

## Pei C. Chiu

Department of Civil and Environmental Engineering

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## EDUCATION

- 7/90 - 1/96 Ph.D., Stanford University, CA. Civil and Environmental Engineering.  
9/89 - 6/90 M.S., Stanford University, CA. Civil and Environmental Engineering.  
9/83 - 6/87 B.S., National Taiwan University, Taipei, Taiwan. Chemical Engineering.

## EXPERIENCE

- 9/09 - present Professor, Department of Civil & Environmental Engineering, University of Delaware, DE.  
9/02 – 8/09 Associate Professor, Department of Civil & Environmental Engineering, University of Delaware, DE.  
9/96 - 8/02 Assistant Professor, Department of Civil & Environmental Engineering, University of Delaware, DE.  
1/96 - 7/96 Postdoctoral Scholar, Department of Civil & Environmental Engineering, Stanford University, CA.  
7/90 - 12/95 Research Assistant, Department of Civil & Environmental Engineering, Stanford University, CA.

## COURSES TAUGHT

- CIEG233: Environmental Engineering Processes (sophomore)  
CIEG367: Environmental Engineering Thermodynamics (junior)  
CIEG434: Air Pollution Control (junior/senior)  
CIEG833: Fate of Organic Pollutants in the Environment (graduate)

## SELECTED REFEREED PUBLICATIONS

- Saquinj, J., Yu, Y.-H. and Chiu\*, P. C. (2016) "Wood-Derived Black Carbon (Biochar) as a Microbial Electron Donor and Acceptor" *Environmental Science & Technology Letters*, in press, DOI: 10.1021/acs.estlett.5b00354.  
Oh, S.-Y., Son, J.-G. and Chiu, P. C. (2015) "Black Carbon-Mediated Reductive Transformation of Nitro Compounds by Hydrogen Sulfide" *Environmental Earth Sciences*, 73, 1813-1822.  
Yi, S., Witt, B., Chiu, P. C., Guo, M. and Imhoff\*, P. T. (2015) "The Origin and Reversible Nature of Poultry Litter Biochar Hydrophobicity" *Journal of Environmental Quality*, 44(3), 963-971.  
Wang, Y., Lin, Y., Chiu, P. C., Imhoff, P. T. and Guo\*, M. (2015) "Phosphorus Release Behaviors of Poultry Litter Biochar as a Soil Amendment" *Science of the Total Environment*, 512/513, 454-463.  
Yu, Y.-H. and Chiu\*, P. C. (2014) "Kinetics and Pathway of Vinyl Fluoride Reduction over Rhodium" *Environmental Science & Technology Letters*, 1(11), 448-452.  
Oh, S.-Y., Son, J.-G., Hur, S. H., Chung, J. S. and Chiu P. C. (2013) "Black Carbon-Mediated Reduction of 2,4-Dinitrotoluene by Dithiothreitol" *Journal of Environmental Quality*, 42(3), 815-821.

- Chiu, P. C. (2013) "Applications of Zero-Valent Iron (ZVI) and Nanoscale ZVI to Municipal and Decentralized Drinking Water Systems – A Review" In: *Novel Solutions to Water Pollution*, American Chemical Society, Washington, DC, pp. 237–249.
- Oh, S.-Y., Son, J.-G. and Chiu P. C. (2013) "Biochar-Mediated Reductive Transformation of Nitro Herbicides and Explosives" *Environmental Toxicology & Chemistry*, 32(3), 501-508.
- Shi, C., Wei, J., Jin, Y., Kniel, K. E. and Chiu\*, P. C. (2012) "Removal of Viruses and Bacteriophages from Drinking Water Using Zero-Valent Iron" *Separation and Purification Technology*, 84, 72-78.
- Ingram, D. T., Callahan, M. T., Ferguson, S., Hoover, D. G., Chiu, P. C., Shelton, D. R., Millner, P. D., Camp, M. J., Patel, J. R., Kniel, K. E., Sharma, M. (2012) "Use of Zero-Valent Iron Biosand Filters to Reduce *Escherichia coli* O157:H12 in Irrigation Water Applied to Spinach Plants in a Field Setting" *Journal of Applied Microbiology*, 112, 551-560.
- Oh, S.-Y., Son, J.-G., Lim, O.-T. and Chiu P. C. (2012) "The Role of Black Carbon as a Catalyst for Environmental Redox Transformation" *Environmental Geochemistry and Health*, 34(1), 105-113.
- Jung, Y., Han, B., Mostafid, M. E., Chiu, P., Yazdani, R. and Imhoff, P. T. (2012) "Photoacoustic Infrared Spectroscopy for Conducting Gas Tracer Tests and Measuring Water Saturations in Landfills" *Waste Management*, 32(2), 297-304.
- Phillips, K. L., Sandler, S. I. and Chiu, P. C. (2011) "A Method to Calculate the One-Electron Reduction Potentials for Nitroaromatic Compounds Based on Gas-Phase Quantum Mechanics." *Journal of Computational Chemistry*, 32(2), 226-239.
- Oh, S.-Y., Kang, S.-G., Kim, D.-W. and Chiu P. C. (2011) "Degradation of 2,4-Dinitrotoluene by Persulfate Activated with Iron Sulfides" *Chemical Engineering Journal*, 172(2/3), 641-646.
- Phillips, K. L., Chiu, P. C. and Sandler, S. I. (2010) "Reduction Rate Constants for Nitroaromatic Compounds Estimated from Adiabatic Electron Affinities." *Environmental Science & Technology*, 44(19), 7431-7436.
- Yazdani, R., Mostafid, M. E., Han, B., Imhoff, P. T., Chiu, P. C., Augenstein, D., Kayhanian, M. and Tchobanoglous, G. (2010) "Quantifying Factors Limiting Aerobic Activity During Aerobic Bioreactor Landfilling" *Environmental Science & Technology*, 44(16), 6215-6220.
- Oh, S. Y., Kang, S. G. and Chiu P. C. (2010) "Degradation of 2,4-Dinitrotoluene by Persulfate Activated with Zero-Valent Iron" *Science of the Total Environment*, 408, 3464-3468.
- Oh, S. Y. and Chiu\*, P. C. (2009) "Graphite- and Soot-Mediated Reduction of 2,4-Dinitrotoluene and Hexahydro-1,3,5-trinitro-1,3,5-triazine" *Environmental Science & Technology*, 43(18), 6983-6988.
- Oh, S. Y., Chiu, P. C. and Cha, D. K. (2008) "Reductive Transformation of 2,4,6-Trinitrotoluene, Hexahydro-1,3,5-trinitro-1,3,5-triazine, and Nitroglycerin by Pyrite and Magnetite" *Journal of Hazardous Materials*, 158(2/3), 652-655.
- Ye, J. and Chiu\*, P. C. (2006) "Transport of Atomic Hydrogen through Graphite and Its Reaction with Azoaromatic Compounds." *Environmental Science & Technology*, 40(12), 3959-3964.

