol. XXXX, No. 2, 1999, 6-11.

Wolfe, T.A. and Pizzi, N.G. "Optimizing Filter Performance." Journal of New England Water Works Association, Vol. 113, No. 1, March 1999, 6-21.

Wolfe, T.A. "Impacts of the Interim Enhanced Surface Water Treatment Rule (IESWTR)." Ohio Section Newsletter, American Water Works Association, Vol. XXXX, No. 1, 1999, 6-9.

Wolfe, T.A. "Maintaining Filters: Part IV of a Series – Backwashing." Ohio Section Newsletter, American Water Works Association, Vol. XXXIX, No. 3, 1998, 14-18.

Wolfe, T.A. "Microbial/Disinfection By-Products Package." Ohio Section Newsletter, American Water Works Association, Vol. XXXVIII, No. 3, 1997, 6-10.

Wolfe, T.A., Pizzi, N.G. and Gnagy, M., Water Course II Workbook. Columbus, Ohio: Operator Training Committee of Ohio (OTCO), Inc., 1997.

Wolfe, T.A. "SDWA Amendments of 1996 - What's the Impact on Your PWS?" Ohio Section Newsletter, American Water Works Association, Vol. XXXVII, No. 3, 1996, 6-9.

DeMarco, J., Metz, D.H., Wolfe, T.A. and Aieta, E.M. "Unit Process Evaluation at RMTD Develops Alternatives for the Future." Proceedings of the AWWA Water Quality Technology Conference, 'Advances and Innovations in Water Quality Enhancement', Boston, Massachusetts, November 17-21, 1996.

Gnagy, M. and Wolfe, T.A., "Enhanced Coagulation and TOC Removal." Ohio Section Newsletter, American Water Works Association, Vol. XXXVII, No. 2, 1996, 5-10.

Schwarzwalder, R.O., Pizzi, N.G. and Wolfe, T.A. "Meeting Today's Challenges in Expanding/Upgrading the Crown Surface WTP." Proceedings of the AWWA Engineering and Construction Conference, 'Achieving Customer Satisfaction: The Engineer's Challenge', Denver, Colorado, March 17-20, 1996.

Management of Water Treatment Plant Residuals, by American Society of Civil Engineers and the American Water Works Association, 1996 (Contributing Author).

Wolfe, T.A. "Update of the Partnership for Safe Water." Ohio Section Newsletter, American Water Works Association, Vol. XXXVII, No. 1., 1996, 16-19.

Pizzi, N.G. Hoover's Water Supply and Treatment. Dubuque, Iowa: Kendall/Hunt Publishing Co., 1995 (Contributing Author).

Nielson, J.C., Schwarzwalder, R.O. and Wolfe, T.A. "Evaluation of Waste Stream Recycling Alternatives - A Case Study." Proceedings of the AWWA Annual Conference and Exposition, Anaheim, California, June 18-22, 1995.

Wolfe, T.A. "Optimizing 'Your' Water Treatment Plant." The Operator, Vol. 2, No. 9, 1995, 1-7.

Wolfe, T.A. "Corrosion Control." The Operator, Vol. 2, No. 8, 1995, 1-7.

Wolfe, T.A. "Disinfection/Inactivation." The Operator, Vol. 2, No. 7, 1995, 1-4.

Wolfe, T.A. "Filtration." The Operator, Vol. 2, No. 6, 1995, 1-7.

Wolfe, T.A. "Clarification." The Operator, Vol. 2, No. 5, 1995, 1-4.

Wolfe, T.A. "Flocculation." The Operator, Vol. 2, No. 4, 1995, 1-3.

Wolfe, T.A. "Rapid Mixing." The Operator, Vol. 2, No. 3, 1995, 1-4.

Wolfe, T.A. "Dealing with the Microorganisms of the 90's." The Operator, Vol. 2, No. 2, 1995, 3-4.

Jacangelo, J.G., Wolfe, T.A. and Adham, S.S. "Application of Membrane Technology to Meet Present and Future Drinking Water Regulations." Poster Session in Proceedings of the AWWA Engineering Design Conference, 'Engineering Tomorrow's Water Treatment Systems', Cincinnati, Ohio, March 20-23, 1994.

Malmrose, P.E. and Wolfe, T.A., "Recent Advances in Technologies for Dewatering Coagulant Residuals." Proceedings of the AWWA Engineering Design Conference, 'Engineering Tomorrow's Water Treatment Systems', Cincinnati, Ohio, March 20-23, 1994.

