



MICHAEL T. RAFFERTY

Engineer

AREAS OF EXPERTISE

- Soil and Groundwater Remediation
- Treatment System Design
- Hazardous Waste Management
- Remediation Cost Estimates
- Project Management
- Expert Witness

SUMMARY OF QUALIFICATIONS

Mr. Rafferty has extensive experience in the design, construction, and operation of groundwater treatment, soil treatment, and oil and chemical process facilities. He has been responsible for the design of process systems (including equipment, piping, and instrumentation); construction, startup, and operation of treatment plants; project material control; and various construction-related activities. He has managed site characterization and remediation programs in compliance with federal, state, and local regulatory guidelines for a wide variety of sites where the soil or groundwater was affected by metals, chlorinated organic compounds, and petroleum hydrocarbons as well as non-aqueous phase liquids (NAPLs). Mr. Rafferty has been directly responsible for all phases of these projects, including soil and groundwater investigations; conceptual remedial design studies; development of design drawings and specifications; bid document preparation and evaluation; construction management; field supervision and inspection, and report preparation. He has been an expert witness and has provided technical input for mediation, arbitration, and litigation of environmental and construction claim cases.

Mr. Rafferty is Office Manager of SSP&A's San Francisco, California office.

REPRESENTATIVE EXPERIENCE

S.S. Papadopoulos & Associations, Inc., San Francisco, California

- Former Pesticide Manufacturing Site, East Palo Alto, California – Served as Project Manager for the remediation of a site impacted by approximately 100 tons of arsenic and related compounds. Responsible for coordinating two Feasibility Studies and Remedial Action Plans according to federal and state requirements. The work included evaluation of treatment technologies and the development, screening, and selection of remedial action alternatives. Coordinated extensive hydrogeologic and soil investigations, risk assessments, and a long-term groundwater monitoring program required for this site by the California Regional Water Quality Control Board and U.S. Environmental Protection Agency. Remediation to date includes excavation of over 5,000 cubic yards of soil for disposal at a hazardous waste landfill, treatment of over 18,000 cubic yards of arsenic-containing soil, and installation of a three-layer asphalt cap. Special features of this project involved evaluation of environmental exposure to a nearby sensitive wetland environment,

YEARS OF EXPERIENCE: 30+
EDUCATION MS - Civil Engineering, University of California, Berkeley, 1987 BS - Chemical Engineering, Cornell University, 1979
REGISTRATIONS Professional Engineer: California No. C44916 Arizona No. 24299 Colorado No. PE 35978 Tennessee No. 00114477 Oregon No. 16372 New Jersey No. GE42584 Maryland No. 26732 Nebraska No. E-12748 Texas No. 89969 Washington No. 41213 U.S. Virgin Island No. 901219
PROFESSIONAL HISTORY S.S. Papadopoulos & Associates, Inc. Vice President and Principal Engineer, 1999 to present Geomatrix Consultants Project to Principal Engineer, 1987 to 1999 University of California, Berkeley Research Assistant, 1986 to 1987 Bechtel Corporation Project/Senior Field Engineer, 1980 to 1985 Aerojet Corporation Engineer, 1979 to 1980

MICHAEL T. RAFFERTY

Engineer

Page 2

restoration of a nearby salt pond, remediation of residential and school properties, and use of vegetation (phytoremediation) to control arsenic-affected groundwater.

