

CIVIL ENGINEERING

OREGON STATE UNIVERSITY

College of Engineering

ISTOK, JONATHAN D.
Professor

DEGREES

B.S., Geology, Ohio State University, 1978
M.S., Soil Science, Oregon State University, 1981
B.S., Civil Engineering, Oregon State University, 1986
Ph.D., Civil Engineering, Oregon State University, 1986

ACADEMIC POSITIONS

Professor, Department of Civil Engineering, Oregon State University, 1993 - present.
Associate Professor, Department of Civil Engineering, Oregon State University, 1989 - 93.
Pacific National Laboratories Affiliate Staff Scientist, 1995 - present
Assistant Professor, Departments of Agricultural Engineering and Civil Engineering,
Oregon State University, 1986 - 1989.
Instructor, Department of Agricultural Engineering, Oregon State University, 1984 - 85.

NON-ACADEMIC POSITIONS

Consulting 1986-present
Science Applications International Corporation, Lockheed Corporation, U.S. Geological Survey, U.S. Environmental Protection Agency, U.S. Soil Conservation Service, Benton County, Sandia National Laboratory, Tennessee Valley Authority, Landau Associates, Reynolds Electrical and Engineering Company, Benton County, Oregon, Reynolds Engineering and Electric Company, Shell Development Corporation, Chevron Research and Technology Company, Pacific Northwest Laboratories, RZA Inc., CH2MHILL, D.B. Stevens & Associates, Nature Conservancy, Lawrence Livermore National Laboratories, Malheur County Soil and Water Conservation District, Vineyard Mountain Homeowners Association, Hart Krauser & Associates, OHM Environmental Services, Brewer Environmental Services, Idaho National Engineering Laboratory, American Petroleum Institute, British Petroleum, Omega Environmental Services.

FIELDS OF SPECIALIZATION

Groundwater flow and solute transport processes; Groundwater remediation technology development; Hydrologic site characterization; Aquifer testing

PROFESSIONAL ACTIVITIES

Registration
Professional Engineer, State of Oregon (OR. 16,007)

PUBLICATIONS

Books

- Dawson, K.J. and J.D. Istok. 1991. *Aquifer Testing: Design and Analysis of Pumping and Slug Tests*. Lewis Publishers, Inc.
- Istok, J.D. 1990. *Groundwater Modeling by the Finite Element Method*. Water Resources Monograph No. 13. American Geophysical Union. Washington, D.C.
- Istok, J.D. 1998. *Technical Bulletin on Oxygen Releasing Materials for In Situ Groundwater Remediation*. American Petroleum Institute, Health and Environmental Sciences Department, Publication Number 4671, July 1998, Washington DC.

