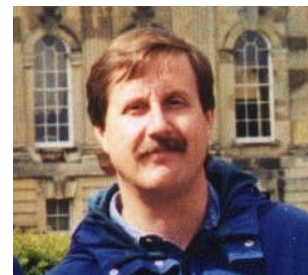


PHILLIP W. BUTTERFIELD, Ph.D., P.E.

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Dr. Butterfield is an environmental engineer and microbiologist whose recent work has focused on the role biofilm plays in capture, persistence and protection of pathogens in the environment and drinking water systems. He is currently an Associate Research Professor in the Department of Civil and Environmental Engineering, Washington State University, Spokane, Washington, where he carries on an active research program and provides expert consulting services in the area of biofilm in drinking water systems, water treatment applications, and water reuse distribution and systems. Prior to his doctoral studies he was a practicing professional engineer with CH2M HILL where he was responsible for planning, design and construction of numerous drinking water facilities including treatment plants, pumping stations, major pipelines and prestressed concrete and steel reservoirs. Before joining Washington State University in 2007 he was a Research Scientist/Engineer in the Department of Environmental and Occupational Health Sciences at the University of Washington, and prior to that position he was an Assistant Research Professor at the Center for Biofilm Engineering at Montana State University–Bozeman. His research has investigated the role of biofilm in environmental health and environmental engineering, and in particular biofilm's role in the biological stability and microbial quality of drinking water, microbial quality of reclaimed water, and biological treatment systems. One aspect of his work has involved investigating the use of biofilm to monitor drinking water for the presence of pathogens, including those considered bioterrorist agents. Dr. Butterfield is also working to develop tools and information that assist operators and managers of small water systems to protect public health by determining where their systems have the greatest potential for microbial contamination. His [Microbial Risk Assessment Tool](#) for small water systems consists of a PC-based self-assessment instrument that provides the small water system operator with an indication of those components of the water system that represent the greatest risk for microbial contamination. Dr. Butterfield's work has included investigating the kinetics of microbial growth in municipal water systems, chlorine and its effect on biofilm biokinetics, the biostability of water in distribution systems, and the interactions between iron oxides, humic substances and biofilm. He has also been involved in the investigation of novel metallo-complexes designed to fight biofilm related infections in humans.

EDUCATION

Degree	University	Year	Major
Ph.D.	Montana State University Department of Civil Engineering Center for Biofilm Engineering	1998	Civil and Environmental Engineering Supporting area: Microbiology
M.S.	University of Colorado (Boulder, CO)	1977	Civil Engineering (Environmental)
B.S.	University of Colorado (Boulder, CO)	1976	Civil Engineering

EXPERIENCE

Dates	Organization	Position
2007-present	Department of Civil and Environmental Engineering, Washington State University, Spokane, WA	Associate Research Professor
2003-2007	Department of Environmental and Occupational Health Sciences, School of Public Health and Community Medicine, University of Washington, Seattle, WA	Research Scientist/Engineer

Dates	Organization	Position
1999-2003	Center for Biofilm Engineering and Department of Civil Engineering, Montana State University	Research Assistant Professor
1994-1998	Center for Biofilm Engineering, Montana State University	Graduate Research Assistant
1998-present	CH2M HILL Global Water Business Group Denver, Colorado	Senior Technologist (Biofilm in Water and Reuse Systems)
1987-1994	CH2M HILL Portland, Oregon	Manager, Water Systems Department Staff Manager, Water Business Group for Portland, Corvallis, and Honolulu Offices; Project and Client Manager
1981-1987	CH2M HILL Boise, Idaho	Project Manager Project Engineer
1980-1981	HKM Associates Billings, Montana	Project Engineer
1978-1980	Wright-McLaughlin Engineers Denver, Colorado	Project Engineer
1977-1978	Stahly Engineering and Associates	Project Engineer

PUBLICATIONS

Butterfield, P.G., Hill, W., Butterfield, P.W., Smith, K., Larsson, L, and Severtsen, D.L. *TERRA: A conceptual framework addressing environmental health in rural communities*. Submitted to American Journal of Public Health, September 2006 (peer-reviewed and revised manuscript submitted).

Butterfield, P.W., Takatani, K. and Camper, A.K. *Persistence of Bacterial Pathogens and MS2 Bacteriophage in a Model Home Water System following UV Disinfection Treatment*. Submitted to Journal of Water and Health, 2006 (peer-reviewed and currently under revision).

Butterfield, P.W. and Camper, A.K. 2004. *Development of a Toolbox to Assess Microbial Contamination Risks in Small Water Systems*. Journal of Water and Health, 2(4), 217-232.

