

Liyuan Liang

Group Leader, Earth & Aquatic Sciences Group
Distinguished R&D Staff

Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, TN 37831-6038
Phone: (865)241-3933
Fax: (865)576-8646
liangl@ornl.gov

Research Areas and Focuses

- [Biological and chemical transformation of mercury at the sediment-water interface](#)
- Aqueous chemical speciation and surface chemical reactions that control the fate of metals, radionuclides and organic compounds in engineering systems and natural environments.
- Geochemical and interfacial processes affecting metal oxide colloidal particles in aquatic and subsurface environments
- R&D of remediation technologies for soil and groundwater
- Sequestration studies of clathrate CO₂ gas hydrates
- R&D of Permeable Reactive Barrier technology for groundwater remediation

Education

- Ph.D., Environmental Engineering, California Institute of Technology, Pasadena, CA, 1988

Professional positions

2007-present Distinguished R&D Staff and Leader, Earth and Aquatic Sciences Group, Environmental Sciences Division, Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee

2006-2007 Chief Scientist, Environmental Sciences Division, ORNL, Oak Ridge, Tennessee

2005-2007 Rotational assignment, Office of Strategic Planning, ORNL, Oak Ridge, Tennessee

2001-2005 Senior Lecturer in School of Engineering and Director Cardiff Foundation of Environmental Research (CFER), Cardiff University, Wales, UK

1999-2005 Senior Staff Scientist, ORNL (part-time 2001-2005), Oak Ridge, Tennessee

1997-1999 Senior Lecturer, School of Earth Sciences, Cardiff University, Wales, UK

1993-1997 Staff Scientist and Group Leader, Environmental Sciences Division, ORNL, Oak Ridge, Tennessee

- 1990-1993 Research Assistant Professor, University of Tennessee, Knoxville and ORNL, Oak Ridge, Tennessee
- 1988-1990 Assistant Professor, Environmental Health Department, University of South Carolina, Columbia, South Carolina

Career

Twenty plus years in Environmental Science and Technology at National Laboratory and Higher Education institutes in the USA and UK: fundamental science, leadership, R&D management, strategic planning.

Research

Investigations of contaminant transformation in aquatic and sediment environments

Key areas:

- Aqueous chemical speciation and surface chemical reactions that control the fate of metals, radionuclides and organic pollutants in engineering systems and natural environments
- Fate of nanoparticles in natural water/sediment environments: colloid stability, deposition, and transport, and the chemical processes governing mineral oxide particle precipitation and dissolution in water

Focuses:

- Biological and chemical transformation of mercury at the sediment-water interface
- R&D of remediation technologies for soil and groundwater
- Geochemical and interfacial processes affecting metal oxide colloidal particles in aquatic and subsurface environments
- Sequestration studies of clathrate CO₂ gas hydrates
- R&D of Permeable Reactive Barrier technology for groundwater remediation

Responsibilities, current and recent

Leader, Earth and Aquatic Sciences Group, Environmental Sciences Division, ORNL, 2007 to present

- Leading ~50 scientific staff and postdoctoral researchers in fundamental and applied R&D in Earth and aquatic systems. Specific responsibilities include strategic program development, fund allocations, staff coverage, recruitment, hiring and personnel issues, space allocation, performance assessment evaluation, and annual appraisal promotion reviews
- Research Manager, with internal and external scientists, of Science Focus Area (SFA) Program on 'Biogeochemical and molecular mechanisms controlling contaminant transformation in the environment'. DOE BER Subsurface Biogeochemical Research Program
- Leading and overseeing DOE sponsored mercury groundwater and soil contamination research programs at Oak Ridge, Tennessee
- Multi-National Laboratory initiative for Advanced Subsurface Computation for Environmental Management, ORNL
- Subsurface Biogeochemical Research Program, Laboratory Lead, liaising with DOE to facilitate ORNL laboratory-wide research applications and university collaborations

Chief Scientist, Environmental Sciences Division, Oak Ridge National Laboratory, 2006-2007

Coordinated activities between Environmental Sciences Division and ORNL's Spallation Neutron Source (SNS) to advance joint research projects that involve neutron applications. Organized discussion and PI-to-PI meetings that developed concepts in plant sciences, vadose-zone water distribution, CO₂ uptake by plants, and neutron diffraction of cellulose for bioenergy production. Led a research project that involved scientists from SNS, Chemical Sciences Division and Environmental Sciences Division in investigating interactions of microbial-membrane proteins at the oxide mineral surfaces. Mentored postdocs; initiated Young Emerging Scientist seminar series.