Refereed Technical Journals

- Yin, J, R. Haggerty, D. L. Stoliker, D. B. Kent, J. D. Istok, J. Greskowiak, John M. Zachara. 2010. Transient groundwater chemistry 1 near a river: 2 Effects on U(VI) transport in laboratory column experiments. *Water Resources Research* (In Press)
- Lee, Jae-Hyuk, M. Dolan, J. Field, and J.D. Istok. 2009. Monitoring Bioaugmentation with Single-Well Push-Pull Tests in Sediment Systems Contaminated with Trichloroethene. *Environmental Science & Technology* Volume 44, Issue 3 Pages 1085-1092.
- Istok, J.D., M. Park, M. Michalsen, A. M. Spain, L. R. Krumholz, C. Liu, J. McKinley, P. Long, E. Roden, A. D. Peacock, B. Baldwin. 2010. A Thermodynamically-Based Model for Predicting Microbial Growth and Community Composition Coupled to System Geochemistry: Application to Uranium bioreduction. *Journal of Contaminant Hydrology* [Volume 112, Issues 1-4](#) Pages 1-14.
- Michalsen M.M., A.D. Peacock, A.N. Smithgal, D.C. White, A.M. Spain, Y. Sanchez-Rosario. L.R. Krumholz. S.D. Kelly, K.M. Kemner, J. McKinley J, S.M. Heald, M.A. Bogle, D.B. Watson, and J.D. Istok. 2009. Treatment of Nitric Acid-, U(VI)-, and Tc(VII)-Contaminated Groundwater in Intermediate-Scale Physical Models of an In Situ Biobarrier. *Environmental Science & Technology*, 43(6):1952-61.
- Gieg, L.M., R.E. Alumbaugh, J.A. Field, J. Jones, J.D. Istok, and J.M. Suflita. 2009. Assessing In Situ Rates of Anaerobic Hydrocarbon Bioremediation. *Microbial Biotechnology*, 2(2), 222–233.
- Baldwin, B. R., A. D. Peacock, M. M. Park, D. M. Ogles, J. D. Istok, J. P. McKinley, C. T. Resch, and D. C. White. 2008. Multilevel Samplers as Microcosms to Assess Microbial Response to Biostimulation. *Ground Water*, 46:295-304.
- Kim Y., J.D. Istok, and L. Semprini. 2008. Single-Well, Gas-Sparging Tests for Evaluating the In Situ Aerobic Cometabolism of Cis-1,2-Dichloroethene and Trichloroethene. *Chemosphere*, 71(9):1654-64.
- Li, X.Z., A.M. Spain, J.M. Senko, J.D. Istok, and L.R. Krumholz. 2008. Interactions of Nitrate, Iron, Uranium and Technetium during bioremediation. *Geochimica et Cosmochimica Acta* Volume 72, Issue 12, Pages: A546-A546.
- Spain, A.M., A.D. Peacock, J.D. Istok, M.S. Elshahed, F.Z. Najjar, B.A. Roe, D.C. White, and L.R. Krumholz. 2007. Identification and Isolation of a *Castellaniella* Species Important During Biostimulation of an Acidic Nitrate- and Uranium-Contaminated Aquifer. *Applied Environmental Microbiology*, 73(15):4892-904.
- Michalsen, M.M., A. D. Peacock, A. M. Spain, A. N. Smithgal, D. C. White, Y. Sanchez-Rosario, L. R. Krumholz, and J.D. Istok. 2007. Sediment Microbial Community Shifts Correlate with Geochemistry in Model Bio-Barrier for Uranium and Technetium Removal from Groundwater. *Applied Environmental Microbiology*, 73(18): 5885–5896