Butterfield, P.G. and Butterfield, P.W. 2003. Pesticide exposure: Risk and treatment strategies. In *Environmental Health and Nursing Practice*, Sattler, B. and Lipscomb, J. (Eds.), Springer Publishing Company, New York.

Butterfield, Phillip W., Camper, A.K., Biederman, J.A., and Bargmeyer, A.M. 2002. *Minimizing Biofilm in the Presence of Iron Oxides and Humic Substances*. Water Research 36(15), 3898-4405.

Butterfield, Phillip W., Bargmeyer, Alex M., Camper, A.K., and Biederman, J.A. 2002. *Modified Enzyme Activity Assay to Determine Biofilm Biomass*. Journal of Microbiological Methods, 50(1), 23-31.

Butterfield, Phillip W., Camper, A.K., Ellis, B.D. and Jones, W.L. 2002. *Chlorination of Model Drinking Water Biofilm: Implications for Growth and Organic Carbon Removal*. Water Research, 36(17), 4391-4405.

Camper, A., Burr, M., Ellis, B., Butterfield, P. and Abernathy, C. 1999. *Development and structure of drinking water biofilms and techniques for their study*. J. Appl. Microbiol. Symp. Suppl. 85, 1S-12S.

Ellis, B.D., Butterfield, P., Jones, W.L., McFeters, G.A., and Camper, A.K. 1999. *Effects of Carbon Source, Carbon Concentration and Chlorination on Growth Related Parameters of Heterotrophic Biofilm Bacteria*. Microbial Ecology, 38, 330-347.

REPORTS, ARTICLES, PROFESSIONAL PAPERS AND CONFERENCE PROCEEDINGS

Butterfield, Phillip W., Camper, Anne K. and Rupp, Gretchen. 2007. *Online tool helps utilities assess microbial contamination risks*. Opflow, 33(1), 20-23.

“Biofilm’s Role in Capture and Persistence of Pathogens in Drinking Water Systems.” Presented at the 19th Annual University of Washington / University of British Columbia Environmental and Occupational Health Conference, Semiahmoo, WA, January 8, 2007.

Butterfield, Phillip W., Camper, Anne K. and Rupp, Gretchen. 2005. *Toolbox to assist small water systems in determining potential microbial contamination risks*. Proc. 2005 AWWA WQTC, Quebec City, Canada.

Ford, T., Rupp, G., Butterfield, P., and Camper, A. 2005. *Protecting Public Health in Small Water Systems—Report of an International Colloquium*. May 1-12, 2004, Bozeman, MT, USA. Montana Water Center, Bozeman, MT.

Narasimhan, R., Brereton, J., Abbaszadegan, M., Ryu, H., Butterfield, P., Thompson, K., et al. 2005. *Characterizing microbial water quality in reclaimed water distribution systems* (Collaborative Research Report). Denver, CO: American Water Works Association Research Foundation.

Butterfield, P., Burr, M., Clark, S., Mewton, J., and Camper, A. *Capture and attenuation of pathogens by biofilm in packed-columns under oligotrophic nutrient conditions*. Poster Presentation and abstract, ASM Biofilms 2003, Victoria, Canada, November 2003.

Camper, A. K., P. W. Butterfield, B. D. Ellis, W. L. Jones, P. M. Huck, W. B. Anderson, C. Volk, N. J. Welch, and M. W. LeChevallier. 2000. *Investigation of the biological stability of water in treatment plants and distribution systems*. American Water Works Association Research Foundation.

Butterfield, Phillip W., Camper, Anne K., Biederman, Joel, and Bargmeyer, Alex M. *Effects of Various Corrosion Control Techniques on the Development of Biofilm on Iron Oxide Surfaces*. Proc. 2001 AWWA WQTC, Nashville.

Butterfield, Phillip W., Camper, Anne K., Jones, Warren L., and Ellis, Brian D. *Effects of Chlorine On Biofilm Growth and Substrate Uptake In Model Drinking Water Systems*. Proc. 1999 AWWA WQTC, Tampa.

Camper, Anne K., Huck, Peter M., Anderson, William B., Butterfield, Phil, Ellis, Brian, and Jones, Warren. *Constituents of Biodegradable Organic Matter that Support Biofilm Development*. Proc. 1998 AWWA WQTC, San Diego.

Butterfield, Phillip W., Ellis, Brian, Camper, Anne, and Jones, Warren. *Evaluation of Growth Kinetics for Model Drinking Water System Biofilm Cells Utilizing Humic Substances as the Primary Carbon Source*. Poster Presentation, 1997 AWWA WQTC, Denver.

Butterfield, Phillip W., Camper, Anne K., Ellis, Brian D., Jones, Warren L., and McFeters, Gordon A. *Uptake of Specific Organics by Microorganisms in a Model Distribution System Biofilm*. Proc. 1996 AWWA WQTC, Boston.

