CURRICULUM VITAE

ROBERT G. ARNOLD

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EDUCATION:

1986 Ph.D. California Institute of Technology
Pasadena, California

Thesis: "Dissimilative Fe(III) Reduction by Pseudomonas sp. 200", 345 pp. Advisor: Michael R. Hoffmann

1976 MSEE University of North Carolina
Chapel Hill, North Carolina

Thesis: "Optimization of Unit Processes for Sulfide Removal from the Municipal Groundwater Supply at Roper, North Carolina", 139 pp. Advisor: Philip C. Singer.

1969 BSME United States Naval Academy, Annapolis, Maryland

EMPLOYMENT:

1997-Present Professor
Department of Chemical and Environmental Engineering
The University of Arizona, Tucson, Arizona

1992-1997 Associate Professor
Department of Chemical and Environmental Engineering
The University of Arizona, Tucson, Arizona

1986-1992 Assistant Professor
Department of Civil Engineering and Engineering Mechanics
The University of Arizona, Tucson, Arizona

1977-1981 Environmental Engineer
County Sanitation Districts of Los Angeles County

1969-1974 Military Service, U.S. Naval Officer

REGISTRATION: State of California Civil Engineer
License No. C031415

PROFESSIONAL HONORS:

1987 National Science Foundation
Presidential Young Investigator

1989 "Outstanding Faculty Member--Civil Engineering," 1989--awarded annually by University of Arizona Civil Engineering undergraduates.

1992 Quentin Mees award recipient for research. Annual award for research in environmental engineering from the Arizona Water and Pollution Control Association.

2002 Quentin Mees award recipient for research.

PROFESSIONAL SERVICE:

1996-2002 Associate editor and/or editor-in-chief for ASCE *Journal of Environmental Engineering*.

2000-present Member, Water Environment Research Foundation Research Council

2002-present Member, Water Reuse Foundation's Research Advisory Council

PEER-REVIEWED PUBLICATIONS

Willinger, M., E. Rupp, B. Barbaris, S. Gao, R. Arnold, E. Betterton, and A. Saez. 2009. Thermocatalytic destruction of gas-phase perchloroethylene using propane as a hydrogen source. Journal of Hazardous Materials. 167:770-776.

Gao, S., E. Rupp., S. Bell, M. Willinger, *et al.* 2008. Mixed redox catalytic destruction of chlorinated solvents in soils and groundwater: from the laboratory to the field. Annals of the New York Academy of Sciences. 1140:435-445.

Arnold, R. and K. Arnold. Accepted for publication, 2008. Integrated Urban Water Management in the Tucson, Arizona Metropolitan Area. UNESCO.

Teske, S. and R. Arnold. 2008. Removal of natural and xeno-estrogens during conventional wastewater treatment. Rev Environ Sci Biotechnol. 7:107-124.

Arnold, R., S. Teske, M. Tomanek, J. Engstrom, C. Leung, *et al.* Accepted for publication, 2008. Fate of polybrominated diphenyl ethers during wastewater treatment/polishing and sludge stabilization/disposal. Annals of the New York Academy of Sciences.

Zhang, J., M. Tomanek, H. Dong, R. Arnold, *et al.* 2008. Fate of polybrominated diphenyl ethers, nonylphenol, and estrogenic activity during managed infiltration of wastewater effluent. J Environ Engr. 134(6): 433-442.

Orbay, O., S. Gao, B. Barbaris, E. Rupp, E. Saez, R. Arnold and E. Betterton. 2007. Catalytic dechlorination of gas-phase perchloroethylene under mixed redox conditions. Appl. Catalysis (B Environmental). Science Direct at www.sciencedirect.com.

Arnold, Carpenter, Kirk, Koh, Armour, Cebrian, *et al.* 2007. Meeting Report: Threats to human health and environmental sustainability in the Pacific Basin. Environ. Health Perspect. 115: 1770-1775.

Conroy, O., A.E. Saez, D. Quanrud, W.P. Ela and R.G. Arnold. 2007. Changes in estrogen/anti-estrogen activities in ponded secondary effluent. Sci. Total Environ. 382: 311-323.

Miller, J.H., W.P. Ela, K.E. Lansey, P.L. Chipello and R.G. Arnold. 2006. Nitrogen transformations during soil-aquifer treatment of wastewater effluent – oxygen effects in field studies. J. Environ. Engr. 132(10): 1298-1306.