- Istok, J.D., M.M. Park, A.D. Peacock, M. Oostrom and T.W. Wietsma. 2007. An Experimental Investigation of the Fate of Nitrogen Gas Produced During Denitrification. *Ground Water* 45(4): 461–467.
- Azizian, M., L. Semprini, and J.D. Istok. 2007. Evaluation of the In Situ Aerobic Cometabolism of Chlorinated Ethenes by Toluene-Utilizing Microorganisms Using Push-Pull Tests. *Journal of Contaminant Hydrology*, 90:105-124.
- Liu, J. A. K. Brown, X. Meng, J. D. Istok, D. B. Watson, and Y. Lu. 2006. A Catalytic Beacon Sensor for Uranyl with Parts-Per-Trillion Sensitivity and Million-Fold Selectivity. *PNAS*, 104(7), 2056 – 2061.
- Baldwin, B. R., J. P. McKinley, A. D. Peacock, M. Park, D. Ogles, J. D. Istok, C. T. Resch and D. C. White. 2006. Multilevel samplers to assess microbial community response to biostimulation. *Eos Transactions AGU* 87(36).
- Michalsen, M. M., B.A. Goodman, S.D. Kelly, K.M. Kemner, J.P. McKinley, J.W. Stucki, and J.D. Istok. 2006. Uranium and Technetium Bio-Immobilization in Intermediate-Scale Physical Models of an In Situ Bio-Barrier. *Environmental Science & Technology*, 40(22): 7048-7053.
- Nielsen, M. E., Fisk, M. R., Istok, J. D. & Pedersen, K. 2006. Microbial Nitrate Respiration of Lactate at In Situ Conditions in Ground Water from a Granitic Aquifer Situated 450 m Underground. *Geobiology* 4 (1), 43-52.
- Harris, S.H., J.D. Istok, and J.M. Suflita. 2006. Changes in Organic Matter Quality Influencing Sulfate Reduction in an Aquifer Contaminated by Landfill Leachate. *Microbial Ecology*, Vol. 51 (4), pp. 535-542.
- Kim, Y., J.D. Istok, and L. Semprini. 2005. Push-Pull Tests Evaluating In Situ Aerobic Cometabolism of Ethylene, Propylene, and cis-Dichloroethylene. *Journal of Contaminant Hydrology*, 82(1-2):165-81.
- Davis, B.D., J.D. Istok, and L. Semprini. 2005. Numerical Simulations of Radon as an In Situ Partitioning Tracer for Quantifying NAPL Contamination Using Push–Pull Tests. *Journal of Contaminant Hydrology* 78 (2005) 87– 103.
- Ennis, E., R. Reed, M. Dolan, L. Semprini, J.D. Istok, and J.A. Field. 2005. Reductive Dechlorination of the Vinyl Chloride Surrogate Chlorofluoroethene in TCE-Contaminated Groundwater. *Environmental Science & Technology*, 39, 6777-6785.
- Gu, B., H. Yan, P. Zhou, D.B. Watson, M. Park, and J.D. Istok. 2005. Natural Humics Impact Uranium Bioreduction and Oxidation. *Environmental Science & Technology*, 39, p. 5268-5275.
- Field, J. A.; R. Reed, J.D. Istok, L. Semprini, P. Bennett, and T.E. Buscheck. 2005. Trichlorofluoroethene: A Reactive Tracer for Evaluating Reductive Dechlorination in Large-Diameter Permeable Columns. *Ground Water Monitoring & Remediation*, Vol. 25, No. 2, pp.68-77.
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- Kim, Y., J.D. Istok, and L. Semprini. 2004. Push-Pull Tests for Assessing In Situ Aerobic Cometabolism. *Ground Water* Vol. 42, No. 3, pp: 329-337.
- Istok, J.D., J.S. Senko, L. R. Krumholz, D. Watson, M.-A. Bogle, A. Peacock, Y-J. Chang, and D.C. White. 2004. In Situ Bio-Reduction of Technetium and Uranium in a Nitrate-Contaminated Aquifer. *Environmental Science & Technology* Vol. 38, pp: 468-475.