Office of Strategic Planning, Oak Ridge National Laboratory, 2005-2007

Rotational post in the Strategic Planning Office of the Laboratory Director:

- Assisting ORNL's strategic and business planning
- Chair, Seed Money Review Committee, Laboratory Directed Research and Development fund
- Advising Laboratory Director's Office on initiatives related to 'Science to Energy and the Environment'
- Concurrently leading research program at ORNL Spallation Neutron Source Facility: 'Interactions of microbial-membrane proteins with mineral surfaces'.

Service

National and international editing, conference organizing, reviewing, technical advising, consulting, examining, committee work, session chairing, working groups, government advising, teaching, invited lectures, etc., including:

- Special Session chair on "Molecular Mechanisms of Bacterial Methylation and Resistance: Laboratory-Field Links" at the International Conference on Mercury as a Global Pollutant (ICMGP), Halifax, Nova Scotia, Canada, 07/2011
- Organizer and session chair for two technical sessions, Goldschmidt Conference, Knoxville, TN 06/2010
- Organizer of Breakout Session on mercury biogeochemistry, DOE PI meeting, Washington DC, 04/2009
- Organizer, American Geological Union Fall Biosciences sessions, San Francisco, 12/2008
- Advisory Committee, session chair and invited speaker, 1st International Conference on Environmental Sciences and Technology, New Orleans, 01/2005
- External PhD thesis examiner, Nottingham University, UK., 11/2004
- Organizing Committee, International Symposium on Permeable Reactive Barriers, Belfast, UK, 03/2004
- Conference co-organizer, Environmental Particles Symposium, 77th American Chemical Society Colloid and Surface Science Symposium, Atlanta, 06/2003
- Co-organizer and speaker, Workshop on Permeable Reactive Barriers Network and First Faraday, UK, 10/2002
- Organizer, American Geological Union Fall Hydrology sessions, 12/2001

- Technical Committee, International Containment and Remediation Technology Conference and Exhibition, organized and chaired sessions on Reactive Barrier Technology; DOE Environmental Protection Agency, Department of Defense, NASA, Dupont and IT Group, Orlando, FL, 06/2001
- Founding member, Steering Committee for European Treatment Zones Team, 1998-2000
- Committee Member, Environment and Water Group, Society of Chemical Industry, 1998-2000
- Invited expert speaker by UK Environment Agency at NATO CCMS Pilot Study meeting on Permeable Wall Technology, Vienna, Austria, 02/1998
- Panel member, Environmental Protection Agency Roundtable on Permeable Reactive Walls, St. Petersburg Beach, FL, 1997
- Steering Committee Member, US Remediation Technology Development Forum (RTDF), Permeable Reactive Barriers Action Team, 1996-2004
- Chair and organizer for Session on Innovative Treatment Technologies for TCE Removal from Groundwater and Soils, Emerging Technologies in Hazardous Waste Management VII. American Chemical Society, American Academy of Environmental Engineers, Atlanta, GA, 1995
- Panel member, Environmental Protection Agency review for Mobilization of Colloid in Subsurface, Ada, OK, 1995

