ROBERT M. POWELL

SENIOR PROJECT SCIENTIST/SENIOR PROJECT MANAGER

(248) 977-0317 ***cell***
Email: rpowell@powellassociates.com
LinkedIn: http://www.linkedin.com/pub/robert-powell/5/30b/952

ADDENDUM TO CURRICULUM VITAE

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Professional Experience (recent consulting)

For Horizon Environmental Corporation:

- **Selected work on Horizon projects includes:**

  - Serving as an expert witness on court cases requiring extensive exploratory data analysis (EDA) of soil samples contaminated with various metals, using GIS, statistical transect and spatial analyses and a variety of other techniques.
  - Serving as an advisor for the Little Traverse Bay Bands of Odawa Indians (LTBB) on remediation of the Bay Harbor Superfund Removal Site, a complex former Brownfield site that impacts Lake Michigan, including the LTBB reservation and fishing rights, with cement kiln dust leachate.
  - Created a water and lake sediments sampling plan for Manistee Lake; designed using EDA for the Little River Band of Ottawa Indians.
  - Evaluated and advised on hydrogeology and ongoing development of a long-term voluntary ground water monitoring strategy, with potential natural attenuation processes, at a coating and finish manufacturing facility.
  - Assessed potential natural sources and behaviors of certain volatile chemicals for a court case involving a large industrial client.

- Developed a sampling guidance document for combustion of recycled input materials to a large industrial client to reduce fossil fuel consumption.
- Evaluated soil and ground water data using EDA to isolate impacts due to RCRA WMUs from the impacts of historical fill and natural background at an abandoned steel mill as prelude to developing regulatory facility-specific soil PSIC (particulate soil inhalation criteria).
- Analyzed innovative PRB designs proposed in a RI/FS for chlorinated hydrocarbons impacting property boundaries and assistance with the development of appropriate compliance and performance monitoring using low-flow rate sampling methods for the Washington State Department of Ecology.
- Prepared conceptual designs and preliminary cost estimates for consideration of a PRB in the subsurface to remediate 1,1,1-TCA at a manufacturing site.
- Developed an analysis regarding the use of in situ oxidation by permanganate versus reductive dechlorination by nanoparticle zero-valent iron (ZVI) to remediate the chlorinated hydrocarbon contaminants in a fractured bedrock aquifer.
- Reviewed a proposal to carry out monitored natural attenuation of TCE and its degradation products at a fractured shale and bedrock site.
- Did contaminant geochemical and exploratory data analysis, developed a direct push sampling plan, and created a conceptual design and cost estimate for a PRB using Apatite II™ as the reactive media at a redevelopment site that had soils and ground water contaminated with metals and organic compounds.
- Provided support on chemistry related to the volatilization of organic compounds and the emissions calculations for air modeling of a volatile pesticide release.
- Participated in the assessment of zinc intrusion into a river via surface runoff and storm sewer drainage into a leaky retention pond at an industrial facility.
- Addressed NPDES compliance issues for a steel mill client requiring significant interaction with the regulators at the Michigan Department of Environmental Quality (MDEQ).

For Powell & Associates Science Services:

- **Carried out a variety of tasks associated with a sensitive lake environment and industrialization within a tribal reservation boundary.** *Client: Little River Band of Ottawa Indians*

  - Created the document, "Brief Evaluation of Tondu Responses to the Manistee Planning Commission Questions. 10 December 2003." pp. 4.
  - Conducted EDA and created the report, "Exploratory Analysis of Chemistry Data from: Preliminary Investigation of The Extent of Sediment Contamination in Manistee Lake." 22 December 2003. pp. 18.
  - Developed the fact sheet, "Northern Lights Power Project Special Use Permit Fact Sheet." 02 Jan 2004. pp. 2.
  - Wrote the document, "Brief Evaluation of NTH Consultants' Responses to Mr. Dave Barber on 12/02/2003." 7 January 2004. pp. 5.