- Oh, S. Y., Lee, J., Cha, D. K. and Chiu\*, P. C. (2006) "Reduction of Acrolein with Elemental Iron: Kinetics, Pathway, and Enhanced Biodegradation" *Environmental Science & Technology*, 40(8), 2765-2770.
- Zhang J., Joslyn, A. and Chiu\*, P. C. (2006) "1,1-Dichloroethene as the Predominant Intermediate of Microbial Trichloroethene Reduction" *Environmental Science & Technology*, 40(6), 1830-1836.
- Oh, S. Y., Cha, D. K., Chiu, P. C. and Kim, B. J. (2006) "Zero-Valent Iron Treatment of RDX- and Perchlorate-Containing Wastewaters from an Ammunition-Manufacturing Plant at Elevated Temperatures" *Water Science & Technology*, 54(10), 47-53.
- Son, A., Lee, J., Chiu, P. C. and Cha, D. K. (2006) "Microbial Reduction of Perchlorate with Zero-Valent Iron." *Water Research*, 40(10), 2027-2032.
- Oh, S. Y., Chiu, P. C., Kim B. J. and Cha, D. K. (2006) "Enhanced Reduction of Perchlorate by Elemental Iron at Elevated Temperatures" *Journal of Hazardous Materials*, 129(1-3), 304-307.
- Han, B., Jafarpour, B., Gallagher, V. N., Imhoff, P. T. Chiu, P. C. and Fluman, D. A. (2006) "Measuring Seasonal Variations of Moisture in a Landfill with the Partitioning Gas Tracer Test" *Waste Management*, 26(4), 344-355.
- Saxe, J. R., Lubenow, B. L., Chiu, P. C., Huang, C.-P. and Cha, D. K. (2006) "Enhanced Biodegradation of Azo Dyes Using an Integrated Elemental Iron-Activated Sludge System: I. Evaluation of System Performance" *Water Environment Research*, 78(1), 19-25.
- Saxe, J. R., Lubenow, B. L., Chiu, P. C., Huang, C.-P. and Cha, D. K. (2006) "Enhanced Biodegradation of Azo Dyes Using an Integrated Elemental Iron-Activated Sludge System: II. Effect of Physical-Chemical Parameters" *Water Environment Research*, 78(1), 26-30.
- Oh, S. Y., Chiu, P. C., Kim B. J. and Cha, D. K. (2005) "Zero-Valent Iron Pretreatment for Enhancing the Biodegradability of RDX" *Water Research*, 39(20), 5027-5032.
- You, Y., Han, J., Chiu, P. C. and Jin, Y. (2005) "Removal and Inactivation of Waterborne Viruses Using Zero-Valent Iron" *Environmental Science & Technology*, 39(23), 9263-9269.
- Oh, S. Y., Cha, D. K., Kim, B. J. and Chiu\*, P. C. (2005) "Transformation of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), and Methylenedinitramine (MDNA) with Elemental Iron" *Environmental Toxicology & Chemistry*, 24(11), 2812-2819.
- Jafarpour, B., Imhoff, P. T. and Chiu\*, P. C. (2005) "Quantification and Modeling of 2,4-Dinitrotoluene Reduction with High-Purity and Cast Iron" *Journal of Contaminant Hydrology*, 76(1&2), 87-107.
- Oh, S. Y., Cha, D. K., Kim B. J. and Chiu\*, P. C. (2004) "Reduction of Nitroglycerin with Cast Iron: Pathway, Kinetics, and Mechanisms" *Environmental Science & Technology*, 38(13), 3723-3730.
- Dentel, S. K., Strogon, B. and Chiu, P. C. (2004) "Direct Generation of Electricity from Sludges and Other Liquid Wastes" *Water Science & Technology*, 50(9), 161-168.
- Ye, J. and Chiu\*, P. C. (2004) "Graphite-Mediated Azobenzene Reduction with Zero-Valent Iron" *PWEA Keystone Water Quality Manager*, 37(5), 16 pp.
- Oh, S. Y., Cha, D. K., Chiu, P. C. and Kim B. J. (2004) "Conceptual Comparison of Pink Water Treatment Technologies: Granular Activated Carbon, Anaerobic Fluidized-

