

**ROBERT M. POWELL**

**rpowell@powellassociates.com**

- Owner of Powell & Associates Science Services for over six years, a small, Native American owned 8(a) program and SDB certified environmental consulting company with special expertise in ground water systems.
- Member of the External Advisory Group (EAG) for the Water Quality and Hydrology Group (ESH-18) of Los Alamos National Laboratory.
- 27 years of continuous scientific experience in environmental science and chemistry.
- 15 years of research experience on the transport, fate, sampling and remediation of metals, inorganic and organic chemicals in the subsurface.
- 12 years of experience with metals partitioning onto mobile subsurface colloids, surface charge effects and metal-organic complexation.
- 11 years of experience with contaminant remediation using permeable reactive barriers.
- 15 years of experience in support of U. S. EPA’s National Risk Management Research Laboratory, Robert S. Kerr Environmental Research Center (RSKERC), Ada, OK.
- 7 years of experience as on-site contractor Quality Assurance Coordinator at RSKERC.
- 11 years experience in analytical geochemistry at the Oklahoma Geological Survey.
- 2 years experience in grassland ecology and genetics research at the University of Oklahoma.
- 26 years of experience supervising and managing scientists, technicians and students.
- 35 scientific publications on groundwater science with 52 posters, presentations and abstracts for scientific meetings and innumerable project reports.
- Hazwoper certification through “train the trainer.”

**EDUCATION:**

M.S., Environmental Science, University of Oklahoma, Norman OK 1994  
*Thesis: “Geochemical Effects on Chromate Reduction and Remediation Utilizing the Thermodynamic Instability of Zero-Valence-State Iron”*

B.Sc., Zoology, University of Oklahoma, Norman OK 1980

**EMPLOYMENT HISTORY:**

Powell & Associates Science Services	Owner	1996-current
ManTech Environmental Ada, OK	Project Scientist & QA Coordinator	1986-1997
Oklahoma Geological Survey	Analytical Chemist	1975-1986
University of Oklahoma Department of Zoology	Research Assistant	1974-1975

## **EXPERIENCE OVERVIEW:**

Before operating Powell & Associates, I spent 11 years performing research and ground water investigations for the Robert S. Kerr Environmental Research Center (RSKERC) of the USEPA's National Risk Management Research Laboratory. Before this I spent ten years in the chemistry laboratory of the Oklahoma Geological Survey, University of Oklahoma. I have authored at least 35 publications and am an author on more than 52 presentations, posters, and abstracts for meetings as well as numerous project reports and proposals in response to RFPs. I have performed research and developed expertise in a number of areas including:

- Improved methods for ground water sampling.
- Site characterization and assessment.
- Corrosion process mechanisms for contaminant remediation by zero-valence-state metals (for permeable reactive barriers).
- Transport and fate of both dissolved and colloidal ground water contaminants.
- Techniques for in situ contaminant remediation, including reactive barriers and bioremediation.
- Contaminant/matrix interfacial interactions and mechanisms of both natural attenuation and facilitated transport.
- Metals partitioning onto mobile subsurface colloids and surface charge effects on colloidal interfacial interactions.
- Metal-organic complexes and their interactions with groundwater and aquifer materials.
- The measurement and relevance of aquifer organic carbon.
- Numerous analytical techniques, including particle size, electrophoretic mobility, selective ion electrodes, total carbon/organic carbon (Leco, Dohrmann, OIC, and Beckman), inductively coupled plasma emission spectrometry (ARL 35000), atomic absorption spectrometry (flame, graphite furnace, and cold vapor), X-ray diffraction, X-ray fluorescence, calorimetry, Vis-Uv and IR spectrophotometry, autotitrators, polarography, ion chromatography, fluorometry, field sampling equipment, and coal analysis.

I am, by education and experience, also well trained in biology, particularly in the areas of physiology and ecology. I have supervised numerous scientists, technicians and students.