Pilot-Scale Evaluation of Alternative Treatment Processes for the City of Helena Tenmile Creek Supply. Presented at the 1986 Rocky Mountain Chapter APWA Conference. Sheridan, Wyoming. April 17, 1986.

Pilot-Scale Evaluation of Alternative Treatment Processes for a Mountain Stream Water Source. Presented at the 1986 Rocky Mountain AWWA/WPCA Conference. Breckenridge, Colorado. September 10, 1986.

Butterfield, Phillip W. Kinetics of Biofilm Growth and Substrate Uptake in Model Drinking Water Systems. Ph.D. Dissertation, Montana State University, Bozeman, Montana, December 1998.

PROFESSIONAL PRESENTATIONS

"Biofilm's Role in Capturing Pathogens in Drinking Water Systems." Presented to the School of Environment and Sustainability, Royal Roads University, British Columbia, May 30, 2006.

"Biofilm Development in Drinking Water Systems and Its Effects on Microbial Quality." ENVH 580 Seminar Series, Department of Environmental and Occupational Health Sciences, University of Washington, February 19, 2004.

"Assessing Potential Microbial Contamination Risks for Small Water Systems." Presented to the Department of Environmental and Occupational Health Sciences, University of Washington, March 20, 2003.

"Assessing Microbial Contamination Risks in Small Water Systems." Presented at the Winter 2003 Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman, MT, February 7, 2003.

"Biodegradable Dissolved Organic Carbon (BDOC) Measurement in Drinking Water." Presented at the Biofilm in Drinking Water Workshop, Center for Biofilm Engineering, Montana State University, Bozeman, MT, November 21, 2002.

"Assessing Microbial Contamination Risks in Small Water Systems," Center for Biofilm Engineering Seminar, Montana State University, Bozeman, MT, November 14, 2002.

"The interaction of biofilm, chlorine, humic substances and corroded pipe—possible effects on drinking water microbial quality," Seminar presented to CDC/NCID/DPD, October 2002, and to the University of Iowa Hygienic Laboratory staff, April 2002.

"Assessing Microbial Contamination Risks for Small Water Systems," 68th Annual Water School for Water & Wastewater Operators & Managers, September 17, 2001, Montana State University, Bozeman.

"Investigation of Corrosion Control Alternatives to Minimize Biofilm in the Presence of Iron Oxides and Humic Substances." Presented at the Summer 2001 Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Relationships Between Biodegradable Organic Matter, Treatment and Disinfection Processes, and Biofilm in Distribution Systems." Presented at the Pacific Northwest American Water Works Association Annual Conference, Spokane, Washington. May 2000.

"Biofilm in Low-Nutrient Environments." Presented at the February 2000 Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Bioavailability of Humic Substances for Biofilm in Drinking Water." Presented at the National Science Foundation Annual Site Review, Center for Biofilm Engineering, Montana State University, Bozeman. February 1999.

"Effects of Chlorine on the Kinetics of Growth and Substrate Uptake for Biofilm in Model Drinking Water Systems." Presented at the February 1999 Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Biological Stability of Drinking Water: Research Results Using Mixed-Population Biofilms." Presented at the 1997 Spring Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Cross-Disciplinary Concept Successfully Meets CBE Goals." Presented at the National Science Foundation Engineering Education Innovators' Conference, Arlington, Virginia, April 1997.

"Biological Stability of Drinking Water in Treatment and Distribution Systems." Presented at the 1996 National Science Foundation Review Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Biological Stability of Drinking Water." Presented at the S.C. Johnson Wax Symposium *Biofilm In Homes, In Industry, and In the Environment*, Racine, WI, January 1996.

"Biofilm Control Related to Water Quality." Presented at the 1995 Winter Technical Advisory Committee Meeting, Center for Biofilm Engineering, Montana State University, Bozeman.

"Combining Design and Construction Experience Results in a Quality Concrete Reservoir." Presented at the Pacific Northwest Section AWWA Annual Conference, May 1992.

"Water Rates." Presented at the Idaho Joint AWWA/WPCF Conference. March 1982.

INVITED GUEST LECTURES

"Overview of Current Drinking Water Quality Issues." Presented at the Collaborative on Health and the Environment–Northwest meeting, December 6, 2004.

"Drinking Water and Public Health: Microbial and Chemical Agents." Presented at continuing education seminar "Essentials for Environmental Health Practice: Home, Community and Workplace." Sponsored by the Northwest Center for Occupational Health and Safety, Department of Environmental Health, School of Public Health and Community Medicine, University of Washington, March 2002. (25 participants).