- Bed Reactor, and Zero-Valent Iron-Fenton Process" *Water Science & Technology*, 49(5/6), 129-136.
- Türkmen, M., Dentel, S. K., Chiu\*, P. C. and Hepner, S. (2004) "Analysis of Sulfur and Nitrogen Odorants Using Solid-Phase Micro-Extraction (SPME) and GC-MS" *Water Science & Technology*, 50(4), 115-120.
- DiFrancesco, A. M., Chiu\*, P. C., Standley, L. J., Allen, H. E. and Salvito, D. (2004) "Dissipation of Fragrance Materials in Sludge-Amended Soils" *Environmental Science & Technology*, 38(1), 194-201.
- Dentel, S. K., Strogon, B. and Chiu, P. C. (2004) "Direct Generation of Electricity from Biosolids Using Microbial Fuel Cells" *Biosolids Technical Bulletin*, 9(5), 6-8.
- Oh, S. Y., Chiu, P. C., Kim B. J. and Cha, D. K. (2003) "Enhancing Fenton Oxidation of TNT and RDX through Pretreatment with Zero-Valent Iron" *Water Research*, 37(17), 4275-4283.
- Oh, S. Y., Cha, D. K., Chiu, P. C. and Kim B. J. (2003) Enhancing Oxidation of TNT and RDX in Wastewater: Pretreatment with Elemental Iron" *Water Science & Technology*, 47(10), 93-99.
- Imhoff, P. T., Jakubowitch, A., Briening, M. L. and Chiu, P. C. (2003) "Partitioning Gas Tracer Tests for Measurement of Water in Municipal Solid Waste" *J. Air & Waste Manage. Assoc.*, 53(11), 1391-1400.
- Oh, S. Y., Cha, D. K. and Chiu\*, P. C. (2002) "Graphite-Mediated Reduction of 2,4-Dinitrotoluene with Elemental Iron" *Environmental Science & Technology*, 36(10), 2178-2184.
- Perey, J. R., Chiu, P. C., Huang C. P. and Cha, D. K. (2002) "Zero-valent Iron Pretreatment for Enhancing Biodegradability of Azo Dyes" *Water Environment Research*, 74(3), 221-225.
- Oh, S. Y., Cha, D. K., Kim B. J. and Chiu\*, P. C. (2002) "Effect of Adsorption to Elemental Iron on the Transformation of 2,4,6-Trinitrotoluene and Hexahydro-1,3,5-trinitro-1,3,5-triazine in Solution" *Environmental Toxicology & Chemistry*, 21(7), 1384-1389.
- Perey, J. R., Oh, S. Y., Lubenow, B. L., Cha, D. K., Huang C. P. and P. C. Chiu\* (2001). "Enhancing Biodegradability of Refractory Aromatics: Pretreatment with Elemental Iron" *The 6th International Symposium on In Situ and On-Site Bioremediation*, San Diego, CA, 6(6), 149-155.
- Kim, I. K., Huang, C. P. and Chiu, P. C. (2001) "Sonochemical Decomposition of Dibenzothiophene in Aqueous Solution" *Water Research*, 35(18), 4370-4378.
- Lampron, K. J., Chiu, P. C. and Cha, D. K. (2001) "Reductive Dehalogenation of Chlorinated Ethenes with Elemental Iron: the Role of Microorganisms" *Water Research*, 35(13), 3077-3084.
- Chiu\*, P. C. and Lee M. (2001) "2-Bromoethanesulfonate Affected Bacteria in a Trichloroethene-Dechlorinating Culture" *Applied & Environmental Microbiology*, 67(5), 2371-2374.
- Cha, D. K., Chiu, P. C., Kim, S. D. and Song, J. S. (2000). "Hazardous Waste: Treatment Technologies" *Water Environment Research*, 72(5), 59 pp.
- Lampron, K. J., Chiu\*, P. C. and Cha, D. K. (1998). "Biological Reduction of Trichloroethene Supported by Fe(0)" *Bioremediation Journal*, 2(3&4), 175-181.
- Semadeni, M., Chiu, P. C. and Reinhard, M. (1998). "Reductive Transformation of Trichloroethene Catalyzed by Vitamin B<sub>12</sub>: Reactivities of the Intermediates -

- Acetylene, Chloroacetylene, and DCE Isomers" *Environmental Science & Technology*, 32(9), 1207-1213.
- Huang, C. P., Wang, H. W. and Chiu, P. C. (1998). "Nitrate Reduction by Metallic Iron" *Water Research*, 32(8), 2257-2264.
- Chiu, P. C. and Reinhard, M. (1996). "Transformation of Carbon Tetrachloride by Reduced Vitamin B<sub>12</sub> in Aqueous Cysteine Solution" *Environmental Science & Technology*, 30(6), 1882-1889.
- Chiu, P. C. and Reinhard, M. (1995). "Metallocoenzyme-Mediated Reductive Transformation of Carbon Tetrachloride in Titanium(III) Citrate Aqueous Solution" *Environmental Science & Technology*, 29(3), 595-603.