PUBLICATIONS

Journal articles

- Jeffra K. Schaefer, Sara S. Rocks, Wang Zheng, Liyuan Liang, Baohua Gu, and François M. M. Morel, 2011. Active transport, substrate specificity, and methylation of Hg(II) in anaerobic bacteria, *Proc. Natl. Acad. Sci. USA* 108:8714-8719.
- Gu, B.; Dong, W.; Liang, L.; Wall, N. A. 2011 Dissolution of technetium(IV) oxide by natural and synthetic organic ligands under both reducing and oxidizing conditions. *Environ. Sci. Technol.*, 45 (11), pp 4771–4777.
- Dong, W., Y. Bian, L. Liang, B. Gu, 2011. Binding Constants of Mercury and Dissolved Organic Matter Determined by a Modified Ion Exchange Technique. *Environ. Sci. Technol.*, 45 (8), pp 3576–3583
- Gu, B., Y. Bian, C.L. Miller, W. Dong, X. Jiang, and L. Liang. 2011. Mercury reduction and complexation by natural organic matter in anoxic environments. *Proceedings of the National Academy of Science USA*. 108, 1479-1483.
- Porat, I., T. A. Vishnivetskaya, J. J. Mosher, C. C. Brandt, Z. Yang, S. C. Brooks, L. Liang, M. M. Drake, M. Podar, S. D. Brown, and A. V. Palumbo. 2010 “Characterization of Archaeal Community in Contaminated and Uncontaminated Surface Stream Sediments,” *Microbial Ecology* 60: 784-795.
- Johs A., L. Shi, T. Droubay, J.F. Ankner, and L. Liang. 2010. Characterization of the decaheme c-type cytochrome OmcA in solution and on hematite surfaces by small angle X-Ray scattering and neutron reflectometry. *Biophysics Journal* 98(2)12: 3035-3043.
- Guo H.-B., A. Johs, J.M. Parks, A.O. Summers, S.M. Miller, L. Liang, and J.C. Smith. 2010. Structure and conformational dynamics of the metalloregulator MerR upon binding of Hg(II). *Journal of Molecular Biology* 398:555-568.
- Dong, D., Liang, L., Brooks, S. C., Southworth, G., Gu, B. 2010. Roles of dissolved organic matter in the speciation of mercury and methylmercury in a contaminated ecosystem in Oak Ridge, Tennessee, *Environ. Chem.* 2010, 7, 94–102. doi:10.1071/EN09091

- Miller, C., Southworth, G., Brooks, S. C., Liang, L., Gu, B. 2009. Kinetic controls on the complexation between mercury and dissolved organic matter in a contaminated environment. *Environ. Sci. Technol.*, 43, 8548–8553.
- Parks, J.M., Guo, H., Momany, C., Liang, L., Miller, S.M., Summers, A.O., Smith, J.C. 2009. Mechanism of Hg-C protonolysis in the bacterial organomercurial lyase MerB. *J. Am. Chem. Soc.* 131, 13278–13285.
- Wang, W., Liang, L., Johs, A., Gu, B., 2008. Thin Films of Uniform Hematite Nanoparticles: Controls on Surface Hydrophobicity and Self-Assembly. *Journal of Materials Chemistry* 18, issue 47, 5770 – 5775.
- Wang, W., Liang, L., Johs, A., Ankner, J. F., Gu, B. 2008. Controlled synthesis, manipulation of surface hydrophobicity, and self-assembly of hematite nanocrystals. *Geochim Cosmochim. Acta*, 72(12): A1001-A1001.
- Wang, W., Gu, B., Liang, L. 2007. Effect of anionic surfactants on synthesis and self-assembly of silica colloidal nanoparticles. *J Coll. Inter. Sci.* 313 (1), 169-173.
- Hofmann, A., Liang, L. 2007. Mobilization of colloidal ferrihydrite particles in porous media – an inner-sphere complexation approach. *Geochim Cosmochim. Acta* 71, 5847–5861.
- Kamolpornwijit, W., Liang, L. 2006. Investigation of gas production and entrapment in granular iron medium. *J. Cont. Hydrology* 82, 338-356.
- Liang, L., Moline, G.R., Kamolpornwijit, W., West, O.R. 2005. Influence of hydrogeochemical processes on zero-valent iron reactive barrier performance: a field investigation. *J. Cont. Hydrology* 78, 291-312.
- Riding R., Liang, L. Seawater chemistry control of limestone accumulation over the past 550 million years. 2005. *Revista Española de Micropaleontología*, 37(1),1-11
- Riding R., Liang, L. 2005. Geobiology of microbial carbonates: metazoan and seawater saturation state influences on secular trends during the Phanerozoic. *Palaeogeography, Palaeoclimatology, Palaeoecology* 219, 101-115.
- Wang W., Gu, B., Liang, L., Hamilton, W. 2004. Adsorption and structural arrangement of cetyltrimethyl-ammonium cations at the silica nanoparticle-water interface. *J. Phys. Chem. B.* 108(45), 17477-17483.
- Gabitto, J., Riestenberg, D., Lee, S., Liang, L., Tsouris, C. 2004. Ocean disposal of CO₂: conditions for producing sinking CO₂ hydrate. *Journal of Dispersion Science and Technology* 25 (5), 703-712.
- Wang W., Gu, B., Liang, L. 2004. Effect of surfactants on the formation, morphology and surface property of synthesized SiO₂ nanoparticles. *J. Dispersion Science and Technology* 25 (5): 595-603.
- Riestenberg, D.A., Chiu, E., Gborigi, M., Liang, L., West, O.R., Tsouris, C. 2004. Investigation of jet breakup and droplet distribution on liquid CO₂ and water systems – implications for CO₂ hydrate formation for ocean carbon sequestration. *American Mineralogist* 89: 1240-1246.
- Wang W., Gu, B., Liang, L., Hamilton, W., Wesolowski, D.J. 2004. Synthesis of rutile (α-TiO₂) nanocrystals with controlled size and shape by low-temperature hydrolysis: effects of solvent composition. *J Phys. Chem. B*, 108 (39), 14789-14792.
- Kamolpornwijit W., Liang, L., Moline, G.R., Harts, T., West, O.R. 2004. Identification and quantification of mineral precipitates in FeO fillings from a column study. *Environ. Sci. Technol.* 38,