"Biofilm Growth in Potable Water Distribution Systems." Presented at the Research Committee Seminar (Continuing Education), Virginia Section of the American Water Works Association, Richmond, VA, September 2000 (200 participants).

"Drinking Water and Public Health: Microbial and Chemical Agents." Presented at the Healthy Water, Healthy People Writing Workshop, sponsored by Project WET, Montana State University, and the HACH Scientific Foundation, August 2000 (20 participants).

"Drinking Water and Public Health: Risks from Microbial and Chemical Agents." Presented at the short course "Moving Upstream: Environmental Health and Nursing," College of Nursing, Montana State University, Bozeman, Montana, July 2000 (14 participants) and May 2001 (45 participants).

"Treatment Options for Removing Organics from Drinking Water." Continuing Education Class at the Montana Water and Wastewater Operators Short School, Montana State University, Bozeman, MT, September 1999 (30 participants).

"Options for Organics Control in Drinking Water," and "Effects of Chlorine on the Kinetics of Growth and Substrate Uptake for Biofilm in Model Drinking Water Systems." Professional Development Workshop for U.S. Air Force environmental engineering personnel, April 1999 (5 participants).

"Drinking Water Quality Standards," guest lecture, Civil Engineering 340, Principles of Environmental Engineering. Spring 1995, 1996 and 1999, Fall 1999 and Spring 2000 (approximately 40 to 60 students).

"Drinking Water and Public Health: Risks from Microbial and Chemical Agents." Guest lecture, Nursing 565, Principles of Population Health. Fall 1999, 2000, and 2001 (approximately 10 to 12 students).

"Drinking Water Regulations–A Force Behind Biofilm Control in Distribution Systems," and "Options for Organics Control in Drinking Water." Continuing Education Classes at the workshop "Biofilms in Water Systems," sponsored by the Montana Environmental Training Center, Bozeman, MT, January 1999 (17 participants).

"How to Minimize Regrowth in Distribution Systems." Continuing Education Class at the Montana Water and Wastewater Operators Short School, Montana State University, Bozeman, MT, September 1997 (20 participants).

"Biofilms in Distribution Systems: Occurrences, Causes, Implications and Control Strategies." Preconference Seminar (Continuing Education), *Water Quality Deterioration in Water Distribution Systems*, 1996 Wisconsin Section AWWA Annual Conference, Green Bay (100 participants).

"Basics of Water Treatment Filtration." Continuing Education Class at the Eighth Annual Waterworks and Wastewater Short School, Emerald Empire-Mid Coast AWWA Subsections, March 1992 (30 participants).

"Basics of Water Treatment Filtration." Continuing Education Class at the Eleventh Annual Waterworks Short School, Northwest Oregon AWWA Subsection, September 1991 (40 participants).

SUMMARY OF ACADEMIC AND RESEARCH EXPERIENCE

Dates	Organization	Position
2007-present	Department of Civil and Environmental Engineering, Washington State University, Spokane, WA	Associate Research Professor

Duties and Responsibilities

Perform research in the areas of biofilm in drinking water and water reuse distribution and storage systems. Specific areas of research include the role of biofilm in the microbial quality of water stored in aircraft drinking water tanks; fate, transport and occurrence of pathogens in environmental settings; concentration and detection of pathogens in water; and biofilm and its relationship to pathogens in water.

Dates	Organization	Position
2003-present	Department of Environmental and Occupational Health Sciences, School of Public Health and Community Medicine, University of Washington, Seattle, WA	Research Scientist/Engineer

Duties and Responsibilities

Perform research to understand the relationships between organic carbon compounds commonly found in water and growth of biofilm in municipal water systems; relationship between biofilm and microbial quality in reclaimed water distribution systems; chlorine and its effect on growth and uptake of carbon compounds in biofilm; interactions between iron oxides, humic substances and biofilm; microbial contamination risk assessment for water systems; detection of pathogens in drinking water; biofilm and its relationship to pathogens in water systems; long-term fate of pathogens in home plumbing systems following UV light disinfection; and role of biofilm in the microbial quality of water stored in aircraft drinking water tanks. Co-teach environmental health courses focusing on water, microbial risks in drinking water and public health. Co-organizer of an international colloquium "Protecting Public Health in Small Water Systems," held May 2004 on the campus of Montana State University, and attended by 45 professionals from 17 different countries.

Dates	Organization	Position
1999-2003	Center for Biofilm Engineering and Department of Civil Engineering, Montana State University	Research Assistant Professor

Duties and Responsibilities

Research assistant professor responsible for conducting research involving biofilm's role in modifying the quality of drinking water and reclaimed water as it moves through a distribution system, including the interactions between biofilm and pathogens, and the biological stability of drinking water. Responsibilities were to perform research in the laboratory, write manuscripts for publication, write proposal for new grants, manage technical staff, mentor undergraduate and graduate students, present research at national conferences, and maintain involvement in the overall research and education mission of the Center for Biofilm Engineering. As an adjunct in the Department of Civil Engineering, responsibilities were to develop class material and teach courses involving environmental and civil engineering.