As owner of Powell & Associates, my clients have included:

- Little River Band of Ottawa Indians, Manistee, MI
- Sewell Environmental, Ada, OK
- RPS Consultants, Manchester, UK
- Natural Resource Technology, Inc., Pewaukee, WI
- Electric Power Research Institute (EPRI), Palo Alto, CA
- Los Alamos National Laboratory (LANL), University of California, Los Alamos, NM
- U.S. EPA (primarily the National Risk Management Research Laboratory, NRMRL)
- U.S. DOD
- ManTech Environmental Research Services Corporation
- Dynamac International Corporation
- Applied Hydrogeologic Research, Bothell, WA
- SCS Engineers, Bellevue, WA
- Snohomish County Health District, Snohomish, WA

My current and former projects with Powell & Associates include:

- Evaluation of sediment contamination information in Manistee Lake and development of Fact Sheets for the Little River Band of Ottawa Indians.
- Developing ground water monitoring guidance for the electric power utility industry for Natural Resources Technology.
- Evaluating the site characterization and proposal tenders for development and installation of a permeable reactive barrier at the British Aluminum Tubes site for RPS Consultants, Manchester, UK.
- Developing the report “Survey of Remediation Technologies for Inorganic Constituents in Groundwater at Electric Utility Sites” for the Electric Power Research Institute.
- Developing the report “Technology Update: Current Status of the Practice for Permeable Reactive Barrier Technology Applications” for USEPA.
- Experimental design, field studies, research, groundwater sampling design, data analysis, preparation of interim reports, and preparation of an Issue Paper for the project “Anaerobic Bioactive Wall for In-Situ Reductive Bioremediation of Chloroethenes Using Induced Electrical Potential” for USEPA.
- Authoring an invited chapter titled “Techniques for Ground Water Sampling” for the Handbook of Environmental Instrumentation (John Wiley & Sons).
- Authoring the cover article for the June, 1997, Pollution Engineering magazine titled “Hitting the Bulls-Eye in Groundwater Sampling.”
- Participation in an External Advisory Group to the Los Alamos National Laboratory.
- Participation as a panel reviewer for USEPA Phase II SBIR proposals.
- Development of a Fact Sheet, a Report, a White Paper and an Environmental Research Brief on permeable reactive barrier technologies for groundwater remediation for USEPA.
- Development of a report on “The Natural Attenuation of Arsenic” for USEPA.
- Development of a report on “Bioattenuation of Redox-Sensitive Metals” for USEPA.
- Evaluation of research funding proposals for the Strategic Environmental Research Development Program (SERDP) for the Department of Defense.
- Authoring of an invited chapter for the Encyclopedia of Environmental Analysis and Remediation on “Iron Metal for Subsurface Remediation” (John Wiley & Sons).
- Development of an exploratory data analysis and statistics report for Applied Hydrogeologic Research, Bothell, WA, for their City of Olympia Septic Monitoring Program.
- Preparing a report evaluating and making recommendations for 19 landfills within Snohomish County, WA, for the Snohomish County Health District. Teamed with Applied Hydrogeologic Research, Bothell, WA, to win this contract.
- Prepared a report for USEPA titled “Economic Analysis of the Implementation of Permeable Reactive Barriers for Remediation of Contaminated Ground Water.” I developed a new methodology for cost comparisons in this report.
- Analyzed the groundwater geochemical characteristics of the Coupeville Solid Waste Facility, Island Co., WA, and prepared a report on for SCS Engineers, Bellevue, WA.

Other subcontracted tasks included the evaluation of research data, the production of peer-reviewed manuscripts, and the review of such materials prepared by other scientists and engineers. I have routinely performed reviews for journals, such as *Environmental Science & Technology*, as well as USEPA, USGS, DOD, DOE, and other governmental agencies and organizations.

I spent eleven years as a Project Scientist and Quality Assurance Coordinator for ManTech Environmental Research Services Corporation at the Robert S. Kerr Environmental Research Laboratory, Ada, OK, carrying out original groundwater research in both the laboratory and field. Prior to this I served as an Analytical Chemist at the Oklahoma Geological Survey, University of Oklahoma, and as President of Great Plains Laboratories, Norman, OK. Details of these positions will be made available upon request.