## INVITED SEMINARS

- 04/15 Department of Civil and Environmental Engineering, Penn State University, University Park, PA. "The Mechanism for Biochar-Promoted Microbial Nitrate Reduction."
- 02/15 Department of Civil and Environmental Engineering, University of Virginia, Charlottesville, VA. "Microbial Nitrate Reduction Promoted by Zero-Valent Iron and Biochar."
- 12/14 DENIN Environmental Frontier Seminar Series, Newark, DE. "Microbial Reduction of Nitrate Promoted by Zero-Valent Iron and Black Carbon (Biochar)."
- 11/14 State Key Laboratory of Environmental Aquatic Chemistry, Chinese Academy of Sciences (CAS), Beijing, China. "Catalytic Reduction of Vinyl Fluoride over Rhodium: Kinetics, Pathway, and the Critical Role of Water."
- 02/14 National Cheng-Kung University, Taiwan. "Kinetics, Pathway, and Mechanism for the Catalytic Reduction of Fluoroethene by Hydrogen over Rhodium."
- 08/13 National Cheng-Kung University, Taiwan. "From Iron Wall to Chicken Poop: The Role of Carbon in Environmental Redox Catalysis."
- 03/13 Air Liquide, Delaware Research and Technology Center, Newark, DE. "Preventing Formation of Total Trihalomethanes (TTHM) in Drinking Water Using Zero-Valent Iron."
- 03/13 Third Annual Delaware Sustainable Chemistry Summit, Delaware Biotechnology Institute, Newark, DE. "Preventing Formation of Toxic DBPs in Drinking Water Using ZVI."
- 02/13 Delaware River Water Alliance, First Topical Meeting on Water Technology, King of Prussia, PA. "Using ZVI for Drinking Water Treatment"
- 09/12 2012 CAPA Annual Meeting, National Agricultural Library, Washington, DC. "Improving Drinking Water Treatment through Use of Zero-Valent Iron (ZVI) and Nanoscale ZVI."
- 07/12 Beijing Construction Engineering Group Environmental Remediation Company, Beijing, China. "The Mechanisms for the Reductive Degradation of Nitro Explosive Compounds by Granular Iron."
- 04/12 Department of Civil and Environmental Engineering, Villanova University, Villanova, PA. "Improving Drinking Water Treatment through Use of Zero-Valent Iron (ZVI) and Nanoscale ZVI."
- 04/12 Department of Plant and Soil Sciences, University of Delaware, Newark, DE. "The Discovery of Black Carbon as a Mediator of Organic Contaminant Redox Transformation in Reducing Environments."

- 03/12 College of Bioresources and Agriculture, National Taiwan University, Taiwan. "Environmental Nanotechnology: Application of Iron Nanoparticle Media to Drinking Water Purification."
- 03/12 Department of Agricultural Chemistry, National Taiwan University, Taiwan. "Abiotic Oxidation-Reduction Reactions of Organic Contaminants in Environmental Systems."
- 03/12 College of Bioresources and Agriculture, National Taiwan University, Taiwan. "A Novel Remediation Approach Inspired by a New Redox Mechanism in Reactive Iron Barriers."
- 03/12 Second Annual Delaware Sustainable Chemistry Summit, Newark, DE. "Innovations for Clean Drinking Water: Zero-Valent Iron."
- 02/12 Department of Civil and Environmental Engineering, Temple University, Philadelphia, PA. "Improving Drinking Water Treatment through Use of Zero-Valent Iron (ZVI) and Nanoscale ZVI."
- 09/11 State Key Laboratory of Environmental Aquatic Chemistry, Chinese Academy of Sciences, Beijing, China. "A Novel Remediation Approach Inspired by a Redox Mechanism in Reactive Iron Barriers."
- 03/11 2011 IWA Workshop for Young Water Professionals, National Taiwan University, Taipei, Taiwan. "A Few Things I Learned ... Or Wish I Had."
- 01/11 National Chiao-Tung University, Taiwan. "Black Carbon as a Catalyst of Environmental Transformation Reactions...And Beyond."
- 12/10 University of Ulsan, Ulsan, South Korea. "The Discovery of Black Carbon as an Environmental Redox Mediator."
- 11/10 Industrial Technology Research Institute, Taiwan. "Nanoscale Zero-Valent Iron (nZVI) for Portable Drinking Water Treatment."
- 10/10 National Taiwan University of Science and Technology, Taipei, Taiwan. "Graphitic Carbon-Catalyzed Reductive Degradation of Organic Contaminants."
- 10/10 Keynote speaker, 2010 Annual Conference on Civil and Ecological Engineering, Kaohsiung, Taiwan. "Applications of Zero-Valent Iron (ZVI) and Nanoscale ZVI to Drinking Water Treatment."
- 10/10 Department of Environmental Engineering, National Chung Hsing University, Taichung, Taiwan. "Black Carbon-Mediated Reductive Transformation of Nitrogenous Pollutants."
- 04/10 The Inaugural Delaware Environmental Institute (DENIN) Symposium, Newark, DE. "Potential Impacts of Biochar Addition on Soil Transport Properties, Nutrient Levels, and Greenhouse Gas Emissions."
- 07/09 2009 International Workshop on Integrated Watershed Management (IWIWM), Taipei, Taiwan. "Application of Zero-Valent Iron to Drinking Water Treatment."
- 06/09 The Chesapeake Section of American Water Works Association (CSAWWA), Milford DE. "Simultaneous Removal of Viruses, DBP Precursors, Arsenic, and Iron Using Zero-Valent Iron."
- 09/08 ACHMM 2008 National Conference, Nicollet Mall, Minneapolis, MN. "Synergistic Treatment of Hazardous Chemicals Using Zero-Valent Iron and Graphite."
- 11/07 The 5th UNU & GIST Joint Workshop on Sound Management of Hazardous Chemicals and Sustainable Energy, Gwangju Institute of Science and