Dates	Organization	Position
1994-1998	Center for Biofilm Engineering, Montana State University	Graduate Research Assistant

Duties and Responsibilities

Doctoral student responsible for research to investigate the role of different substrate classes in growth and development of drinking water biofilm, including chlorine and its interaction with substrates and biofilm. Determined the microbial kinetics of growth and substrate utilization for the biofilm and the fate of coliform organisms in drinking water biofilm.

Mentors: Dr. Anne Camper and Dr. Warren Jones

RESEARCH EXPERIENCE

Dates	Project	Role	Funding Agency
10/2006 – 5/2008	Role of Biofilm in Aircraft Water Storage Tanks on Bacterial Water Quality	Principal Investigator	Montana Water Center Technical Assistance Center for Small Water Systems, U.S. EPA \$99,000
7/2006 – 7/2009	A Novel Molecular-Based Approach for Broad Detection of Viable Pathogens in Drinking Water. US EPA 2005-STAR-K1 Project Number R833011	Co-Investigator	U.S. EPA \$597,987
2006-2007	Capture and Concentration of Pathogens from Drinking Water Using a Porous-Media Biofilm Reactor	Principal Investigator	Departmental funding
2005-2009	Reducing Environmental Risk to Rural Low Income Families. 1R01NR009239-01A1	Co-Investigator	NIH-NINR \$2,157,066
2004-2005	Assessing the Long-term Safety of Ultraviolet Light Disinfection Point-of-Use/Point-of-Entry Treatment Devices	Principal Investigator	Montana Water Center Technical Assistance Center for Small Water Systems \$75,000
2002-2004	Household Environmental Risk Reduction in Rural Children. Part of a NIH COBRE grant titled CEHS Faculty Development, P20RR017670, A. Holian–Principal Investigator.	Co-Investigator; under Junior Principal Investigator P.G. Butterfield	NIH \$15,000 (PWB only)
2004-2005	Phase II – Development of Expert Opinion and Software Enhancements to the Toolbox to Assess Microbial Contamination Risks for Small Drinking Water Systems.	Principal investigator	Montana Water Center and U.S. EPA \$14,375
2002-2003	Characterizing Microbial Water Quality in Non-Potable Reclaimed Water Distribution Systems to Optimize End Uses	Co-principal investigator, in association with Narasimhan Consulting Services, Inc.,	American Water Works Association Research Foundation \$42,500 (PWB only)

Dates	Project	Role	Funding Agency
		and CH2M HILL	
2001-2002	Toolbox to Assess Microbial Contamination Risks for Small Drinking Water Systems	Co-principal investigator	Montana Water Center and U.S. EPA \$119,950
2002	Evaluation of a Novel Method to Automate the Measurement of Biodegradable Dissolved Organic Carbon in Drinking Water	Advisor and Mentor REU Program	National Science Foundation grant to Center for Biofilm Engineering
1999-2001	Interactions Among Factors That Influence Biofilm, Bacterial Regrowth, and Corrosion in Distribution Systems	Post-doctoral Researcher and Project Director	U.S. EPA \$350,000
2000-2001	Modified Enzyme Assay to Determine Biofilm Biomass	Advisor and Mentor	Montana State University Undergraduate Scholars Program
1994-1998	Assessment of Growth and Substrate Uptake Kinetics of Biofilm Microorganisms in Drinking Water Distribution Systems	Ph.D. Candidate	American Water Works Association Research Foundation and National Science Foundation

TEACHING EXPERIENCE

Courses as lead instructor

Spring 2003	Engineering 600 Seminar, 1 semester credit, 11 students (seminar for doctoral students), lectures focused on development of presentations for oral defense of proposals
Fall 2002	Civil Engineering 442, Environmental Science and Engineering, 3 semester credits, 15 students (introductory class to all aspects of environmental engineering)
Spring 2002 Spring 2001	Civil Engineering 340, Principles of Environmental Engineering, 3 semester credits, 37-42 students (class material covered the basic components of environmental engineering for civil engineering students)
Fall 2001	Civil Engineering 331, Engineering Hydrology, 2 semester credits, 75 students (basic hydrology for civil engineering students)