5757-5765.

- Tsouris, C., Brewer, P., Peltzer, E., Walz, P., Riestenberg, D.A., Liang, L., West, O.R. 2004. Hydrate composite particles for ocean carbon sequestration: field verification. *Environmental Science and Technology* 38, 2470-2475.
- Wang W., Gu, B., Liang, L., Hamilton, W. 2003. Fabrication of near-infrared photonic crystals using highly-monodispersed submicrometer SiO₂ spheres. *J. Phys. Chem. B.* 107, 12113-12117.
- Lee, S.Y., Liang, L., Riestenberg, D., West, O.R., Tsouris, C., Adams, E. 2003. CO₂ hydrate composite for ocean carbon sequestration. *Environmental Science and Technology* 37, 3701-3708.
- Liang, L., Sullivan, A.B., West, O.R., Kamolpornwijit, W., R. Moline. 2003. Predicting the precipitation of mineral phases in permeable reactive barriers. *Environmental Engineering Science* 20 (6), 635-653.
- Kamolpornwijit, W., Liang, L., West, O.R., Moline, G.R., Sullivan, A.B. 2003. Heterogeneity development and its influence on long-term PRB performance: a column study. *J. Contaminant Hydrology* 66, 161-178.
- Wang, W., Gu, B., Liang, L., Hamilton, W. 2003. Fabrication of two- and three-dimensional silica nanocolloidal particle arrays. *J. Phys. Chem. B* 107(15), 3400-3404.
- West, O.R., Tsouris, C., Liang, L., Lee, S., McCallum, S.D. 2002. Negatively buoyant CO₂ hydrate composite material for ocean carbon sequestration. *AIChE Journal* 49, 283-285.
- Korte, N, West, O.R., Liang, L., Gu, B., Zutman, J.L., Fernando, Q. 2002. The effect of solvent concentration on the use of palladized-iron for the step-wise dechlorination of polychlorinated biphenyls in soil extracts. *Waste Management* 22, 343-349.
- Phelps, T.J, Peters, D.J., Marshall, S.L., West, O.R., Liang, L., Blencoe, J.G., Alexiades, V., Jacobs, G.K. 2001. A new experimental facility for investigating the formation and properties of gas hydrates under simulated seafloor conditions. *Review Sci. Instruments* 72(2), 1514-1521.
- Phillips, D.H., Gu, B., Watson, D.B., Roh, Y., Liang, L., Lee, S.Y. 2000. Performance evaluation of a zero-valent iron reactive barrier: mineralogical characteristics. *Environ. Sci. Technol.* 34, 4169-4176.
- Liang, L, Korte, N., Gu, B., Puls, R., Reeter, C. 2000. Geochemical and microbial reactions affecting the long-term performance of in situ iron barriers. *Advances in Environ. Res.* 4, 273-286.
- Liang, L, Hofmann, A., Gu, B. 2000. Ligand-induced dissolution and release of ferrihydrite colloids. *Geochim. Cosmochim. Acta.* 64(12), 2027-2037.
- Korte, N.E., Zutman, J.L., Schlosser, R.M., Liang, L., Fernando, Q. 2000. Field application of palladized iron for the dechlorination of trichloroethene. *Waste Management* 20, 687-694.
- Gu, B, Brown, G.M., Bonnesen, P.V., Liang, L., Moyer, B.A., Ober, R., Alexandratos, S.D. 2000. Development of novel bifunctional anion-exchange resins with improved selectivity for pertechnetate: column break-through and field studies. *Environ. Sci. Technol.* 34, 1075-1080.
- Gu, B, TJ Phelps, L Liang, MJ Dickey, BL Kinsall, and GK Jacobs, 1999. Biogeochemical Dynamics in Zero-Valent Iron Columns: Implications for Permeable Reactive Barriers. *Environ Sci & Technol* 33:2170-2177
- Birke, V, L Liang, H Burmeier, 1999. Durchströmte Reaktoren zur In-situ Grundwassersanierung. *TerraTech*, 1999(1): 23-25