- Created a point-by-point, "Evaluation of the Tondu Corporation Environmental Assessment for the Northern Lights Power Plant Project as Submitted to the City of Manistee Planning Commission on 12/17/2003." 29 January 2004. pp. 7.
- Assessed and outlined, "Potential Strategic Leveraging Issues for Manistee Planning Commission Public Hearing." 09 Feb 2004. pp. 2.
- Developed a discussion outline titled, "General Topics for the Manistee Planning Commission Public Hearing to be held on Thursday, 02/19/2004." 17 Feb 2004. pp. 2.
- Assessed the issues and wrote the document, "Health and Safety Issues of Concern with Regard to Operation of the Northern Lights Power Plant." 27 February 2004. pp. 3.
- Developed an outline of issues regarding the building of a coal-fired power plant on Manistee Lake, MI, "Issues of Concern for the City of Manistee Planning Commission Regarding the Tondu Application for the Northern Lights Power Plant Special Use Permit." 03 March 2004. pp. 3.
- Evaluated the environmental aspects of a coal-fired power plant on Manistee Lake, MI, and wrote, "Environmental Issues of Concern with Regard to Construction and Operation of the Northern Lights Power Plant; Including a Brief Assessment of the MPC Role in the Process of Considering the Tondu Corporation Special Use Permit Application to the City of Manistee Planning Commission (MPC)." Monday, 22 March 2004. pp. 6.
- Carried out extensive and detailed EDA using the programs DataDesk 6.2 and Aable 1.5.8 on data from Manistee Lake sediments and wrote the report, "General Assistance Program (GAP) Evaluation of the Sediment Contamination in Lake Manistee Using Exploratory Data Analysis." 29 June 2004. pp. 63.
- Located and researched information available regarding industry on the shoreline and in the vicinity of Manistee Lake during the past 150 years, compiled, analyzed and tabulated information on contaminants relative to those industrial processes, assessed those having the greatest probable impact on degradation of the Lake, developed a comprehensive plan for further sampling and other needed actions, and wrote the report, "General Assistance Program (GAP) Pollution Inventory and Action Plan for Manistee Lake." 29 September 2004. pp. 87.
- Served as an expert during the Federal Court litigation of The Manistee Salt Works Development Corporation (plaintiff) vs. The City of Manistee and the Little River Band of Ottawa Indians and the Manistee Citizens for Responsible Development (defendants). Created the expert report, "Assessment of Northern Lights Power Plant Impacts on the Manistee Lake Environment," as a submittal to the court.
- Created the educational presentation, "Contamination in Manistee Lake Sediments: Studies, Evaluations and Further Actions," and presented it to city, county, and tribal planners in the Manistee area.

- **Created report document sections and performed technical and editorial review for projects in Botany Bay, Australia.** *Client: Sewell Environmental Associates LLC*

  - "Botany Bay Groundwater Project Groundwater Cleanup Plan." 28 Oct 2003. pp. 74.
  - "Review of DNAPL Site Characterization and Treatment Technologies: In Support Of Proposed Clean-Up Activities At Orica Botany Site." 29 Oct 2003. pp. 11.

- **Evaluated tender submissions for a proposed permeable reactive barrier installation in England.** *Client: RPS Consultants*

  - Performed an assessment of PRB design, installation and cost proposals and made recommendations to RPS Consultants for selecting the contractor in the report "Evaluation of Proposed Permeable Reactive Barrier Installation at the British Aluminum Tubes Site, Redditch." 11 April 2003. pp. 8.

- **Conducted investigations and surveys relative to the remediation needs of the electric power utility industry and generated a report of conclusions and recommendations.** *Client: Electric Power Research Institute (EPRI)*

  - Performed a survey then researched, evaluated and ranked both the contaminants of interest at electric power utility sites and remediation technologies for those contaminants; authored the report "Survey of Remediation Technologies for Inorganic Constituents in Groundwater at Electric Utility Sites." June 2003. pp. 100. The report focused on metals and inorganic contaminants resulting from both coal storage and coal combustion by-products and on PRBs as the primary treatment modalities.