#### **COMPUTER EXPERIENCE:**

I have used computers extensively in my work since 1979, beginning on a PDP11/03 terminal and an Apple IIe. The following are incomplete lists of my software experience:

Operating Systems-	MacOSX and Classic, DOS, Windows, NEXT.
Programming-	Advanced Basic, HTML, Mathematica <sup>®</sup>
Statistics/Science/Math-	DataDesk <sup>6.2</sup> , JMP/SAS, Mathematica <sup>®</sup> , MathCad, Hi-Q, ChemThes3
Modeling Software-	MinteqA2 Equilibrium Metals Speciation Model, University of Florida Breakthrough Curve Models, Oasis/BioPlume
Other Software-	FileMaker, FastTrack Schedule, WordPerfect, Excel, Word, Access, Transform/Dicer, SigmaPlot, DeltaGraph, Cricket Graph, Photoshop, Canvas, Chemintosh, EndNote Plus, PowerPoint, Beaker, AppleWorks, Omnipage, Timeslice, IdeaKeeper, NoteTaker 2003, Adobe GoLive, various browsers, FTP programs and other internet software. Very well versed in networking, including wireless networks.

#### **TECHNICAL TRAINING:**

- OSHA Hazwoper Certifications through "Train the Trainer." 2003
- Introduction to Mathematica, University of Illinois at Urbana Champaign. 1993
- OSHA 40 Hour Hazwoper Operations Training Certificate (current). 1991
- Fundamentals of Experimental Design. 1991
- Basic Statistics for Research and Development. 1989
- Control Charting for Research and Development. 1989
- Basic Quality Assurance. 1989
- Atomic Spectroscopy, Perkin-Elmer Corporation. 1987
- Fundamentals of Ion Chromatography, Dionex Corp. 1984
- Supervision and Management Training and Certification, Univ. of Oklahoma. 1983
- Instrumentation for Laboratory Electronics, American Chemical Society. 1982
- Atomic Absorption Training Course, Perkin-Elmer Corp. 1978
- Theory and Use of Specific Ion Electrodes, Orion Corp. 1977
- Coal Geology Fundamentals, University of Oklahoma. 1976

#### **MEMBERSHIPS:**

- MENSA, The International High IQ Society.
- The American Chemical Society, Environmental Division.
- The National Ground Water Association.

#### **AWARDS AND HONORS:**

- President's Award for Excellence, 1995, ManTech Environmental Technology, Inc.

- Scientific and Technological Achievement Award, Level III, U. S. Environmental Protection Agency, 1996
- Two-time winner of the Performance Incentive Program Award, ManTech Environmental Technology, Inc.

## **ROBERT M. POWELL PUBLICATIONS LIST**

As of 11/2003

Mr. Powell's publications include the following list, with approximately 52 presentations, posters, and abstracts at meetings. In addition he has authored numerous scientific reports for clients.

Powell, R. M. and R. W. Puls. 2003. Technology Update: Current Status of the Practice for Permeable Reactive Barrier Technology Applications. U.S. EPA Report. In review.

Powell, R. M. 2003. "Techniques for Ground Water Sampling." Invited chapter for the Handbook of Environmental Instrumentation, John Wiley & Sons, Inc., New York. In press.

Powell, R. M., Powell, P. D., and R. W. Puls. 2002. "Economic Analysis of the Implementation of Permeable Reactive Barriers for Remediation of Contaminated Ground Water." U.S. EPA. EPA/600/R-02/034. June 2002.

Powell, R. M., Puls, R. W. "Natural Attenuation of Arsenic." U.S. EPA Internal Report.

Powell, R. M., Shen, H., and G. W. Sewell. "Bioattenuation of Redox-Sensitive Metals." U.S. EPA Issue Paper. In review.

Puls, R. W., Powell, R. M., Paul, C. J., and D. W. Blowes. 1999. "Ground Water Remediation of Chromium Using Zero-Valent Iron in a Permeable Reactive Barrier: Laboratory and Field Study Results." Chapter 13 in ACS Symposium Series 725, Innovative Subsurface Remediation, Field Testing of Innovative Remediation Technologies, pp. 182-194.