- Gu, B, L Liang, MJ Dickey and S Dai, 1998. Reductive Precipitation of Uranium(VI) by zero-valent iron, *Environ. Sci. Technol.*, 32:3366-3373
- Liang, L, NE Korte, JD Goodlaxson, J Clausen, Q Fernando, R Muftikian, 1997. Byproduct formation during reduction of TCE by zero-valence iron and palladized iron. *Ground Water Monitoring & Review*, Winter: 122-127
- Korte, N, OR West, L Liang, MJ Pelfrey and TC Houk, 1997. A field-scale test facility for permeable reactive barriers at the Portsmouth gaseous diffusion plant. *Federal facilities environmental journal*, Autumn: 105-114
- Korte, N, L Liang, R Muftikian, C Grittini and Q Fernando, 1997. The dechlorination of hydrocarbons, *Platinum Metals Review*, 41(1): 2-6
- Satmark, B, Y Albinsson, and L Liang, 1996. Chemical effects of goethite colloid on the transport of radionuclides through a quartz-packed column. *J. Contaminant hydrology*, 21: 231-241
- McCarthy, JF, B Gu, L Liang, J Mas-Pla, TM Williams, and T-CJ Yeh, 1996. Field tracer tests on the mobility of natural organic matter in a sandy aquifer. *Water Resources Res.* 32(5): 1223-38
- Gu, B, K E Dowlen, L Liang, and JL Clausen. 1996. Efficient separation and recovery of technetium-99 from contaminated groundwater. *Separations Technol.* 6:123-132
- Liang, L, B Gu, and X Yin, 1996. Removal of Technetium-99 from Contaminated Groundwater with Sorbents and Reductive Materials. *Separations Technol.* 6: 111-122
- Gu B, T Mehlhorn, L Liang and JF McCarthy, 1996. Competitive adsorption, displacement, and transport of organic matter on iron oxide: II. Displacement and transport. *Geochim. Cosmochim. Acta.* 60: 2977-2992
- Gu B, T Mehlhorn, L Liang and JF McCarthy, 1996. Competitive adsorption, displacement, and transport of organic matter on iron oxide: I. competitive adsorption. *Geochim. Cosmochim. Acta.* 60: 1943-1950
- Gu, B, J Schmitt, Z Chen, L Liang and JF McCarthy, 1995. Interactions of the Fractionated Natural Organic Matter with Iron Oxide, *Geochim. Cosmochim. Acta*, 59 (2): 219-229
- Sainers, JE, GM Hornberger and L Liang, 1994. First- and Second-Order Kinetics Approaches for Modeling the Transport of Colloidal Particles in Porous Media. *Water Resources Research*, 30 (9): 2499-2506
- Gu B, J Schmitt, Z Chen, L Liang and JF McCarthy, 1994. Adsorption-desorption of Natural Organic Matter on Iron-oxide: Mechanisms and Models, *Environ. Sci. Technol.* 28 (1): 38-46
- McCarthy, JF, TM Williams, L Liang, PM Jardine, AV Palumbo, LW Cooper, LW Jolley and DL Taylor, 1993. Mobility of Natural Organic Matter in a Sandy Aquifer, *Environ. Sci. Technol.* 27:667-676
- Liang, L, JF McCarthy, LW Jolley, JA McNabb, and TL Mehlhorn, 1993. Iron Dynamics-Observations of Transformation during Injection of Natural Organic Matter in a Sandy Aquifer. *Geochim. Cosmochim. Acta*, 57: 1987-1999
- Liang, L, JA McNabb, JM Paulk, B Gu and JF McCarthy, 1993. Kinetics of Fe(II) Oxygenation at Low Partial Pressure of Oxygen in the Presence of Natural Organic Matter, *Environ. Science and Technol.*, 27(9): 1864-1870
- Liang, L and JJ Morgan, 1990. Chemical Aspects of Iron Oxide Coagulation in Water: Laboratory Studies and Implication for Natural Systems. *Aquatic Sciences*, 52: 32-55