- Schroth, M.H. and J.D. Istok. 2004. Approximate Solution for Solute Transport During Spherical Flow Push-Pull Tests. *Ground Water* Vol. 43, No. 2, pp. 280-284.
- Hageman, K.J., J.A. Field, J.D. Istok, and L. Semprini. 2004. Quantifying Effects of Fumarate on In Situ Reductive Dechlorination Rates. *Journal of Contaminant Hydrology*, Vol. 75, pp. 281-296.
- Hageman, K.J., J.A. Field, and J.D. Istok. 2003. Forced Mass Balance Technique for Estimating In Situ Transformation Rates of Sorbing Solutes in Groundwater. *Environmental Science & Technology*, 37, pp: 3920-3925.
- Peacock, A.D., Y-J. Chang, J. D. Istok, L. Krumholz, R. Geyer, and D.C. White. 2003. Utilization of Microbial Biofilms as Monitors of Bioremediation. *Journal of Microbial Ecology*, Volume 47, 284-292.
- Davis, B.M., J.D. Istok and L. Semprini. 2003. Static and Push-Pull Methods Using Radon-222 to Characterize Dense Nonaqueous Phase Liquid Saturations. *Ground Water*, Vol. 41, No. 4, pp: 470-481.
- Hageman, K.J., J.A. Field, J.D. Istok, and L. Semprini. 2004. Quantifying the effects of fumarate on in situ reductive dechlorination rates. *Journal of Contaminant Hydrology* Vol. 75, No. 3-4, pp.281-96.
- Reusser, D.E., J.D. Istok, H.R. Beller, and J.A. Field. 2002. In Situ Transformation of Deuterated Toluene and Xylene to Benzylsuccinic Acid Analogues in BTEX-Contaminated Aquifers. *Environ. Sci. Technol.* 36, 4127-4134.
- Istok, J.D., J.A. Field, M.H. Schroth, B.M. Davis, and V. Dwarakanath. 2002. Single-Well, Push-Pull Partitioning Tracer Test for NAPL Detection in the Subsurface. *Environmental Science & Technology*, 36, 2708-2716.
- Davis, B.M., J.D. Istok, L. Semprini. 2002. Push-Pull Partitioning Tracer Tests Using Radon-222 to Quantify Non-Aqueous Phase Liquid Contamination. *Journal of Contaminant Hydrology* vol. 58, 129-146
- Senko, J. M., J.D. Istok, J. M. Suflita, and L. R. Krumholz. 2002. In-Situ Evidence for Uranium Immobilization and Remobilization. *Environmental Science & Technology* vol. 36, pp. 1491-1496.
- Hageman, K.J., J.D. Istok, J.A. Field, T.E. Buscheck, and L. Semprini. 2001. In Situ Anaerobic Transformation of Trichloroethene in Trichloroethene-Contaminated Groundwater. *Environmental Science & Technology* vol. 9, pp. 1729-1735.
- Schroth, M.H., M. Oostrom, T.W. Wietsma, and J.D. Istok. 2001. In-Situ Oxidation of Trichloroethene by Permanganate: Effects on Porous Medium Hydraulic Properties. *Journal of Contaminant Hydrology* vol. 50, no. 1-2, pp. 79-98.
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- Field, J.A., Sawyer, T.E., Schroth, M.H., Humphrey, M.D. and Istok, J.D. 2000. Effect of Cation Exchange on Surfactant-Enhanced Solubilization of Trichloroethene. *Journal of Contaminant Hydrology*, 46, 131-149.
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- Schroth, M.H., J.D. Istok, and R. Haggerty. 2000. In-Situ Evaluation of Solute Retardation Using Single-Well Push-Pull Tests". *Advances in Water Resources* v. 24, pp. 105-117.
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- Field, J.A., J.D. Istok, M.H. Schroth, T.E. Sawyer, and M.D. Humphrey. 1999. Laboratory Investigation of Surfactant-Enhanced TCE Solubilization Using Single-Well, "Push-Pull" Tests. *Ground Water*, Vol. 37, No. 4, pp. 581-588.
- Istok, J.D., J.E. Amonette, C.R. Cole, J.S. Fructer, M.D. Humphrey, J.E. Szecsody, S.S. Teel, V.R. Vermeul, M.D. Williams, and S.B. Yabusaki. 1999. In Situ Redox Manipulation by Dithionite Injection: Intermediate-Scale Laboratory Experiments. *Ground Water*, Vol. 37, No. 6, pp. 884-889.
- Istok, J.D., J.A. Field, M.H. Schroth, T.E. Sawyer, and M.D. Humphrey. 1999. Laboratory and Field Investigation of Surfactant Sorption Using Single-Well, "Push-Pull" Tests. *Ground Water*, Vol. 37, No. 4, pp. 589-598.
- Field, J.A. and J.D. Istok. 1998. Comment on Estimation of Nonaqueous Phase Liquid-Water Interfacial Areas in Porous Media Following Mobilization by Chemical Flooding. *Environmental Science and Technology*, Vol. 32, No. 2, pp. 3836-3837.
- Schroth, M.H., J.D. Istok, J.S. Selker, M. Oostrom, and M.D. White. 1997. Multifluid Flow in Bedded Porous Media: Laboratory Experiments and Numerical Simulations. *Advances in Water Resources*, Vol. 22, No. 2, pp. 169-183.
- Schroth, M.H., J.D. Istok, G.T. Conner, M.R. Hyman, and K.T. O'Reilly. 1998. Spatial Variability in Aerobic Respiration and Denitrification Rates in a Petroleum Contaminated Aquifer. *Ground Water*, Vol. 36, No. 6, pp. 924-937.
- Schroth, M.H., J.D. Istok, and J.S. Selker. 1998. Three-Phase Immiscible Fluid Movement in the Vicinity of Textural Interfaces. *Journal of Contaminant Hydrology*, Vol. 32, pp.1-23.
- Donaldson, J.H., J.D. Istok, and K.T. O'Reilly. 1998. Dissolved Gas Transport in the Presence of a Trapped Gas Phase: Development and Laboratory Testing of a Two-Dimensional Kinetic Model, *Ground Water*, Vol. 36, No. 1, pp. 133-142.
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- Donaldson, J.H., J.D. Istok, M.D. Humphrey, K.T. O'Reilly, C.A. Hawelka, and D.H. Mohr. 1997. Development and Laboratory Testing of a Kinetic Model for Dissolved Oxygen Partitioning and Transport in Porous Media in the Presence of Trapped Gas. *Ground Water*, Vol. 35, No. 2, pp. 113-119.
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- Rautman, C.A. and J.D. Istok. 1996. Probabilistic Assessment of Ground-Water Contamination: 1. Geostatistical Framework. *Ground Water*, Vol. 34, No. 5, pp. 899-909.