- Technology, Gwangju, Korea. "Removal of Viruses from Water Supply Using Zero-Valent Iron."
- 10/07 Penn State Institute of Energy and the Environment, Penn State Harrisburg, PA. "Removal of Microbial Pathogens from Drinking Water Using Zero-Valent Iron."
- 03/06 ACS Special Symposium: *Creative Advances in Environmental Science & Technology*, in Honor of René P. Schwarzenbach, 231st American Chemical Society National Meeting, Atlanta, GA. "Graphite-Mediated Reduction of Nitrogenous Compounds."
- 03/06 School of Civil Engineering, Purdue University, West Lafayette, IN. "Graphite-Mediated Transformation of Nitrogenous Contaminants by Zero-Valent Iron."
- 02/06 Department of Civil and Environmental Engineering, University of Maryland, Baltimore County, Baltimore, MD. "Degradation of Nitro Explosives Using Elemental Iron – From Laboratory Study to Field Demonstration."
- 07/05 School of Environmental Science and Engineering, Shanghai Jiaotong University, Shanghai, China. "Mechanisms for the Reduction of Nitrogenous Compounds with Elemental Iron."
- 07/05 Department of Chemical and Biomolecular Engineering, National Singapore University, Singapore. "Beyond Groundwater Remediation: Applications of Zero-Valent Iron to Drinking Water and Wastewater Treatment."
- 07/05 College of Environmental Science and Engineering, Tongji University, Shanghai, China. "Zero-Valent Iron for Subsurface Permeable Reactive Barriers and Other Environmental Applications."
- 02/05 Department of Civil and Environmental Engineering, Rice University, Houston, TX. "The Roles of Graphite and Atomic Hydrogen in the Reduction of Nitrogenous Compounds with Elemental Iron."
- 06/04 National Taiwan University, Taiwan. "Mechanisms for the Reduction of Nitrogenous Pollutants with Elemental Iron: the Role of Carbon Inclusions"
- 06/04 Industrial Technology Research Institute, Taiwan. "Reductive Degradation of Energetic Compounds – TNT, RDX, HMX, and nitroglycerin – with Elemental Iron and Fenton's Reagent"
- 06/04 National Jiao-Tong University, Taiwan. "*In Situ* Anaerobic Bioremediation and Reactive Iron Barriers for the Reduction of Groundwater Pollutants"
- 06/04 National Cheng-Kung University, Taiwan. "Graphite-Mediated Reduction of Nitrogenous Pollutants with Elemental Iron"
- 06/04 National Chia-Nan University, Taiwan. "Graphite-Mediated Reduction of Nitrogenous Pollutants with Elemental Iron"
- 06/04 National Sun Yat-Sen University, Taiwan. "Regio-Selective Reduction of Nitrogenous Compounds with Commercial Cast Iron: the Role of Graphite Inclusions"
- 06/03 International Flavors and Fragrances, Inc., NJ. "Mechanisms for the Dissipation and Fate of Fragrance Materials in Sludge and Soil."
- 05/01 School of Environmental Science, Engineering, and Policy, Drexel University, PA. "Microbial Reductive Dechlorination Supported by Zero-Valent Iron."
- 03/01 URS Corporation / DuPont Co., Wilmington, DE. "Coupling Microbial and Chemical Dechlorination of TCE in an Iron-Water System."

- 06/99 Department of Civil and Environmental Engineering, Stanford University, CA. "Fate of Trichloroethene in an Iron-Water System in the Presence of a Dechlorinating Culture."
- 02/99 Department of Plant and Soil Sciences, University of Delaware, DE. "Microbial Dechlorination of Trichloroethene Coupled with Anaerobic Fe(0) Corrosion."
- 11/98 DuPont Experimental Station, Wilmington, DE. "Microbial Reductive Dechlorination Supported by Elemental Iron."
- 02/97 Geography and Environmental Engineering, Johns Hopkins University, MD. "The Pathway of Trichloroethene Reduction Mediated by Vitamin B<sub>12</sub>."
- 02/97 Tyndall Air Force Base, Tyndall, FL. "Reductive Transformation of Trichloroethene Catalyzed by Vitamin B<sub>12</sub>."

## CONFERENCE PROCEEDINGS AND PRESENTATIONS

One hundred and forty-one conference proceedings and presentations.

Conferences include

- American Chemical Society (ACS) National Meetings
- Gordon Research Conferences
- Association of Environmental Engineering & Science Professors (AEESP) Conferences
- Goldschmidt Conference
- Society of Environmental Toxicology & Chemistry (SETAC) Meetings
- Battelle Bioremediation Conferences
- Water Environment Federation (WEF) Conferences
- AWWA Water Quality Technology Conferences