- **Served as a member of the External Advisory Group (EAG) for the Hydrogeologic Workplan at the Los Alamos National Laboratory (LANL).** *Client: Los Alamos National Laboratory (University of California).*

  - The EAG consisted of six scientists providing guidance to the Groundwater Integration Team (GIT) at the LANL. Workplan objectives were to do a full-scale hydrogeologic characterization of the LANL subsurface, determine the best locations for perched and regional aquifer monitoring wells, elucidate ground water flow directions, and evaluate the movement of contaminants from the various potential surface/soil sources within the DOE facility.
  - Coauthored nine semi-annual review reports for the Workplan; primary authorship of the sections, "Data Gathering," "Data Quality Objectives," "Database," "Geochemical Modeling," and "Ground Water Monitoring." Responsible for technical additions, support and review on all other sections that included, "Program Management," "Management of Stakeholder Issues," "Action Plan for Recommendations of the EAG," "Administrative Issues," "Modeling," "Drilling and Well Completion," and "Risk Based Assessment." These reports were titled, "Semi-Annual Report to the Groundwater Integration Team of the Los Alamos National Laboratory by the External Advisory Group." 1998 through 2002. Elizabeth L. Anderson, Robert W. Charles, Charles F. McLane, Robert M. Powell, Jack D. Powers and David C. Schafer.
  - Analyzed the relationships among various management groups involved in the Workplan program and coauthored the report, "An Examination of the Relationship Between the Environmental Restoration Program and the Hydrogeologic Workplan at Los Alamos National Laboratory." 12 Feb 2001. Robert W. Charles and Robert M. Powell. pp. 3.
  - Reviewed four LANL Standard Operating Procedures, "ER-SOP-6.01 Purging Wells for Representative Sampling of Groundwater", "ER-SOP-6.02 Field Analytical Measurements of Groundwater Samples", "ER-SOP-6.03 Sampling for Volatile Organics in Groundwater", "ER-SOP-xxx Multi-Level Groundwater Sampling of Monitoring Wells, The Westbay MP System." 03 Sept 2001.

- Evaluated well drilling, completion reports, and analytical results; coauthored the report, "Assessment of Regional Aquifer Well-Development Techniques at the Los Alamos National Laboratory and Impacts on Sampling." 23 Jan 2002. Robert M. Powell and David C. Schafer. pp. 18.
- Assessed the Workplan well tests and coauthored the report, "Response to New Mexico Environment Department Letter to Los Alamos National Laboratory Re: Suspension of Falling-Head Slug Tests Dated December 14, 2001, NM0890010515." 24 Feb 2002. David C. Schafer and Robert M. Powell. pp. 10.
- Reviewed and reported to LANL on the New Mexico Environment Department Hazardous Waste Bureau position paper "Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring." 27 June 2002.

➢ **Provided direct support to U.S. EPA for technical program review**. *Client: U.S. EPA*

- Reviewer in Washington, D.C. for the U.S. EPA Small Business Innovation Research (SBIR) Program; evaluated funding proposals for the in situ remediation of contaminated groundwater. 1999.
- Peer-reviewer for the U.S. EPA National Risk Management Research Laboratory document, "Review: Capstone Report on the Application, Monitoring and Performance of Permeable Reactive Barriers for Ground Water Remediation: Volume 1-Performance Evaluations at Two Sites." 2003.

➢ **Provided indirect support to U.S. EPA on numerous ground water and subsurface topics via subcontracts with two prime contractors.**

Client: ManTech Environmental Research Services Corporation (MERSC)

- Managed the project/writing team for the U.S. EPA document, "Permeable Reactive Barrier Technologies for Contaminant Remediation." EPA/600/R-98/125, by Powell, R. M., Puls, R. W., Blowes, D., Vogan, J., Gillham, R. W., Powell, P. D., Schultz, D., Landis, R., and T. Sivavec. 1998. pp. 102.
- Coauthored, "In Situ Remediation of Ground Water Using Permeable Reactive Barriers." 1998. Bor-Jier (Ben) Shiau, Mary Sue LaFever, Robert M. Powell. pp. 20.
- Authored sections of the successful MERSC research and analytical support proposal for the U.S. EPA National Risk Management Research Laboratory, Ada, OK. 1998.
- Reviewed and revised the U.S. EPA report/manuscript for peer-review, "Chemical Enhanced Replenishment of Elemental Iron for In Situ Reactive Barriers." 1999. Bor-Jier (Ben) Shiau.
- Evaluated research data and authored the report, "Mercury Removal from Solution by Reactions with Peerless Iron and other Solid-Phase Materials," 1999. pp. 13.