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- Humphrey, M.D., J.D. Istok, L.E. Flint, and A.L. Flint. 1996. An Improved Method for Measuring Imbibition Rates on Low Permeability Core Specimens. *Soil Science Society of America Journal*, Vol. 60, No. 1, p.28-34.
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- Istok, J.D. and M.D. Humphrey. 1995. Laboratory Investigation of Buoyancy-Induced Flow (Plume Sinking) During Two-Well Tracer Tests. *Ground Water*, Vol. 4, No. 33, pp. 597-604.
- Istok, J.D., C.A. Rautman, L.E. Flint, and A.L. Flint. 1994. Spatial Variability in Hydrologic Properties of a Volcanic Tuff. *Ground Water*, Vol. 32, No. 5, p. 751-760.
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- Vermeul, V.A., J.D. Istok, A.L. Flint, and J.L. Pikul. 1993. An Improved Method for Quantifying Soil Macroporosity. *Soil Science Society of America Journal*, Vol. 57, p. 809-816.
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- Cooper, R. M. and J. D. Istok. 1988. Geostatistics Applied to Groundwater Contamination 2. Application. *Journal of Environmental Engineering*, Vol. 114, No. 2, pp. 287-299.
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- Istok, J. D., D. K. McCool, L. G. King and L. Boersma. 1986. Effect of Rainfall Measurement Interval on EI Calculation. *Transactions American Society of Agricultural Engineers*. Vol. 29, No. 3, pp. 730-734.
- Istok, J. D. and L. Boersma. 1986. Joint Frequency Distributions for Erosion Research. *Soil Science Society of America Journal*. Vol. 50, No. 3, pp. 752-758.
- Istok, J. D. and G. F. Kling. 1983. Effect of Subsurface Drainage on Runoff and Sediment Yield from an Agricultural Watershed in Western Oregon, USA. *Journal of Hydrology*, Vol. 65, pp. 249-291.
- Istok, J. D. and M. E. Harward. 1982. Influence of Soil Moisture on Smectite Formation in Soils Derived from Serpentinite. *Soil Science Society of America Journal*, Vol. 46, pp. 1106-1108.
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RESEARCH GRANTS

- Technical Working Group- Metals and Radionuclides, Savannah River National Laboratory, 4/08 – 10/13 (\$ 45,980)
- Evaluation of Potential Adverse Impacts of Deep Subsurface Development in Portland, Oregon. City of Portland, 7/06 – 12/06 (\$35,980)
- Development and Testing of a Thermodynamic Network Model. Pacific Northwest National Laboratory, 10/07-9/08 (\$ 145,000).
- Stability of U(VI) and Tc(VII) Reducing Microbial Communities to Environmental Perturbation: Development and Testing of a Thermodynamic Network Model. Dept of Energy NABIR Program, 10/04-9/09 (\$ 1,081,937).
- Anaerobic Biodegradation of Petroleum Hydrocarbons: Fundamental Science to Determine In Situ Rates of Metabolism, National Science Foundation, 10/01/03-9/30/06 (\$ 500,000).
- Factors Controlling In Situ Uranium and Technetium Bio-Reduction and Reoxidation at the NABIR Field Research Center, Dept of Energy NABIR Program, 10/02-9/03 (\$ 1,300,000).
- Neurotoxic superfund chemicals and biomarkers, National Institutes of Health, 10/00-9/04 (\$1,200,000)
- In Situ Determination of Uranium Reduction Kinetics at the Bear Creek Valley Field Research Center: Feasibility Studies, Dept of Energy NABIR Program, 10/00-10/02 (\$ 500,000).
- Neurotoxic superfund chemicals and biomarkers, National Institutes of Health, 10/00-9/04 (\$1,200,000)
- In Situ Measurement of TCE Degradation Using a Single-Well, “Push-Pull” Test, Western Region Hazardous Substance Research Center, 10/99-10/00 (\$ 124,569).