Courses as co-instructor

Spring 2004, 2005, 2006	Environmental Health 433, Sampling and Analysis III, 4 quarter hours, 10-14 students (Environmental microbiology laboratory focusing on sampling and detection of pathogens in water, wastewater, food, surfaces and air)
Fall 2003, 2004, 2005, 2006	Environmental Health 440/545, Water, Wastewater and Health, 3 quarter hours, undergraduates, 4 quarter hours graduates, 20-24 students (class covers source, transport, fate and health effects of pathogen in water, and fundamental methods for treatment to remove or kill pathogens in water)
Winter 2005, 2006	Environmental Health 594, Seminar: Current Topics in Environmental Health, 1 quarter hour, 8 to 10 students (share responsibility with other 3 other faculty members) (students select major topic for detailed investigation from an environmental health perspective; past

Courses as lead instructor

topics include Walkerton water-borne *E. coli* outbreak and environmental hazards to first responders to Katrina disaster)

Fall 1996 Environmental Engineering 544, Environmental Engineering Laboratory, 2 semester credits, 8 graduate students (water and wastewater analysis laboratory)

Courses as guest lecturer

Winter 2003, 2004, 2005 Environmental Health 431, Sampling and Analysis I: Sampling strategies for water and wastewater (2 lectures)

Fall 2004 Environmental Health 111, Exploring Environment and Health Connections: Water, Wastewater and Environmental Health (2 lectures plus one class for student discussion)

GRADUATE STUDENT COMMITTEES

Dates	Student	Thesis	Degree
2006-	Clarita Lefthand-Begay	Microbial Source Tracking to determine sources of contamination in Tulalip Bay (Committee Member)	M.S. Environmental Health, UW
2003-2005	Karen Takatani	Pathogen survival in home water systems following POE UV light disinfection (Primary Mentor)	M.S. Environmental Health, UW
2003- 2005	Kristin Cunningham	Disinfection of pathogen-contaminated environmental surfaces by spray application of a ClO ₂ disinfectant (Committee Member)	M.S. Environmental Health, UW
2003-2005	Wes Bauman	Pathogen survival and persistence in a biofilm trap (Committee Member)	M.S. Environmental Engineering, MSU
2003-2004	Nicola Josephs	An Evaluation of the Utility of F+RNA Coliphage for Source Tracking Pathogens in the Environment (Committee Member)	M.S. Environmental Health, UW
2001-2003	Alex Bargmeyer	Evaluation of innovative biofilm control technologies for drinking water systems (Committee Member)	M.S Environmental Engineering, MSU
2000-2001	Kristin Van Andel	The influence of distribution system infrastructure on bacterial regrowth (Committee Member)	M.S. Environmental Engineering, MSU

SUMMARY OF ENGINEERING EXPERIENCE

Dates	Organization	Position
1998-present	CH2M HILL Global Water Business Group Denver, Colorado	Senior Technologist (Biofilm in Water and Reuse Systems)

Duties and Responsibilities

Provide expertise to CH2M Hill clients with concerns regarding biofilm and its role in water quality degradation in distribution systems, particularly its role in harboring opportunistic pathogens. Duties have included development of monitoring plans to assess control of biofilm in distribution systems, evaluation of biofilm control strategies in raw water pipelines, determining methods to improve the microbial quality of

drinking water in the water system of a large industrial complex, and consulting in the area of biofouling of membranes used for water treatment.

Dates	Organization	Position
1987-1994	CH2M HILL Portland, Oregon	Manager, Water Systems Department Staff Manager, Water Business Group for Portland, Corvallis, and Honolulu Offices Project and Client Manager

Duties and Responsibilities

Managed business development, procured projects, managed staffing of projects, and mentored staff members with regard to their performance and professional growth. Project manager responsible for execution and completion of numerous drinking water projects for municipal clients. Projects included transmission pipelines, pumping facilities, major storage facilities, and rehabilitation of old and design of new treatment plants. Prepared municipal water system master plans for cities, including distribution system hydraulic modeling, source and treatment evaluations, and development of capital improvement programs and financial plans. Prepared economic studies, rate evaluations and bond issue analyses for municipal clients.

Dates	Organization	Position
1981-1987	CH2M HILL Boise, Idaho	Project Manager Project Engineer

Duties and Responsibilities

Managed business development, procured projects and managed study and design projects. Performed water treatment plant pilot studies, prepared preliminary designs, and managed design of new treatment facilities. Prepared municipal water system master plans for cities, including distribution system hydraulic modeling, source and treatment evaluations and development of capital improvement programs. Performed water and sewer rate studies for municipalities.