- **Natural Resource Damage Claims, New Jersey** – Served as an expert witness for five cases brought by the State against responsible parties, seeking damages for groundwater contamination. Testimony focused on the cost and time to remediate groundwater to cleanup levels below MCLs.
- **Groundwater Treatment Facilities** – Served as Project Manager for groundwater and soil remediation at several facilities where chlorinated solvents were found in the subsurface. These projects involved soil aeration, design and installation of soil vapor extraction systems, groundwater extraction and containment, and groundwater treatment by aeration, air stripping, oxidation, and activated carbon adsorption. Responsibilities included design, negotiation of permits, field supervision, documentation and inspection, as well as all aspects of contract administration. Example: An aging groundwater treatment system at a CERCLA site in Cupertino, California utilizing air stripping was scheduled for replacement by the site owner. A new activated carbon system was instead proposed, reducing operating costs and increasing reliability of the treatment to meet discharge goals. Mr. Rafferty was the engineer of record for the design, and he and other SSP&A staff oversaw construction and startup of the plant.
- **Sediment Remediation, Southern California** – Served as Project Manager for a diverse team of engineers, geochemists, ecological risk assessors and surface water and sediment modelers evaluating client's liability and potential remediation costs at two ship repair facilities in Southern California. Issues included the age of sediments at depth and fingerprinting sources of PCBs, tin, lead, and other contaminants. Assisted client with negotiations regarding lease closeout at one facility, and represented client in negotiations with other responsible parties regarding mediation of cleanup order at the other site.
- **Insurance Litigation for Remediation Costs** – Served as a testifying and non-testifying expert for both insurance companies and responsible parties in cases involving insurance claims for soil and groundwater remediation costs. Issues included identifying an accurate definition of the claim and the amounts spent, verifying the veracity of the claims, and examining the reasonableness of the costs claimed relative to other cleanup sites. Several cases involving mining wastes in Arizona and chlorinated solvent and rocket propellant releases in California involved claims in excess of \$100 million.
- **U.S. Department of Justice** – Served as an expert witness for several environmental litigation cases. Examples: the quantification of damages due a contractor and redevelopment agency for buried asbestos and debris discovered during residential construction at a former Air Force base; the evaluation of the cost of remediating a bleaching agent released in a desert environment; and the remediation of the release of chlorinated solvents that had moved from a military base into an adjacent residential area.
- **Former Pesticide Manufacturing Site, Bound Brook, New Jersey** – Designed, constructed, and operated a pilot passive surface water treatment system for contaminated runoff containing high levels of dissolved arsenic. Also served as a technical reviewer for remediation documents, including extensive grading and cap designs for the site.
- **Spring Discharges Containing PCBs, Tennessee** – Project manager for the design of a treatment plant to treat variable spring flows containing PCBs from historic natural gas compressor station operations. Design flows range from 10 to 500 gallons per minute.
- **Abandoned Sites** – Served as Project Manager for projects involving the investigation and cleanup of sites abandoned by former lessees. Work included debris and building removal, soil-gas surveys, shallow groundwater surveys, well installation, excavation of impacted soil, and hazardous waste removal. These projects resulted in extensive negotiations with government agencies due to the rigorous permitting requirements to accomplish the work. Example: At a

MICHAEL T. RAFFERTY

Engineer

Page 3

former metal recycling facility in Santa Rosa, California, segregated, categorized and disposed of abandoned hazardous materials; removed hundreds of cubic yards of scrap metal from the site; removed several underground tanks; conducted an extensive site investigation, and installed and operated a groundwater extraction and treatment system incorporating 14 onsite and offsite extraction wells that pump to an air stripper to remove chlorinated VOCs.

- **Petroleum Hydrocarbon Contaminated Sites, California** – Served as Project Manager on several studies at petroleum product storage facilities that involved tank removal, site characterization, and remediation of diesel, gasoline, and solvents. Designed remedial action alternatives in compliance with state and local regulatory agency requirements. Projects involved shallow groundwater surveys to evaluate the extent of contamination in groundwater, soil vapor extraction and bioremediation of soil containing hydrocarbons.
- **Interstate Technology & Regulatory Council (ITRC)** – Served as a member of several ITRC teams, including the Remediation Risk Management team, the Solidification/Stabilization team, and the Remediation Process Optimization team. Conducted numerous online training classes over a period of three years. Received the Industry Recognition Award for his service.
- **Habitat for Humanity** – Conducted *pro bono* environmental assessments and assisted with permitting and geotechnical issues for several new residential construction projects located in San Francisco. Work included soil sampling, preparing reports and managing field work including excavation of contaminated soils. Assisted Habitat in arranging for *pro bono* and at-cost services from drilling and remediation contractors and landfills.

PROFESSIONAL SOCIETIES

National Council of Examiners for Engineering and Surveying
Groundwater Resources Association of California