Edited book

- Liang, L., Rinaldi, R., Schober, H. (eds). 2009. Neutron applications in Earth, Energy and Environmental Sciences. Springer, New York, 634 pp.

Book chapters and reports

- Feng He, Liyuan Liang, Carrie Miller, 2010. Technology Evaluation for Waterborne Mercury Removal at the Y-12 National Security Complex, ORNL report ORNL/TM-2010/268
- Southworth, G., Bogle, M., Brooks, S., Liang, L., Peterson, M., Spalding, B., Watson, D., Zhang, F., Abraham, T.J. 2010. Evaluation of New Options for Reducing Mercury Release at the Y-12 National Security Complex, ORNL report ORNL/TM-2010/33
- Pierce, E. M., M. D. Freshley, S. S. Hubbard, B. B. Looney, J. M. Zachara, L. Liang, D. Lesmes, G. H. Chamberlain, K. L. Skubal, V. Adams, M. E. Denham, D. M. Wellman. 2009. Scientific opportunities to reduce risk in groundwater and soil remediation. PNNL-18516, Pacific Northwest National Laboratory: Richland, Washington.
- Johns A, Liang, L, Gu, B., Ankner, J., Wang, W. 2009. Application of neutron reflectometry for studies of biomolecular structures and functions at interfaces. In "Neutron Application in Earth, Energy, and Environmental Sciences, Liang, Rinaldi, Schober (Eds), Springer.
- Southworth, G.R., S. Brooks, M.J. Peterson, M.A. Bogle, C. Miller, M.Elliott, and L. Liang. 2009. Controlling Mercury Release from Source Zones to Surface Water: Initial Results of Pilot Tests at the Y-12 National Security Complex. ORNL/TM-2009/035.
- Barnes, A., Sapsford, D.J., Dey, M., Williams, K.P., Liang, L. 2007. Oxidation of Fe(II) by molecular oxygen in the presence of Fe(OH)₃ surfaces and elevated carbonate concentrations: consequences for passive mine water treatment, in "Advances in Mineral Resources Management and Environmental Geotechnology", Hania, Crete, Greece, September 2006
- L Liang, G Moline, A Sullivan, and OR West, 2002. Integration of geochemical data to hydraulic changes at Permeable reactive barriers sites, TTP No. ORO-9-SS-30, Deliverable Report to DOE SubCon Program, June 2002, 35pp
- Evaluation of Permeable Reactive Barrier Performance, prepared for Federal Remediation Technology Roundtables by the tri-agency Permeable Barrier Initiative (contributed by Gavasgar, A., L Liang, GR Moline, R Puls, C Reeter, B Sass, OR West, R Wilkin et al.), U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, Interstate Technology and Regulatory Cooperation, 60 pp, 2002, EPA 542-R-04-004
- Gerilynn Moline, Liyuan Liang, Wiwat Kamolpornwijit and Libby West, 2001. Long-term monitoring of permeable reactive barriers, Data acquisition report to DOE-Office of Science and Technology, September 31, 2001, 91pp
- L Liang, G R Moline, W Kamolpornwijit, B Gu, AB Sullivan, OR West, Performance Assessment of Zero-Valent Iron Permeable Reactive Barriers, TTP-ORO-9-SS30, report to DOE-SubConc, DNAPL product line. Oak Ridge National Laboratory Oak Ridge, TN August 31, 2001, 64pp
- Liang, L; Korte, NE; Moline, GR; West, OR 2001. Long-term Monitoring of Permeable Reactive