Powell, R. M., Puls, R. W., Blowes, D., Vogan, J., Gillham, R. W., Powell, P. D., Schultz, D., Landis, R., and T. Sivavec. 1998. "Permeable Reactive Barrier Technologies for Contaminant Remediation." U.S. EPA Report. EPA/600/R-98/125.

Powell, R. M. and R. W. Puls. July 1997. "Permeable Reactive Subsurface Barriers for the Interception and Remediation of Chlorinated Hydrocarbon and Chromium (VI) Plumes in Ground Water." U.S. EPA Remedial Technology Fact Sheet. EPA/600/F-97/008.

Powell, R. M. and P. D. Powell. 1998. "Iron Metal for Subsurface Remediation." Invited chapter. The Encyclopedia of Environmental Analysis and Remediation. Robert A. Myers, ed. John Wiley & Sons, Inc., New York. 8:4729-4761.

Powell, R. M. and R. W. Puls. 1997. "Proton Generation by Dissolution of Intrinsic or Augmented Aluminosilicate Minerals for In Situ Contaminant Remediation by Zero-Valence-State Iron." *Environmental Science & Technology*. 31:2244-2251.

Powell, R. M. and R. W. Puls. June 1997. "Hitting the Bull's-Eye in Groundwater Sampling." Cover Article, *Pollution Engineering*. 50-54.

Caughey, M. E., Barcelona, M. J., Powell, R. M., Cahill, R. A., Gron, C., Lawrenz, D., and P. L. Meschi. 1995. "Interlaboratory Study of a Method for Determining Nonvolatile Organic Carbon in Aquifer Materials." *Environmental Geology*. 26:211-219.

Powell, R. M., Puls, R. W., Hightower, S. K., and D. A. Sabatini. 1995. "Coupled Iron Corrosion and Chromate Reduction: Mechanisms for Subsurface Remediation." *Environmental Science and Technology*. 29:1913-1922.

Puls, R. W., Powell, R. M., and D. A. Clark. 1994. "Assessment of Colloidal Transport in Ground Water, Pinal Creek Basin, Arizona." Chapter C in Hydrology and Geochemistry of Aquifer and Stream Contamination Related to Acidic Water in Pinal Creek Basin near Globe, Arizona. U. S. Geological Survey Water-Supply Paper, AZ082-745, 12/1/94. Brown, J. G. & B. Favor, eds.

Powell, R. M. 1994. "Geochemical Effects on Chromate Reduction and Remediation Utilizing the Thermodynamic Instability of Zero-Valence-State Iron." Master's thesis. University of Oklahoma, Norman, OK.

Powell, R. M., Puls, R. W., and C. J. Paul. 1994. "Chromate Reduction and Remediation Utilizing the Thermodynamic Instability of Zero-Valence-State Iron." Water Environment Federation Specialty Conference Series Innovative Solutions for Contaminated Site Management. March 6-9. Miami, FL.

Powell, R. M. and R. W. Puls. 1993. "Passive Sampling of Ground Water Monitoring Wells Without Purging: Multilevel Well Chemistry and Tracer Disappearance." *Journal of Contaminant Hydrology*. 12:51-77.

Puls, R. W. and R. M. Powell. 1992. "Acquisition of Representative Ground Water Quality Samples for Metals." Invited paper. *Ground Water Monitoring Review*, Summer.

Puls, R. W., R. M. Powell, D. A. Clark, B. E. Bledsoe, and C. J. Paul. 1992. "Metals in Ground Water: Sampling Artifacts and Reproducibility", *Hazardous Waste, Hazardous Materials* 2(2):149-162.

Puls, R. W. and R. M. Powell. 1992. "Transport of Inorganic Colloids Through Natural Aquifer Material: Implications for Contaminant Transport." *Environmental Science and Technology* 26(3):614-621.