PUBLICATIONS

- Root, R.A., D. Vlassopoulos, N.A. Rivera, M.T. Rafferty, C. Andrews, and P.A. O'Day. 2009. Speciation and Natural Attenuation of Arsenic and Iron in a Tidally Influenced Shallow Aquifer: *Geochimica et Cosmochimica Acta, ScienceDirect*. 26.
- Binard, K., K. Chiang, M. Rafferty, P. Greer, and J. Semion. 2008. Vegetation Coverage in Cooley Landing Salt Pond Restoration Area. 2006 South Bay Science Symposium for the South Bay Salt Pond Restoration Project, June 6, 2006, San Jose State University, San Jose, California [Edited and Compiled November 12, 2008]. Trulio, L., editor.
- Illera, V., P.A. O'Day, S. Cho, N.A. Rivera, R. Root, M. Rafferty, and D. Vlassopoulos. 2006. Immobilization of Arsenic in a Contaminated Soil Using Ferrous Sulfate and Type V Portland Cement. Poster presentation at the 232nd American Chemical Society National Meeting, September 10-14, San Francisco, California. San Francisco, California.
- Vlassopoulos, D., D. Sorel, T. Luong, M. Karanovic, M. Tonkin, K. Chiang, M. Rafferty, and M. Riley. 2006. Assessment of Potential Perchlorate Impacts from Use of Safety Flares Along California Roadways. Presented at the Groundwater Resources Association (GRA) 16th Symposium in the *Contaminants in Groundwater Series--Perchlorate 2006: Progress Toward Understanding and Cleanup*, January 26, 2006, Santa Clara, California.
- Vlassopoulos, D., N. Rivera, P.A. O'Day, M.T. Rafferty, and C.B. Andrews. 2005. Arsenic Removal by Zerovalent Iron: A Field Study of Rates, Mechanisms, and Long-Term Performance. In *Advances in Arsenic Research: Integration of Experimental and Observational Studies and*

MICHAEL T. RAFFERTY

Engineer

Page 4

Implications for Mitigation. O'Day, P.A., D. Vlassopoulos, X. Meng, and L.G. Benning, editors. ACS Symposium Series Vol. 915. Washington, DC: American Chemical Society. 344-360.

Illera, V., P.A. O'Day, N. Rivera, R. Root, M.T. Rafferty, and D. Vlassopoulos. 2005. Soil Remediation of an Arsenic-Contaminated Site With Ferrous Sulfate and Type V Portland Cement: *EOS Transactions American Geophysical Union*. 86, no. 52, Fall Meeting Supplement: Abstract B31A-0954.

Levison, W., M. Rafferty, D. Sorel, and K. Binard. 2004. Phytoremediation in the San Francisco Bay Area: Using Plant Materials for Environmental Restoration-Part II: *Western Arborist*. 30, no. 4.

Rafferty, M.T., K. Binard, M. Orr, and J. Haltiner. 2003. Successful Design for Wetland Restoration in the San Francisco Bay. 2003 American Water Resources Association Annual Conference, November 3-6, 2003, San Diego, California. Oral Presentation Session 49. November 5.

Rafferty, M.T., C.B. Andrews, D. Vlassopoulos, D. Sorel, and K.M. Binard. 2003. Remediation of an Arsenic Contaminated Site. Presented at the 226th American Chemical Society National Meeting, September 7-11, 2003, New York City, New York.

Vlassopoulos, D., C.B. Andrews, M. Rafferty, P.A. O'Day, and N.A. Rivera Jr. 2003. In Situ Arsenic Removal by Zero Valent Iron: An Accelerated Pilot Test Simulating Long-Term Permeable Reactive Barrier Performance. Presented at the 226th American Chemical Society National Meeting, September 7-11, 2003, New York City, New York.

Sorel, D., C.J. Neville, M.T. Rafferty, K. Chiang, and C.B. Andrews. 2002. Hydraulic Containment Using Phytoremediation and a Barrier Wall to Prevent Arsenic Migration. In *Proceedings of the Third International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, May 20-23, 2002, Monterey, California. Gavaskar, A.R., and A.S.C. Chen, editors. Battelle Press.

Vlassopoulos, D., J. Pochatila, A. Lundquist, C.B. Andrews, M.T. Rafferty, K. Chiang, D. Sorel, and N.P. Nikolaidis. 2002. An Elemental Iron Reactor for Arsenic Removal from Groundwater. In *Proceedings of the Third International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, May 20-23, 2002, Monterey, California. Gavaskar, A.R., and A.S.C. Chen, editors. Battelle Press.

Levison, W., M. Rafferty, and K. Binard. 2001. Phytoremediation in the San Francisco Bay Area: Using Plant Materials for Environmental Restoration-Part I: *Western Arborist*. 27, no. 4.

Tossell, R.W., K. Binard, and M.T. Rafferty. 2000. Uptake of Arsenic by Tamarisk and Eucalyptus Under Saline Conditions. *Proceedings of the Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, May 22-25, 2000, Monterey, California. In 2000 Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Wickramanayake, G.B., and A.R. Gavaskar, editors. *Bioremediation and Phytoremediation of Chlorinated and Recalcitrant Compounds (C2-4)* of 7. Battelle Press.