Client: Dynamac International Corporation

- Researched, developed and authored a report for U.S. EPA that addressed the fate and speciation of arsenic in soils, sediments and ground water, "The Natural Attenuation of Arsenic." 1998. pp. 55.
- Coauthored the U.S. EPA Issue Paper "Bioremediation of Redox Sensitive Metals." 2000. Hai Shen, Robert M. Powell, Guy W. Sewell. pp. 83.
- Several work products were done for the Electrically Enhanced Bioactive Barriers (EEBB) project (U.S. EPA), including participation in a field study at Fallon Naval Air Station, Fallon, NV. A variety of reports were developed on the EEBB studies:
  - A) "Anaerobic Reaction Zone Formation for In-Situ Reductive Bioremediation of Chloroethenes Using Electrode Potentials." 1999. Robert M. Powell, Xihui Zhang, Frank Beck, Guy W. Sewell. pp. 26.
  - B) "Cost Analysis of Hydrogen Injection versus Electrically Enhanced Bioactive Barrier Technology." 1999. Robert M. Powell, Frank Beck, Guy W. Sewell. pp. 6.
  - C) "Summary of the Exploratory Analysis of Data from the November 1999 Field Sampling of Lane E at the Fallon Naval Air Station, Fallon, Nevada." 2000. Robert M. Powell. pp. 13.
  - D) "The Electrically Enhanced Bioactive Barrier Project Sampling Plan for Lane E, Fallon, Nevada." 2000. Robert M. Powell.

  Mr. Powell also prepared a series of proposals, white papers, progress and annual reports for this project.
- Investigated Solvent Extraction Residual Biotreatment (SERB) research for removing contaminants from soils and sediments and authored a Technology Implementation Manual for U.S. EPA for use with this remedial approach. 2001. pp. 30.
- Evaluated numerous sites with, or considering, PRB technology for cost and compared these to remediation alternatives, in particular pump and treat. Developed a new method for comparing pump and treat to PRB costs. Authored the report, "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. pp. 42.
- Researched and developed an update report for U.S. EPA on permeable reactive barrier installations around the world, "Technology Update: Current State of the Practice for Permeable Reactive Barrier Technology Application." 2003. Robert M. Powell. pp. 43.
- Peer-reviewed the joint DOE/U.S. EPA document, "Selection of Partition Coefficient, Kd, Values," that provided partitioning data for metals onto various soil types and mineral phases.

- **Performed exploratory data analyses and provided expert witness support on projects in Washington State involving ground water monitoring issues.** *Client: Applied Hydrogeologic Research (AHR)*

  - Analyzed the data and authored the report, "Exploratory Statistical Analysis of Data from the City of Olympia Septic Monitoring Program." 24 July 1999.
  - Coauthored the report, "Hydrogeologic Support Activities For The Olympia Septic Monitoring Project" for the City of Olympia, Washington. 1999.
  - Expert witness for AHR with regard to ground water monitoring litigation issues.

- **Evaluated data from ten Washington State landfills and prepared recommendations and sampling guidance.** *Client: Snohomish County Health District*

  - Teamed with AHR to evaluate landfills in Snohomish Co. Washington. Recommendations for 10 landfills were developed for the report, "Landfill Groundwater Monitoring Recommendations, Snohomish County, Washington. Prepared for Snohomish County Health District." December 1999. Mark D. Varljen and Robert M. Powell. pp. 58.

- **Carried out several tasks involving proposal development, geochemical evaluations and exploratory data analysis on two landfills, and provided landfill sampling guidance.** *Client: SCS Engineers*

  - Participated in a winning proposal with SCS Engineers for the Army Corps of Engineers, Sol DACW67-01-R-0017, Seattle District; Indefinite Delivery/Indefinite Quantity Contract under Multiple Award Remediation Concept (MARC) for Long Term Monitoring/Long Term Operation in WA, OR, ID and MT and other Areas Serviced by Seattle District. July 2001.
  - Provided written guidance and a plan for geochemical evaluations of the Sunrise Mountain Landfill, Clark Co., NV. Nov. 2001. pp. 4.
  - Prepared an EDA report, "Evaluation of Groundwater Geochemical Characteristics for the Coupeville Solid Waste Facility, Island Co., WA." 09 Jan 2002. pp. 47.