In Situ Redox Manipulation Experiments, Pacific Northwest National Laboratories, 5/99-12/2000 (\$ 73,349).

MTBE Transformations in the Vadose Zone, American Petroleum Institute, 9/98-10/00 (\$ 120,000).

In Situ Evaluation of Anaerobic Transformations of Chlorinated Solvents, Textron Corp., 8/98-9/01 (\$ 367,000).

In Situ Determination of Microbial Metabolic Activity, Department of Energy, 10/98-9/01 (\$ 600,000).

In Situ, Field-Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well Push-Pull Test, Department of Energy, 10/96 - 9/99 (\$ 641,000).

Natural Radon Tracer Method for Identifying and Quantifying Residual Nonaqueous Phase Liquids in the Subsurface, Department of Energy, 10/97 - 9/00 (\$ 405,000).

Technical Bulletin on the Use of Oxygen Releasing Compounds for Site Restoration, Petroleum Research Institute, 11/97-12/97 (\$ 8,000).

In Situ Determination of Anaerobic TCE Transformations Using a Single-Well Push-Pull Test, Western Region Hazardous Substance Research Center (U.S. EPA), 10/97-10/99 (\$ 98,000).

Quantifying Reoxidation Rates of Reducing Reactive Barriers, Pacific Northwest National Laboratories, 10/97-9/98 (\$ 33,000).

Assessment of In Situ Contaminant Oxidation at the TAN Site, Idaho National Engineering Laboratories, 1/98-9/99 (\$ 100,000).

Site Characterization and Feasibility Assessment at Site 300, Lawrence Livermore National Laboratories, 10/97-10/98 (\$ 137,000).

Nitrate Transformations at the Sludge Handling Facility, City of Eugene, 6/96-9/96 (\$ 10,000).

Injection Strategy for Distributing Iron Reducing Bacteria to the Subsurface, Battelle Pacific Northwest National Laboratories, 3/95-12/97 (\$ 75, 739).

Faculty Research Fellowship, Associated Western Universities, 6/97-7/97 (\$ 5,000).

Single-Well Test Method for Site Characterization, Chevron Research and Technology Co., 6/94-6/97 (\$ 101,000).

Zeolite-Gravel Mixtures for Passive Removal of Chromate from Contaminated Groundwater, Battelle Pacific Northwest Laboratories, 8/95-12/95 (\$ 9,251).

Faculty Research Fellowship, Associated Western Universities, 8/95-9/95 (\$ 10,000).

Single-Well, Push-Pull Test for In Situ Determination of Microbial Metabolic Activity, National Center for Integrated Bioremediation Research and Development, 7/95-7/97 (\$ 150,000).

Laboratory-Scale Reduction of Aquifer Solids Using Iron-Reducing Ultra Micro Bacteria, Battelle Pacific Northwest Laboratories, 10/95-7/97 (\$ 60,000).

The "Bubble Wall": A Passive In Situ System for Treatment and/or Containment of Contaminated Groundwater, Western Region Hazardous Substances Research Center, 3/95-3/97 (\$225,696).

Laboratory-Scale Reduction of Aquifer Solids Using Sodium Dithionite, Battelle Pacific Northwest Laboratories, 10/94-12/95 (\$ 54,000).

Interagency Personnel Agreement, 3, U.S. Geological Survey, 10/95-9/96 (\$ 54,000).

Investigation of Three-Phase Transport in One- and Two-Dimensional Bedded Porous Media , U.S. Department of Energy, 10/92-10/95 (\$ 419,000).

Natural and Enhanced In Situ Bioremediation for Petroleum Hydrocarbons, Chevron Research and Technology Company, 6/94-6/96 (\$ 99,976).