Tossell, R.W., K. Binard, L. Sangines-Uriarte, M.T. Rafferty, and N.P. Morris. 1998. Evaluation of Tamarisk and Eucalyptus Transpiration for the Application of Phytoremediation. *Proceedings of the First International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, Monterey, California, May 18-21, 1998. In 1998 First International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Hinchee, R.E., editor. *Bioremediation and Phytoremediation: Chlorinated and Recalcitrant Compounds (C1-4)* of 6. Battelle Press.

Tossell, R.W., N.P. Morris, L.P. Kapustka, K. Binard, and M.T. Rafferty. 1997. Phytoremediation as an Alternative to Control Flow of Arsenic-Bearing Groundwater. *Proceedings of the International Business Communications' Second Annual Conference on Phytoremediation*, Seattle, Washington, June 18-19, 1997.

MICHAEL T. RAFFERTY

Engineer

Page 5

- Johl, C.J., L. Feldman, and M.T. Rafferty. 1995. Put Risk-Based Remediation to Work: Environmental Engineering World. 1, no. 5, September-October.
- Yang, D.S., S. Takeshima, T.A. Delfino, and M. Rafferty. 1995. Use of Soil Mixing at a Metals Site. 88th Annual Meeting of the Air and Waste Management Association, San Antonio, Texas, June 1995.
- Chu, P., M.T. Rafferty, T.A. Delfino, and R.F. Gitschlag. 1991. Comparison of Fixation Techniques for Soil Containing Arsenic. In Emerging Technologies in Hazardous Waste Management II. Tedder, D.W., and F.G. Pohland, editors. ACS Symposium Series. 468.

DEPOSITION AND TESTIMONY EXPERIENCE

DEPOSITION

- 2014 La Loma Grande, LLC vs. United States of America. U.S. District Court for the District of Arizona. Civil Action No. 4:11-CV-00476-RCC. April 25.
- 2014 New Jersey Department of Environmental Protection, et al. vs. Exxon Mobil, et al., Superior Court of New Jersey, Law Division – Gloucester County. GLO-L-1063-07. March 20.
- 2012 Commissioner of the Department of Planning & Natural Resources, et al. v. Century Alumina, et al., District Court of the Virgin Islands, Division of St. Croix, Civil No. 2005-0062, July 26 – 27.
- 2010 New Jersey Department of Environmental Protection, et al. vs. Exxon Mobil, et al., Superior Court of New Jersey, Law Division – Gloucester County. GLO-L-1063-07. May 27-28.
- 2010 New Jersey Department of Environmental Protection, et al. v. Essex Chemical Corp., Superior Court of New Jersey Law Division – Middlesex County, Docket No.: MID-L-5685-07. March 12.
- 2008 New Jersey Department of Environmental Protection vs. Saint-Gobain Performance Plastics Corporation et al. Superior Court of New Jersey. L-1685-05. March 6.
- 2007 Kay Ryan Corley and Allen Corley vs. Colonial Pipeline Company et al. Circuit Court of Hale County, Alabama. CV-2005-138. September 13.
- 2006 Richmond American Homes of Colorado, Inc., Metropolitan Development IV, LLC, Metropolitan Builders, Inc., Standard Pacific of Colorado, Inc., and Touchstone Homes, LLC v. United States of America. U.S. Court of Federal Claims. 05-280C. May 10.
- 2004 Horton et al. vs. United States of America. U.S. District Court for the District of Colorado. Civil Action No. 00-MK-2126 (BNB). February 24.
- 2002 Inspiration Consolidated Copper Company and Phelps Dodge Miami, Plaintiff/Counter-Defendant vs. The American Insurance Company et al., Defendants/Counter-Plaintiffs. Superior Court of the State of Arizona in and for the County of Maricopa. Case No. CV98-00530. May 14 and 15, September 19, 20 and 27.
- 1999 Robert W. McMahon vs. The United States. U.S. District Court for the Southern District of Texas, Laredo Division. Case No. L-99-009. December 1.

TESTIMONY

- 2010 New Jersey Department of Environmental Protection, et al. v. Essex Chemical Corp., Superior Court of New Jersey Law Division – Middlesex County, Docket No.: MID-L-5685-07. March 23



MICHAEL T. RAFFERTY

Engineer

Page 6

2009 Carla M. Clark, et. al v. The City of Santa Rosa et al. Sonoma County Superior Court Case #SCV227896. July 7

2003 Robert W. McMahon vs. The United States. U.S. District Court, Southern District of Texas, Laredo Division. Civil Action No. L-99-009. February 11.