Dates	Organization	Position
1980-1981	HKM Associates Billings, Montana	Project Engineer
1978-1980	Wright-McLaughlin Engineers Denver, Colorado	Project Engineer
1977-1978	Stahly Engineering and Associates	Project Engineer

Duties and Responsibilities

Prepared wastewater collection and/or treatment planning studies for six municipalities. Prepared wastewater collection system models for combined sewer system (SWMM). Designed water transmission pipeline improvements. Prepared preliminary design of improvements to wastewater treatment facilities,

SPECIFIC ENGINEERING EXPERIENCE

Project	Consulting Firm	Client
<u>Biofilm Related Work</u> Developed sampling plan, analyzed data and developed recommendations for reducing biofilm and corrosion related problems in a campus distribution system	CH2M HILL, Parsippany, NJ	Research facility for large manufacturing company

Project	Consulting Firm	Client
Identified problems and developed biofilm control strategies for 72-inch- and 90-inch-diameter raw water pipelines	CH2M HILL, Denver office	Tarrant Regional Water District, Fort Worth, TX
Selected bacterial sampling protocols for evaluation of biofouling in a nanofiltration membrane pilot study	CH2M HILL, Denver office	Boca Raton, FL, Membrane Pretreatment Study
Developed plan for sampling and analysis to establish a biofilm and water quality control program for the distribution system as part of conversion to chloramination	CH2M HILL, Denver office	City of Portsmouth, VA
Water Storage Facilities		
Designed and managed construction of a 15 million gallon circular prestressed concrete reservoir	CH2M HILL, Boise office	Utah Water Conservancy District, Orem, UT
Designed and managed construction of a 10 million gallon circular prestressed concrete reservoir	CH2M HILL Portland office	City of Gresham, OR
Designed and managed construction of two 1-million-gallon steel standpipe reservoirs	CH2M HILL, Portland office	City of Gresham, OR Clairmont Water District, Oregon City, OR
Directed design of a 1-million-gallon above-ground steel reservoir	CH2M HILL, Portland office	Mt. Scott Water District, Clackamas, OR
Water Pumping Facilities		
Designed and managed construction of drinking water pump stations <ul style="list-style-type: none"> 12,000 gallons-per-minute booster pump station, horizontal, split-case centrifugal pumps, surge control valves 8,000 gallons-per-minute booster pump station, vertical turbine pumps, surge control valves 	CH2M HILL, Portland office	City of Vancouver, WA
Designed and managed construction of drinking water pump stations <ul style="list-style-type: none"> Surge control tank and pump upgrade, booster pump station, vertical turbine pumps Rehabilitation of 2 booster pump stations with new pumps, control valves, electrical, control and ventilation 	CH2M HILL, Portland office	Clairmont Water District, Oregon City, OR
Water Pipelines and Associated Facilities		
Designed and managed construction of 2 miles of 24-inch diameter transmission pipeline	CH2M HILL, Portland office	City of Vancouver, WA
Designed and managed construction of 1-½ miles of 20-inch diameter transmission pipeline and 2 automated meter and control valve stations for water purchase from wholesale agency	CH2M HILL, Portland office	City of Vancouver, WA
Designed and managed construction of 5 miles of water transmission pipelines (12- to 18-inch diameter) and two pressure reducing valve stations	CH2M HILL, Boise office	Northern Ute Indian Tribe, UT

Project	Consulting Firm	Client
Directed design and construction of 3 miles of 16-inch-diameter transmission pipeline	CH2M HILL, Portland office	Clairmont Water District, Oregon City, OR
Designed and managed construction of numerous water distribution pipeline replacement projects, 6- and 8-inch diameter pipes	CH2M HILL, Portland office	Clairmont Water District, Oregon City, OR
Managed planning, design and construction of state-of-the-art supervisory control and data acquisition system with computer based control for water system	CH2M HILL, Portland office	City of Gresham, OR
Designed and managed construction of 2 miles of 20-inch-diameter water transmission pipeline and pressure reducing valve station	CH2M HILL, Boise office	Murray City, UT
<i>Water Supply and Treatment Facilities</i>		
Managed rehabilitation of municipal water supply well	CH2M HILL, Boise office	Murray City, UT
Designed emergency repairs and rehabilitation of spring water supply after a major flood	CH2M HILL, Boise office	Murray City, UT
Designed and managed construction of 1.5-million-gallons-per-day capacity spring supply with sand sedimentation, chlorination and fluoridation facilities	CH2M HILL, Boise office	Northern Ute Indian Tribe, UT
Planned, designed and managed construction of an 8,000-gallons-per-minute-capacity and 19,000-gallons-per-minute-capacity air stripping towers for removal of perchloroethylene from groundwater, including vapor-phase granular activated carbon off-gas treatment	CH2M HILL, Portland office	City of Vancouver, WA
Managed water treatment plant evaluation and upgrade study for 60-MGD capacity Hayden Bridge Plant	CH2M HILL, Portland office	Eugene Water and Electric Board, Eugene, OR
Performed water treatment plant evaluation and upgrade study for two surface water treatment plants	CH2M HILL, Boise office	City of Sandpoint, ID
Performed water treatment plant evaluation and upgrade study for surface water treatment plant	CH2M HILL, Boise office	City of Bonners Ferry, ID
Prepared a filtration treatment evaluation study for an unfiltered surface water source (later resulted in design and construction of new membrane filtration plant)	CH2M HILL, Portland office	City of Warrenton, OR
Managed pilot study for ozone and granular activated carbon treatment of Clackamas River water	CH2M HILL, Portland office	Clackamas Water District, Clackamas, OR
Performed pilot studies, preliminary design, final process design and managed overall final design for new 11 million-gallons-per-day Tenmile Water Treatment Plant	CH2M HILL, Boise office	City of Helena, MT