## RESEARCH PROJECTS

- "Measuring and Predicting the Natural and Enhanced Rate and Capacity of Abiotic Reduction of Munitions Constituents." Strategic Environmental Research and Development Program (SERDP), PI, w/ Dom Di Toro and Herb Allen, 5/16-4/20.
- "CONSERVE: A Center of Excellence at the Nexus of Sustainable Water Reuse, Food, and Health." Agriculture and Food Research Initiative (AFRI), Co-PI, with Amy Sapkota et al., 9/15-8/19.
- "Pilot-Scale Investigation of an Integrated Biological-Zero-Valent Iron ("Bio-ZVI") Technology for Nitrate Removal from Water." HKF Technology, LLC, PI, w/ Daniel K. Cha, 9/15-9/16.
- "Integrating Zero-Valent Iron and Biochar Amendments in Green Stormwater Management Systems for Enhanced Treatment of Roadway Runoff – Field Demonstration." Delaware Department of Transportation (DelDOT), Co-PI, w/ Paul T. Imhoff (PI), Daniel K. Cha, Julia A. Maresca, and Mingxin Guo (Delaware State University), 9/15-8/16.
- "Reducing Stormwater Runoff and Pollutant Loading with Biochar Addition to Highway Greenway" Transportation Research Board, NCHRP IDEA Program, Co-PI, w/ Paul T. Imhoff (PI), 3/15-2/17.
- "Reducing Stormwater Volume and Nutrients with Biochar" National Fish and Wildlife Foundation – Chesapeake Bay Innovative Nutrient and Sediment Program, Co-PI, w/ Paul T. Imhoff and Julia A. Maresca, 9/14-8/16.



- "Understanding Nitrate Reduction by Exoelectrogenic Microbes Supported by Black Carbon and ZVI." DENIN Environmental Frontier Grant, PI, w/ Paul T. Imhoff and Mingxin Guo, 2/14-8/15.
- "Integrating Zero-Valent Iron and Biochar Amendments in Green Stormwater Management Systems for Enhanced Treatment of Roadway Runoff: Phase III Field Demonstration." Delaware Department of Transportation (DelDOT), Co-PI, w/ Paul T. Imhoff (PI), Daniel K. Cha, Julia A. Maresca, and Mingxin Guo (Delaware State University), 9/13-8/14.
- "Enhancing Nitrogen Removal in Stormwater Treatment Facilities for Transportation." Center for Advanced Infrastructure and Transportation, Co-PI, w/ Paul T. Imhoff (PI) and Qizhong Guo (Rutgers, the State University of New Jersey), 1/14-12/14.
- "Developing And Evaluating An Innovative Litter Amendment Application System For Poultry Operations." USDA, AFRI Program, Co-PI, with Hong Li (PI), Eric Benson, Rolf Joerger, Carl Schmidt, Daniel Bautista, and Jennifer Timmons (University of Maryland), 9/13-8/15.
- "Integrating Zero-Valent Iron and Biochar Amendments in Green Stormwater Management Systems for Enhanced Treatment of Roadway Runoff – Phase II: Field Evaluation." Delaware Department of Transportation. Co-PI, w/ Paul T. Imhoff (PI), Daniel K. Cha, Julia A. Maresca and Mingxin Guo (Delaware State University), 9/12-8/13.
- "Frequent Application of Litter Amendments in Broiler Houses during Grow-out on Animal Health, Production, and Environment." U.S. EPA, Co-PI, with Hong Li (PI), Eric Benson, Rolf Joerger, Kali Kniel, and Yan Jin, 10/12-3/14.
- "Disinfection Byproduct Precursor Removal by Zero-Valent Iron for Drinking Water Purification." Delaware Sustainable Chemistry Alliance (DESCA), PI, 10/12-3/13.
- "Integrating Zero-Valent Iron and Biochar Amendments in Green Stormwater Management Systems for Enhanced Treatment of Roadway Runoff." Delaware Department of Transportation. Co-PI, w/ Daniel K. Cha (PI), Paul T. Imhoff, Julia A. Maresca and Mingxin Guo (Delaware State University), 9/11-12/12.
- "Removal of Natural Organic Matter (NOM) through Use of Zero-Valent Iron in Water Treatment Plants." Air Liquide, PI, 10/12-3/13.
- "Mitigation of Irrigation Water Using Zero-Valent Iron Treatment." Center for Produce Safety and California Leafy Greens Research Board, Co-PI, with Kalmia E. Kniel (PI) and Dallas Hoover (Animal and Food Sciences), 10/09 - 9/11.
- "Understanding the Mechanisms for the Reduction in Greenhouse Gas Emissions from Soil by Biochar Addition." Delaware EPSCoR Seed Grant Program, PI, with Paul Imhoff and Mingxin Guo (Delaware State University), 1/10 - 6/11.
- "Developing a Multi-Functional Nanoparticle-Enhanced Filter Media for Decentralized Water Purification Systems." National Science Foundation, SBIR Phase I, 1/10 - 6/11. UD sub-award through HydroQual, Inc., PI.
- "Quantifying Capture Efficiency of Gas Collection Systems with *In Situ* Gas Tracers." Environmental Research and Education Foundation (EREF), Co-PI, with Paul T. Imhoff (PI), Ramin Yazdani (Yolo County, CA), and Don Augenstein (Institute for Environmental Management, CA), 1/10 - 8/11.