Quast, K., K. Lansey and R. Arnold. 2006. Boron isotopes as artificial tracers. Ground Water 44: 453-466.

De Las Casas, C.L., K.G. Bishop, L.M. Bercik, M. Johnson, M. Potzler, W.P. Ela, A.E. Saez, S.G. Huling and R.G. Arnold. 2006. In-place regeneration of granular activated carbon using Fenton's reagents. In: Innovative Approaches for the Remediation of Subsurface Contaminated Hazardous Waste Sites: Bridging Flask and Field Scales, ACS Symposium Series 940: 43-65.

Ju, X., M. Hecht, R.A. Galhotra, W.P. Ela, E.A. Betterton, R.G. Arnold and A.E. Saez. 2006. Destruction of gas-phase trichloroethylene in a modified fuel cell. Environ. Sci. Technol. 40: 612-617.

Conroy, O., D.M. Quanrud, W.P. Ela, D. Wicke, K.E. Lansey and R.G. Arnold. 2005. Fate of wastewater effluent hER-agonists and –antagonists during soil aquifer treatment. Environ. Sci. Technol. 39: 2287-2293.

Huling, S.G., P.K. Jones, W.P. Ela and R.G. Arnold. 2005. Repeated reductive and oxidative treatments of granular activated carbon. J. Environ. Engr. 131: 287-297.

Li, H., E.A. Betterton, R.G. Arnold, W.P. Ela, B. Barbaris and C. Grachane. 2005. Convenient new chemical actinometer based on aqueous acetone, 2-propanol, and carbon tetrachloride. Environ. Sci. Technol. 39: 2262-2266.

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He, J., W.P. Ela, E.A. Betterton, R.G. Arnold and A.E. Saez. 2004. Reductive dehalgenation of aqueous-phase chlorinated hydrocarbons in an electrochemical reactor. Ind. Eng. Chem Res. 43: 7965-7974.

Li, H., R.G. Arnold, E.A. Betterton, W.P. Ela and B. Barbaris. 2004. Comment on "The mechanisms of rate enhancing and quenching trichloroethene photodecay in the presence of sensitizer and hydrogen sources" Water Research. 38: 2791-2792.

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Quanrud, D.M., O. Conroy, D. Wilke, G. Seidel, W. Ela, P. Littlehat, G. Gerba, K. Lansey and R.G. Arnold. Accepted for publication, 2004. Comparison of *in vitro* methods for measurement of estrogenic effects in treated wastewater. Journal of Water and Health.

He, J., A.E. Sáez, W.P. Ela, E.A. Betterton and R.G. Arnold, 2004. Destruction of aqueous phase carbon tetrachloride in an electrochemical reactor with a porous cathode. Industrial Engineering Chemistry Research. 43:913-923.

Quanrud, D.M., M.M. Karpiscak, K.E. Lansey and R.G. Arnold, 2004. Transformation of effluent organic matter during subsurface wetland treatment in the Sonoran Desert. Chemosphere. 54(6):777-788.

Kommineni, S., W.P. Ela, R.G. Arnold, S.G. Huling, B.J. Hester, and E.A. Betterton, 2003. NDMA treatment by sequential GAC adsorption and Fenton-driven destruction. Environmental Engineering Science. 20(4):361-373.

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Quanrud, D., R. Arnold, K. Lansey, C. Begay, W. Ela and A.J. Gandolfi, 2003. Fate of organics during soil aquifer treatment: biodegradability, chlorine reactivity, and genotoxicity. Journal of Water and Heath. 01(1):33-44.

Chen, G., E. Betterton, R. Arnold and W. Ela, 2003. Electrolytic reduction of TCE and $CHCl_3$ at Pt-or Pt-coated ceramic electrode. Journal of Applied Electrochemistry. 33:161-169.

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Liu, Z., R. Arnold, E. Betterton, E. Smotkin, 2001. Reductive dehalogenation of gas-phase chlorinated solvents using a modified fuel cell. Environ. Sci. Technol. 35:4320-4326.

Huling, S.G., R. Arnold, R. Sierka and M.R. Miller, 2001. Influence of peat on Fenton oxidation. Water Res. 35(7):1687-1694.

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Picardal, F., R.G. Arnold and B.B. Huey, 1995. Effects of electron donor and acceptor conditions on reductive dehalogenation of tetrachloromethane by *Shewanella putrefaciens* 200. Applied Environmental Microbiology. 61:8-12.