- **Worked with the client to develop reports germane to the sampling needs of the electric power utility industry.** *Client: Natural Resource Technology, Inc.*

  - Coauthored (authored the leachate sampling sections) a generic, "Sampling Plan," (2003) for EPRI to be used for characterizing coal combustion byproduct leachate at 25 CCB management sites in the United States.
  - Coauthored the document, "Guidance for Groundwater Monitoring and Data Analysis at Coal Combustion By-Product Management Facilities" (2004) for EPRI, including sections on well construction, sampling methods and sampling analysis.

PROFESSIONAL EXPERIENCE (prior to consulting)

- **Project Scientist and Quality Assurance Coordinator, ManTech Environmental Research Services Corporation, U.S. EPA NRMRL, Ada, OK.**

Mr. Powell implemented original research as the Principal Investigator on numerous subsurface and ground water research projects at the Robert S. Kerr Environmental Research Center (RSKERC), Ada, OK. Mr. Powell supervised scientists and students carrying out laboratory and field research on these projects and directed the analytical needs and requirements of these projects via the ManTech analytical group. Mr. Powell designed the experiments, developed the workplans and project budgets, successfully maintained the projects within these budgets, met QA and safety requirements, and always achieved the goals and milestones. Milestones always included the production of reports for U.S. EPA and typically peer-reviewed journal articles. Mr. Powell was also the Quality Assurance Coordinator for ManTech. His responsibilities included reviewing and approving all project plans,

quality assurance documents, reports and other outputs prior to submission to the U.S. EPA. His work at the RSKERC is chronicled in his publications list, which follows.

- **Analytical Chemist, Oklahoma Geological Survey, University of Oklahoma**

Mr. Powell served as an Analytical Chemist at the Oklahoma Geological Survey (OGS) chemistry laboratory. His laboratory experience covered the entire range of operations from sample preparation of soils, coal, mineral and water samples and performing wet chemistry through the use of all OGS' analytical instruments. He was the only OGS scientist who could carry out every aspect of every procedure in the analytical laboratory. He improved laboratory data handling by writing seven programs for the PDP11/03 computer that automated the data analysis and performed QA/QC checks via techniques such as mass and ion balances. He participated in the design of custom software to improve instrument control and data analysis using the ARL 35000 sequential ICP. His daily responsibilities included method development, maintenance of quality control, report writing, computer programming, supervision, and doing analyses. He performed analyses of environmental materials using a variety of techniques, with emphasis on ICP and AA spectroscopy, but also using a broad spectrum of wet chemistry procedures and other instruments. Mr. Powell was the leading expert in the State of Oklahoma on the analysis of coal and coal ash. He served as the coordinator for the OGS hazardous waste compliance operations, operating as an interface between the OGS and the University programs. He supervised students, technicians, and chemists as well as carrying out the training required for these positions.

- **Earlier Consulting Experience**

During his career Mr. Powell has been active in the operation of small service companies, notably Powell & Associates Science Services (former owner), Great Plains Laboratories (former President), and Powell & Associates Analytical Services (former owner). These companies provided analytical methods and training to consultants, hospitals, and industry; also specialty chemical analyses of water, oilfield brines, paints, solder, and failed aircraft components.

Computer Hardware and Software Experience

Mr. Powell has used computers extensively since 1976, including card-reading mainframes, the earliest programmable calculators, Digital PDP systems, Apple Macintosh, DOS and Windows operating systems, networking and all associated peripheral computer equipment. Among the software he has employed are DataDesk, Aabel, JMP/SAS, Mathematica, MathCad, SigmaPlot, DeltaGraph, Chemical Thesaurus, JPlot, MathPad, XDrawChem, ChemThesarus, MINTEQA2 Equilibrium Metals Speciation Model, PhreeqcI, University of Florida Breakthrough Curve Models, Oasis/Bioplume, DEVONthink and DEVONagent.

Organizations/Certifications/Training

- The American Chemical Society, Environmental Division
- The National Ground Water Association
- Mensa, The International High IQ Society
- Supervision and Management Certification, University of Oklahoma 1983
- 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 (original date) 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