Project	Consulting Firm	Client
Performed initial pilot studies for new Judy Reservoir Water Treatment Plant	CH2M HILL, Boise office	Skagit PUD, Mount Vernon, WA
<i>Master Plans for Municipal Water Systems</i>		
Determined future water requirements based on planning and growth projections; evaluated water sources for future supply, evaluated existing water treatment plants; performed computer hydraulic modeling of existing and proposed water distribution systems, and developed capital improvements programs	CH2M HILL, Portland office	Clairmont Water District, Oregon City, OR City of St. Helens, OR (Senior consultant) City of Newberg, OR City of Whitefish, MT
Water System master plan and hydraulic modeling	Wright- McLaughlin	City of Golden, CO
Served as District Engineer for rural water system serving 10,000 people	CH2M HILL, Portland office	Clairmont Water District, Oregon City, OR
<i>Economics and planning of municipal utilities and infrastructure</i>		
Performed engineering and economic evaluation of feasibility to provide wholesale water to another municipality	CH2M HILL, Portland office	City of Lake Oswego, OR
Performed engineering analyses required for cost of service water rate studies, cities of population 7,000 to 500,000	CH2M HILL, Boise and Portland offices	City of Coeur d'Alene, ID City of Bozeman, MT City of Rupert, ID Murray City, UT City of Portland, OR
Performed engineering evaluation of facilities, planning and capital improvements program to support a \$25 million revenue bond sale	CH2M HILL, Portland office	City of Portland, OR
Managed and performed a qualitative study of effects of various development alternatives on costs for water, wastewater and storm water infrastructure, performed as part of Portland, Oregon's metropolitan area master plan	CH2M HILL, Portland office	METRO, Portland, OR
Performed wastewater rate studies	CH2M HILL, Boise office	City of Twin Falls, ID City of Rupert, ID
<i>Wastewater Facilities Planning</i>		
Prepared an evaluation of phosphorus removal and sludge disposal alternatives for aerated lagoon effluent, prepared preliminary design of facilities	CH2M HILL, Boise office	City of Whitefish, MT

Project	Consulting Firm	Client
Responsible for preparing "201" wastewater facilities plans. Work included population and growth projections, sewer system and treatment facility evaluation and proposed improvements to sewer system and treatment facilities, including economic analyses of alternatives	Stahly Engineering	City of St. Ignatius, MT
"201" wastewater facilities plans (continued)	Wright-McLaughlin	City of Columbia Falls, MT
"201" wastewater facilities plans (continued)	HKM	City of Lewistown, MT Billings Heights Water District, Billings, MT City of Red Lodge, MT
Prepared predesign report for expansion of an advanced wastewater treatment facility	Wright-McLaughlin	Dillon-Silverthorne, CO
Developed and conducted urban storm water sampling programs in support of development of "Montana Urban Storm Water Quality Evaluation and Pollution Abatement Guidelines"	Stahly Engineering	State of Montana
Assisted in development of storm water master plan	Stahly Engineering	City of Helena, MT

COMMUNITY SERVICE

1999-2003: Chair, Board of Directors, Gallatin County Local Water Quality District, Montana.

PROFESSIONAL REGISTRATION

Professional Engineer: Colorado, Montana and Oregon

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

American Water Works Association
Past Member, AWWA Distribution System Research Committee
Water Environment Federation
American Society of Microbiology

AWARDS

Fellow, Burton K. Wheeler Center for Montana Public Issues. Montana State University, Bozeman, Montana, 1996-97.

Co-recipient of the Characklis Award for Outstanding Graduate Student, Center for Biofilm Engineering, Montana State University, Bozeman, Montana, 1997.

B.S. Degree with Special Honors. University of Colorado, Boulder, CO 1976.

Outstanding Senior Civil Engineering Student at the University of Colorado-Boulder, American Society of Civil Engineers, 1976.