Puls, R. W., R. M. Powell, D. A. Clark and C. J. Eldred. 1991. "Effects of pH, Solid/Solution Ratio, Ionic Strength, and Organic Acids on Pb and Cd Sorption on Kaolinite." *Water, Soil, and Air Pollution* 57-58:423-430.

Puls, R. W., R. M. Powell, D. A. Clark and C. J. Paul. July 1991. "Facilitated Transport of Inorganic Contaminants in Groundwater: Part 2. Colloidal Transport." USEPA Environmental Research Brief. EPA/600/M-91/040.

Puls, R. W. and R. M. Powell. 1991. "Electrostatic Repulsive Effects on the Mobility of Inorganic Colloids in Subsurface Systems", Chapter 4 in Contaminant Transport in the Subsurface-Colloids and Surfactants, the 65th Annual Colloid and Surface Science Symposium, American Chemical Society. June 17-19. Sabatini, D. A. and R. C. Knox, eds. University of Oklahoma, Norman, OK.

Puls, R. W., R. M. Powell, and T. F. Rees. 1991. "Stability and Transport of Inorganic Colloids Through Contaminated Aquifer Material", Proceedings of the Fifth Annual Toxic Substances Hydrology Technical Meeting. March 11-15. Monterey, CA.

Puls, R. W. and R. M. Powell. 1990. "Laboratory Studies on the Stability and Transport of Inorganic Colloids Through Natural Aquifer Material." Concepts in Manipulation of Groundwater Colloids for Environmental Restoration. Oct. 16-18. Manteo, NC.

Puls, R. W., J. H. Eychaner, and R. M. Powell. 1990. "Colloidal-Facilitated Transport of Inorganic Contaminants in Groundwater: Part 1. Sampling Considerations." USEPA Environmental Research Brief. EPA/600/M-90/023.

Powell, R. M. 1990. "Total Organic Carbon Determinations in Natural and Contaminated Aquifer Materials, Relevance and Measurement." Proceedings of the Fourth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring And Geophysical Methods. National Water Well Association. May 14-17. Las Vegas, NV.

Powell, R. M., B. E. Bledsoe, R. L. Johnson, and G. P. Curtis. 1989. "Interlaboratory Methods Comparison for the Total Organic Carbon Analysis of Aquifer Materials." *Environmental Science and Technology* 23:1246-1249. (Reviewed in *The Groundwater Newsletter* 18(19):2. 1989)

Powell, R. M., D. H. Kampbell, B. E. Bledsoe, R. W. Callaway, J. T. Michalowski, S. A. Vandegrift, M. V. White, and J. T. Wilson. 1988. "Comparison of Methods to Determine Oxygen Demand for Bioremediation of a Fuel Contaminated Aquifer." *International Journal of Environmental Analytical Chemistry*. 34:253-263.

Armstrong, J. M., W. Korreck, L. E. Leach, R. M. Powell, S. A. Vandegrift, and J. T. Wilson. 1988. "Bioremediation of a Fuel Spill: Evaluation of Techniques for Preliminary Site Characterization." Proceedings of the National Water Well Association Petroleum Hydrocarbons Conference. Nov. 9-11. Houston, TX.

Bouchard, D. C., R. M. Powell, and D. A. Clark. 1988. "Organic Cation Effects on the Retention of Metals and Neutral Organic Compounds on Aquifer Material." *Journal of Environmental Science and Health, Part A - Environmental Science and Engineering* 23(6):585-601.

Powell, R. M. 1988. "Method Comparison for the Analysis of Total Organic Carbon in Waters and Soils Utilizing the Oceanographics International Ampule Analyzer, Leco Carbon Determinator, and Dohrmann Carbon Analyzer." Northrop Technical Report. TR-4410-87-17.

Bouchard, D. C., R. M. Powell, and D. A. Clark. 1987. "Alkyl Ammonium Cation Effects on Aquifer Material Sorptivity." *Agronomy Abstracts* pp. 166.

Powell, R. M. 1987. "Changes in Volumetric Glassware after Heating at 565°C for Carbon Removal." *EPA Quality Assurance Newsletter* 9(1).