- "Mitigation of Irrigation Water Using Zero-Valent Iron Treatment." Center for Produce Safety and California Leafy Greens Research Board, 10/09 - 9/11, Co-PI, with Kalmia E. Kniel (PI) and Dallas Hoover (Animal and Food Sciences).
- "Intelligent Bioreactor Management Information System – Extension." Department of Energy, Co-PI, with Paul T. Imhoff (PI) and Ramin Yazdani (Yolo County, CA), IEM, and Hydro Geo Chem, 6/08 - 4/10.
- "Improved Filtration Technologies for Pathogen Inactivation in Rural and International Water Supplies." International Research Award, University of Delaware Office of International Studies, Co-PI, with Steve Dentel (PI), George Elambo Nkeng (ENSTP), and Diane Herson (Biology), 7/08 - 6/09.
- "Intelligent Bioreactor Management Information System." Department of Energy, Co-PI with P. T. Imhoff (PI) and R. Yazdani, 1/05 - 12/08.
- "Enhancing Removal of Viruses in Water Treatment Plants Using Zero-Valent Iron" AWWA Research Foundation, PI, with Yan Jin and Kali Kniel, 10/07 – 1/09.
- "Synergistic Treatment of Hazardous Chemicals Using Zero-Valent Iron and Graphite." IHMM John J. McCambridge Research Grant, PI, 6/07 - 5/08.
- "Black Carbon-Mediated Reduction of Environmental Contaminants." Delaware EPSCoR Seed Grant Program, PI, with Doug Doren, 9/06 - 2/08.
- "Pilot-Plant Evaluation of an Integrated Iron-Fenton Process for Treatment of Pink Water." ESTCP sub-award through U.S. Army Engineer Research and Development Center, Co-PI, with D. K. Cha, 6/05 - 12/08.
- "Removal and Inactivation of Water-Borne Viruses Using Permeable Reactive Barriers." Delaware Water Resources Research Center, Co-PI with Y. Jin, 1/04 - 12/06.
- "Improving Performance of Wastewater Treatment Facilities Using Zero-Valent Iron." GS Engineering and Construction Corp. (Korea), Co-PI, with D. K. Cha, 6/05 - 5/06.
- "Reductive Removal of Aqueous Perchlorate by Zero-Valent Iron." U.S. Army, Co-PI, with J. W. Gillespie Jr., S. Yarlagadda, and D. K. Cha, 3/05 - 12/05.
- "Partitioning and Biological Uptake of Fragrance Materials in Sediments Receiving Wastewater Discharge." Research Institute for Fragrances Materials, PI, with H. E. Allen and D. Di Toro, 5/04 - 8/05.
- "Microbial Reductive Dechlorination Coupled with Iron Corrosion." National Science Foundation, Faculty Early Career Development (CAREER) Award, PI, 9/00 - 8/05.
- "Removal and Inactivation of Viruses in Drinking Water Using Zero-Valent Iron." National Science Foundation SBIR Grant, Phase I, 1/05 - 6/05. UD sub-award through Corporate Environmental Solutions, PI, with Y. Jin.
- "Enhancing Biodegradability of Refractory Compounds in Wastewater Treatment Facilities Using Elemental Iron." LG Corporation, Co-PI, with D. K. Cha, 4/04 - 3/05.
- "Reductive Removal of Aqueous Perchlorate by Elemental Iron." U.S. Army, Co-PI, with D. K. Cha, 4/04 - 3/05.
- "An Exploration of Odor Producing Mechanisms in Digested Biosolids and Optimal Control Strategies." Vivendi Water/US Filter, PI, with S. K. Dentel, 10/01 - 11/04.
- "Evaluation of Partitioning Gas Tracers for Measuring Water in Bioreactor Landfills." Department of Energy, Co-PI, with P. T. Imhoff, 9/03 - 8/04.

"Volatilization and Partitioning of Fragrance Materials in Sludge and Soil." Research Institute for Fragrances Materials, PI, with H. E. Allen, 1/03 - 3/04.

"Pretreatment of Energetic Materials before Biofilter." US Army, Co-PI with D. K. Cha, 7/03 - 12/03.

"Characterizing Moisture Content within Landfills." U.S. EPA, Co-PI, with M. Tittlebaum of University of New Orleans and P. T. Imhoff, 7/00 - 6/03.

"Volatilization and Partitioning of Fragrance Materials." Research Institute for Fragrances Materials, PI, with H. E. Allen, 7/02 - 6/03.

"Odor Production from Landfill Cover Materials." Delaware Solid Waste Authority, Co-PI, with Steven K. Dentel, 3/03 - 4/03.

"Treatability Study of Nitroglycerin in Wastewater." US Army, Co-PI with D. K. Cha, 4/02 - 3/03.

"Performance Evaluation of a Pilot-Scale SO<sub>2</sub> Scrubber." Air Quality Management Section, DNREC, PI, 2/02 - 1/03.

"Development of a Model to Predict the Fate of Fragrance Materials in Sludge-Amended Soils." Research Institute for Fragrances Materials, Co-PI, with L. J. Standley of Stroud Water Research Center and H. E. Allen, 6/00 - 5/02.

"Enhancing Degradability of Refractory Aromatics in Wastewater: Pretreatment with Elemental Iron." Water Environment Research Foundation, Co-PI with D. K. Cha, 5/00 - 4/02.

"Enhancing Biodegradability of TNT and Heterocyclic Nitramines in Wastewater: Pretreatment with Elemental Iron." U.S. Army, Co-PI with D. K. Cha, 6/00 - 12/01.

CAREER Award Equipment Grant, National Science Foundation, 9/01.

## **AWARDS AND HONORS**

Outstanding paper and presentation, American Chemical Society (ACS), Division of Environmental Chemistry, 2010.

A Zero-Valent Iron-Based Technology for Water Disinfection, one of the Top Seven Innovations of 2007, *NASA Tech Briefs*.

Excellence in Teaching Award, College of Engineering, University of Delaware, 2003.

Biosolids Research Award, Vivendi Water/US Filter, August, 2001.

Faculty Early Career Development (CAREER) Award, NSF, 2000.

Fellow, Institute for Transforming Undergraduate Education, University of Delaware.

## **STUDENT AWARDS**

Wendi Xu, Air & Waste Management Association (A&WMA) DVC Scholarship Award, April, 2013.