Rusin, P., J. Cassells, L. Quintana, R. Arnold and N. Chrisman, 1995. Elimination of toxic factors in leachate to enhance biooxidation of sulfide ores. Mining Engineering. 173-178.

McCaulou, D.R., R.C. Bales and R.G. Arnold, 1995. Effect of temperature-controlled motility on transport of bacteria and microspheres through saturated media. Water Resources Research. 31:271-280.

Padival, N.A., J.S. Weiss and R.G. Arnold, 1995. Control of *Thiobacillus* by means of microbial competition: Implications for corrosion of concrete sewers. Journal of Water Environment Research. 67:201-205.

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Kuhler, R.J., G.A. Santo, T.R. Caudill, E.A. Betterton and R.G. Arnold, 1993. Photoreductive dehalogenation of bromoform with TiO_2-cobalt macrocycle hybrid catalysts. Environmental Science and Technology. 27:2104-2111.

Picardal, F.W., R.G. Arnold, H. Couch, A.M. Little and M.E. Smith, 1993. Involvement of cytochromes in the anaerobic biotransformation of tetrachloromethane by *Shewanella putrefaciens* 200. Applied and Environmental Microbiology.

Fitch, M.W., D.W. Graham, R.G. Arnold, S.K. Agarwal, P. Phelps, G.E. Speitel and G. Georgiou, 1993. Phenotypic characterization of copper-resistant mutants of *Methylosinus trichosporium* OB3b. Applied and Environmental Microbiology. 59:2771-2776.

Graham, D.W., J.A. Chaudhary, R.S. Hanson and R.G. Arnold, 1993. Factors affecting competition between type I and type II methanotrophs in two-organism, continuous-flow reactors. Microbial Ecology. 25:1-17.

Jewett, D.G., B.E. Logan, R.G. Arnold and R.C. Bales, 1992. Error analysis of collision efficiency and quantification of column study results. EOS, Transactions, American Geophysical Union Fall Meeting, 73(43):166.

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*Arnold, R.G., M.R. Hoffmann, T.J. DiChristina and F.W. Picardal, 1991. Regulation of dissimilative Fe(III) reduction in *Shewanella putrefaciens*. Applied and Environmental Microbiology. 63:789-798.

Morton, R.L., W.A. Yanko, D.W. Graham and R.G. Arnold, 1991. Relationships between sewage quality and crown corrosion in Los Angeles County sewers. Metal concentrations and sulfate reduction. Research Journal of the Water Pollution Control Federation. 63:789-790.

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RESEARCH IN PROGRESS

I am involved in ongoing research in the following areas:

1. ***Abiotic and biochemical catalysis of reductive dehalogenation.*** Heavily halogenated aliphatic contaminants such as perchloroethene, carbon tetrachloride and (to an extent) trichloroethene generally resist aerobic transformation mechanisms. The same compounds, however, are generally amenable to reductive transformations that yield less halogenated homologues. The several mechanisms of reductive dehalogenation are incompletely known. Mechanistic studies and dehalogenating systems under development in this laboratory follow:

   i. Treatment of contaminated gas streams containing semi-volatile chlorinated solvents using a membrane electrode assembly (modified fuel cell apparatus).

   ii. Electrolytic transformation of aqueous-phase chlorinated solvents.

   iii. Catalyzed thermochemical destruction of gas-phase solvents.

   iv. Photocatalytic, two-solvent systems consisting of acetone, isopropanol and the halogenated targets for reductive transformation reactions.

2. ***Oxidation of hazardous organic compounds in soils using H_2O_2 and Fenton-derived hydroxyl radicals.*** Research includes methods for quantifying radical production in environmental samples; utilization of Fenton-driven systems for in-place recovery of spent activated carbon.

3. ***Engineered systems leading to water reuse following infiltration and aquifer storage – the effect of soil-aquifer treatment on organic residuals, available nitrogen forms and pathogens in treated municipal wastewaters.*** Current research emphasis is on the fate of estrogenic and other endocrine disrupting compounds during wastewater treatment processes, biosolids handling and disposal, and effluent polishing operations.

4. ***Trace organic chemicals in products derived from wastewater treatment – reclaimed water and biosolids.*** Current research emphasis is on endocrine disrupting compounds and measurement of EDC activity in chemically complex environmental samples.

5. ***Engineering methods for minimum-cost salt removal from public water sources.*** Ongoing work is designed to establish the feasibility of salt management methods that are affordable in southwestern communities. Emphasis is an optimization of reverse osmosis (for maximum water recovery) and brine disposal.