Natural and Enhanced In Situ Bioremediation for Petroleum Hydrocarbons, Oregon Joint Graduate School of Engineering, 6/94-6/95 (\$ 50,000).

Decision Analysis for Waste Site Characterization, Sandia National Laboratories, 9/93-10/95 (\$ 45,000).

Evaluation of Two New Remedial Technologies for Remediating Petroleum-Contaminated Groundwater, Water Resources Research Institute, 6/94-6/95 (\$ 13,000)

Interagency Personnel Agreement, 2, U.S. Geological Survey, 10/94-9/95 (\$ 54,000).

Research Fellowship, Battelle Pacific Northwest Laboratories, 8/94-9/94 (\$ 6,000).

Enhanced In-Situ BTEX Degradation in Model Aquifers, Chevron Research and Technology Company, 6/93-6/94 (\$ 31,000).

Interagency Personnel Agreement, 1, U.S. Geological Survey, 10/91-9/93 (\$ 40,000).

Interagency Personnel Agreement, 2, U.S. Geological Survey, 10/93-9/95 (\$ 54,000).

Fate and Transport of Nitrate in Vadose Zone, Northern Malheur County, Oregon, Oregon Department of Environmental Quality, 7/92-6/93, (\$ 20,000)

Physical Modeling of Infiltration Processes, Reynolds Electrical and Engineering Company, 9/92-3/93 (\$ 99,000).

Fate and Transport of the Herbicide Dacthal in Groundwater, Water Resources Research Institute, 7/90-6/92 (\$ 12,000).

Numerical Modeling of Heat, Water, and Vapor Transport at ASHES Vent Field, Juan de Fuca Ridge, National Oceanic and Atmospheric Administration, 6/91-12/91 (\$ 7,000).

Equipment for Groundwater Research Laboratory, OSU-Research Council, 7/92-6/93)\$ 6,000).

Development and Verification of a Numerical Model to Predict the Fate and Transport of Chlorinated Phenols in Groundwater, Western Region Hazardous Substances Research Center, 10/89-10/92 (\$ 155,000).

Groundwater Contamination by Pesticides, Agricultural Engineering Research Foundation, 9/89-7/90 (\$ 5,000).

Validation of Subsurface Drainage Model, 2, U.S. Department of Agriculture, 10/89-9/90 (\$ 10,000).

Bayesian Methods for Hazardous Waste Site Characterization, Battelle Pacific Northwest Laboratories, 10/89-9/90 (\$ 25,000).

Managing Groundwater Pollution from Agriculture Related Sources, U.S. Geological Survey, 10/87-9/89 (\$ 48,000).

Geostatistical Analysis of Rock Matrix Hydrogeological Data from Yucca Mountain, 2, U.S. Geological Survey, 10/88-9/91 (\$ 104,000).

Geostatistical Analysis of Rock Matrix Hydrogeological Data from Yucca Mountain, 1, U.S. Geological Survey, 10/87-9/91 (\$ 246,000).

Geostatistical Analysis of Pesticide Contamination in Groundwater Aquifers, Water Resources Research Institute, 7/87-6/88 (\$ 12,000).

Statistical Analysis of Short-Time-Interval Precipitation Data, 2, U.S. Department of Agriculture, Agricultural Research Service, 10/88-9/89 (\$ 35,000).

Validation of Water Table Model, 1, U.S. Department of Agriculture, 10/86-9/87 (\$ 12,000).

A New Method for Analyzing Groundwater Quality Data, Agricultural Engineering Research Foundation, 7/86-6/87 (\$ 5,000).

Groundwater Contamination by Pesticides and Nitrates in the Ontario Area, Agricultural Engineering Research Foundation, 7/87-6/88 (\$ 5,000).

Statistical Analysis of Short-Term-Interval Precipitation Data, 1, U.S. Department of Agriculture, Agricultural Research Service, 10/86-9/88 (\$ 51,000).

Validation of Water Table Model for Western Oregon, U.S. Department of Agriculture, 10/86-9/87 (\$ 13,000).

Validation of Water Table Model, U.S. Department of Agriculture, Soil Conservation Service,
10/87-9/88 (\$ 2,000).