Barriers, Oak Ridge National Laboratory, ORNL/TM-2001/1, Oak Ridge, TN

- Gu, B., D.B. Watson, D.H. Phillips, and L. Liang. 2002. Biogeochemical, mineralogical, and hydrological characteristics of an iron reactive barrier used for treatment of uranium and other contaminants. In *Groundwater Remediation of Trace Metals, Radionuclides, and Nutrients, with Permeable Reactive Barriers*. D.L. Naftz, S.J. Morrison, J.A. Davis, C.C. Fuller (eds). Academic Press. pp. 305-342.
- Walker, DW and L Liang, 2000. *Modeling Flow in Fractured Media*. ORNL/TM-2000/37. Oak Ridge, TN
- Liang, L, B Gu, 1998. The treatment of groundwater with Mixed-Wastes: reductive dechlorination of TCE and reductive precipitation of uranium. NATO/ CCMS Pilot Study, Environmental Protection Agency 542-R-9-003, May 1998. NATO publication No 229: 36-43
- Gu, B, L Liang, GM Brown, PV Bonnesen, BA Moyer, SD Alexandratos, and Ober R 1998. A field trial novel bifunctional resins for removing pertechnetate (TcO₄⁻) from contaminated groundwater. ORNL/TM-13593. Oak Ridge National Laboratory, Oak Ridge, TN
- West, OR, RL Siegrist, TC Houk, L Liang, SY Lee, A Laase, DA Pickering, MJ Dickey, X Yin, B Gu, 1997. The X-625 Treatment Facility: Assessment of Reactive Barrier Technology at PORTS. POEF-LMES-174, Piketon, OH
- Liang, L, OR West, NE Korte, JD Goodlaxson, DA Pickering, JL Zutman, FJ Anderson, CA Welch, MJ Pelfrey, MJ Dickey. 1997. A field-scale test of trichloroethylene dechlorination using iron filings for the X-120/X749 groundwater plume. ORNL-TM-13410, Oak Ridge, TN
- Korte, NE, L Liang, B Gu, MT Muck, JL Zutman, RM Schlosser, RL Siegrist, TC Touk, Q Fernando, 1997. In Situ Treatment of Mixed Contaminants In Groundwater: Application Of Zero-Valence Iron And Palladized Iron For Treatment Of Groundwater Contaminated With Trichlorethene and Technetium-99. ORNL-TM-13530, Oak Ridge, TN
- Gu, G, L Liang, P Cameron, OR West, 1997. TCE and PCB Degradation by Zero-Valence Iron in the Presence of Surfactants, International containment technology conference, St Petersburg, FL. 760-66
- West, OR, Liang, L Holden, WL, Korte, NE, Fernando, Q, Clausen, JL. 1996. Degradation of Polychlorinated Biphenyls (PCBs) Using Palladized Iron, R, ORNL/TM-13217, Oak Ridge, TN
- Brown, GM Presley, DJ Bonnesen, PV Bates, LM Moyer, BA Alexandratos, SD, Patel, V Gu, B Liang, L Siegrist, RL, 1996. Column tests of Resins for Selective Sorption of Technetium from Groundwater: FY1997, ORNL/M-5920, Oak Ridge, TN
- Brown, GM Presley, DJ Bonnesen, PV Bates, LM Moyer, BA Alexandratos, SD, Hussain, LA Patel, V Gu, B Liang, L Siegrist, RL, 1996. Column tests of Resins for Selective Sorption of Technetium from Groundwater. ORNL-M-5508, Oak Ridge, TN
- Brown, GM Presley, DJ Bonnesen, PV Bates, LM Moyer, BA Alexandratos, SD, Patel, V Gu, B Liang, L Siegrist, RL, 1996. Resins for Selective Sorption of Technetium From Groundwater FY 1996, ORNL-M-5480, Oak Ridge, TN
- Liang, L and JF McCarthy, 1995. Colloidal Transport of Metal Contaminants In Groundwater. In *Metal Speciation and Contamination of Soil*. HE Allen, CP Huang, GW Bailey, AR Bowers, eds, Lewis Pub. 87-112
- Brown, GM Bates, LM Bonnesen, PV Moyer, BA Alexandratos, SD, Hussain, LA Patel, V Gu, B Liang, L