Anthony McGuire, Interdisciplinary Undergraduate Research in Sustainability Prize, Second Prize, "Replacing Chlorine with Nanoscale Zero-Valent Iron-Coated Media for Point-of-Use Drinking Water Treatment." August, 2011.

Liping Zhang, Pennsylvania Water Environment Association (PWEA) Student Research Award, "Removal and Inactivation of Waterborne Viruses using Elemental Iron." June, 2007.

Jianchang Ye, Pennsylvania Water Environment Association (PWEA) Student Research Paper Award, "Graphite-Mediated Azobenzene Reduction with Fe(0)." 2004.

Müserref Türkmen, Air Pollution Educational and Research Award, Mid-Atlantic States Section, Air and Waste Management Association, 2003.  
Müserref Türkmen, Air Pollution Educational and Research Award, Mid-Atlantic States Section, Air and Waste Management Association, 2002.  
Seok-Young Oh, Graduate Student Paper Award, American Chemical Society, Division of Environmental Chemistry, "Graphite-Mediated Reduction of 2,4-Dinitrotoluene with Elemental Iron," 2002.  
Jennie R. Perey, Battelle Student Paper Competition Award, "Enhancing Biodegradability of Azo Dyes through Pretreatment with Elemental Iron," 2002.

## **PATENTS**

Jin, Y. and Chiu, P. C. "Removal of Microorganisms and Disinfection Byproduct Precursors Using Elemental Iron or Aluminum." U.S. Patent No. 8,114,279.  
Jin, Y. and Chiu, P. C. "Removal of Microorganisms and Disinfection Byproduct Precursors Using Elemental Iron or Aluminum." Canadian Patent Number 2,538,783.  
Kim, B. J., Oh, S.-Y., Chiu, P. C. and Cha, D. K. "System for Destroying Hazardous Waste Resultant from the Production of Energetics such as Explosives" U.S. Patent No. 7,479,259.  
Cha, D. K., Oh, S.-Y., Chiu, P. C. and Kim, B. J. "Process for Treating Waste from the Production of Energetics" U.S. Patent No. 7,445,717.  
Cha, D. K., Chiu, P. C., Oh, S.-Y., Lee, J.-W. et al. "Process for Treating Refractory Wastewater Using Zero-Valent Iron Treatment and Biodegradation." Korean Patent No. 10-0735635.  
Chiu, P. C. and Jin, Y. "Filtration Media Coated with Zero-Valent Metals, Their Process of Making, and Use." Application No. 61/356,902. Pending.  
Chiu, P. C. and Jin, Y. "Mitigation of Irrigation Water Using Zero-Valent Iron Treatment." Application No. 61/357,304. Pending.

## **PROFESSIONAL ACTIVITIES**

Co-organized and chaired the ACS Symposium "*Thermodynamics and Kinetics in Treatment Processes, Past, Present and Future: Symposium in Honor of Prof. Chin-Pao Huang*" with Doong et al. for the 248th American Chemical Society (ACS) National Meeting, San Francisco, CA (8/14).

Chaired the *Hazardous Chemicals Management* Session at the 5th UNU & GIST Joint Workshop on Sound Management of Hazardous Chemicals and Sustainable Energy, Gwangju Institute of Science & Technology, Gwangju, Korea (11/07).

Organized and presided at the ACS Symposium "*Advances in Surface-Mediated Transformation in Environmental Systems*" with C. H. Huang of Georgia Institute of Technology for the 231st American Chemical Society (ACS) National Meeting in Atlanta, GA (3/06).

Proposal Reviewer/Panelist    NSF SBIR/STTR Program  
  NSF CAREER Program  
  NSF Environmental Engineering Program

NSF Collaborative Research in Chemistry (CRC) Program  
NSF-EPA New Technologies for Environment Program  
EPA Future Atmospheric Chemistry Program  
American Chemical Society Petroleum Research Foundation  
American Association for the Advancement of Science (AAAS)  
Department of State ISTC Program  
Research Grants Council (RGC), Hong Kong  
Maryland Industrial Partnerships (MIPS) Program  
Environmental Molecular Sciences Laboratory (EMSL)

Journal Reviewer

*Environmental Science and Technology*  
*Water Research*  
*Applied Catalysis B: Environmental*  
*Catalysis Letters*  
*Scientific Reports*  
*Carbon*  
*ASCE Journal of Environmental Engineering*  
*Chemosphere*  
*Biotechnology and Bioengineering*  
*Advances in Environmental Research*  
*Biotechnology Progress*  
*Water Resources Research*  
*Bioremediation Journal*  
*Environmental Engineering Science*  
*Ecotoxicology and Environmental Safety*  
*Chemical Engineering Journal*  
*Journal of Environmental Quality*  
*Journal of Applied Electrochemistry*  
*Journal of Chemical Technology and Biotechnology*  
*Journal of Soil and Sediment Contamination*  
*Journal of Water Supply: Research and Technology—AQUA*  
*Journal of American Water Works Association*  
*Journal of Environmental Science*  
*Journal of Hazardous Materials*  
*Ground Water Monitoring & Remediation*  
*Chemical Engineering Science*  
*Industrial and Engineering Chemistry Research*  
*Marine Environmental Research*  
*Science of the Total Environment*  
*Environmental Technology*  
*Electrochemistry Communications*  
*Separation and Purification Technology*  
*Journal of Analytical and Applied Pyrolysis*

Affiliation American Chemical Society (ACS), Division of Environmental Chemistry  
Association of Environmental Engineering and Science Professors (AEESP)  
Chinese-American Professors in Environmental Engineering & Science (CAPEES)