Zachopoulos, S.A., Worcester, G. and Wolfe, T.A. "Determining the Fate of Heavy Metals in a Wastewater Treatment Plant." Proceedings of the Water Environment Federation Annual Conference, Anaheim, California, October 7, 1993.

Wolfe, T.A. - "The New Principles of Corrosion Control." Proceedings of the Conference for Practical Methods to Control Lead and Copper in Drinking Water, Tampa, Florida, April 26-27, 1993.

Wolfe, T.A. and Malmrose, P.E. "New and Improved Dewatering Techniques." Proceedings of the AWWA Annual Conference and Exposition, Vancouver, B.C., 1992, 19-58.

Wolfe, T.A., Brookhart, J.D. and Kerr, J. Water Course II Workbook. Columbus, Ohio: Operator Training Committee of Ohio, Inc., 1992.

Hubel, R.E., Howe, E.W., Wilczak, A., Wolfe, T.A. and Tambini, S.J. "Integrated Pilot Testing Pays Off." Journal, American Water Works Association, Vol. 84, No. 8, 1992, 43-51.

Wolfe, T.A., Doe, P.W. and Malmrose, P.E. "Theory and Design of Mechanical Dewatering of Water Plant Sludges." Proceedings of the AWWA/WPCF Joint Residuals Management Conference, San Diego, California, August 13-16, 1989.

Wolfe, T.A. and Atoulikian, R.G. "Handling Manganese Sludges from Water Treatment Plants." Proceedings of the 2nd Annual Meeting of the American Filtration Society, Pittsburgh, Pennsylvania, March 27-29, 1989.

Wolfe, T.A., Demirel, T. and Baumann, E.R. "Adsorption of Organic Pollutants on Montmorillonite Treated with Amines." Journal, Water Pollution Control Federation, Vol. 58, No. 1, 1986, 68-76.

Wolfe, T.A., Demirel, T. and Baumann, E.R. "Interaction of Aliphatic Amines with Montmorillonite to Enhance Adsorption of Organic Pollutants." Clays and Clay Minerals, Vol. 33, No. 4, 1985, 301-311.

Beck, R.A., Buttle, J.L. and Wolfe, T.A. "Water-Jet Technique Used to Clean Encrusted Pipe." Opflow, Vol. 9, No. 5, 1983, 1.

**EMPLOYMENT HISTORY:**

<b>Company</b>	<b>Job Title</b>	<b>Start Year</b>	<b>End Year</b>
The Ohio State University	Adjunct Faculty	2016	2019
Stantec Consulting	Retired from Stantec Consulting Vice President, Emeritus	2016	
MWH (became part of Stantec in 2016)	Vice President	1993	2016
MWH Americas	East Division Technology Leader	2013	2016
MWH Global	Americas Water Practice Leader	2011	2013
MWH Americas	Columbus Location Manager	2005	2011
MWH Americas	NE Region Water Product Line Director	2001	2005
Montgomery Watson (became MWH in 2001)	NE Region Water Product Line Director	1993	2001

Havens and Emerson (became part of Montgomery Watson in 1993)	Associate / Partner	1988	1993
Cleveland State University	Assistant Professor, Civil Engineering	1983	1988
Havens and Emerson	Manager, Process Engineering	1981	1983
Iowa State University	Research / Teaching Associate	1975	1981
American Society of Civil Engineers	Assistant Manager, Technical Activities	1973	1975

### **AWARDS / RECOGNITION:**

- 2019 – The Water Management Association of Ohio, R. Livingston Ireland Award
- 2017 - Ohio, American Water Works Association (AWWA) Section, John Lechner Award of Excellence
- 2011 - Columbus City Council, Certificate of Honor and Recognition
- 2010 - Ohio AWWA Section, John J. Sadzewicz Award
- 2010 - The Ohio State University, Dean's Meritorious Service to Students Award
- 2009 - Ohio AWWA Section, Best Paper Award
- 2006 - AWWA, Honorary Member Award
- 2006 - American Society of Civil Engineers (ASCE) Cleveland Section, Outstanding Civil Engineer-of-the-Year Award
- 1999 - AWWA, George Warren Fuller Award
- 1999 - Ohio, Water Environment Association (WEA), Larry D. Moon Outstanding Service Award
- 1997 - ASCE, State-of-the-Art of Civil Engineering Award: Manual No. 88 – “Management of Water Treatment Plant Residuals”
- 1996 - Ohio AWWA Section, Richard F. Melick Award
- 1995 - ASCE, National Sponsor Nominee for induction by eminence into the American Academy of Environmental Engineers and Scientists (AAEES)
- 1988 - Cleveland State University, Outstanding Faculty Person for the Fenn College of Engineering