Siegrist, RL, 1996. Sorption of Tc from Contaminated Groundwater on Resins FY 1996, ORNL/M-5088, Oak Ridge, TN

- Brown, GM Bates, LM Bonnesen, PV Moyer, BA Alexandratos, SD, Hussain, LA Patel, VT Liang, L Siegrist, RL, 1995. Selective Resins for Sorption of Technetium From Groundwater, ORNL/FPO-95/38, Oak Ridge, TN
- Siegrist, RL, Gates, DD, West, OR Donaldson, TL, Liang, L, Webb, OF, Corder, SL Dickerson, KS, 1994. In situ Physical Chemical Treatment Technologies For Remediation Of Contaminated Sites: Applicability, Development, Status And Research, ORNL/M-3694, Oak Ridge, TN
- Korte, NE, RL Siegrist, M Ally, B Bischoff, W Bostick, JM Strong-Gunderson, P Kearl, L Liang, D Marsh, A Mattus, a Palumbo, J Stockdale, P Taylor, OF Webb, 1994. In situ Treatment of Mixed Contaminants in Groundwater: Review of Candidate Processes, ORNL/TM-12772, Oak Ridge, TN
- Sainers, JE, JF McCarthy, PM Jardine, L Liang and GM Hornberger. 1993. Transport of TiO₂ through Homogeneous And Structurally Heterogeneous Porous Media, in manipulation of groundwater for environmental restoration. Lewis Publishers, Chelsea, MI. 309-312
- McCarthy, JF, L Liang, PM Jardine, TM Williams. 1993. Mobility of natural organic matter injected into a sandy aquifer. In manipulation of groundwater for environmental restoration. Lewis Publishers, Chelsea, MI. 35-40.
- Liang L, McCarthy, JF, TM Williams and LW Jolley. 1993. Iron Dynamics During Injection of Natural Organic Matter In A Sandy Aquifer. In manipulation of groundwater for environmental restoration. Lewis Publishers, Chelsea, MI. 263-267
- Liang, L and JJ Morgan, 1989. Modeling of Oxide Coagulation in the Presence of Organics. ACS Symposium Series No. 416, Bassett, RL and A Melchior, Eds, p293-308
- Liang, L, 1988. Effects of Surface Chemistry on Kinetics of Coagulation of Submicron Iron Oxide Particles (α-Fe₂O₃) in Water, Report No. AC-5-88, California Institute of Technology

PATENT

- West, Tsouris & Liang: Method and Apparatus for Efficient Injection of CO₂ in Oceans," Patent # 6,598,407 (2003). US Patent Office.