



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 evaluation, design, construction, and operation of groundwater and soil treatment systems and oil and chemical process facilities. 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, feasibility studies, conceptual remedial design studies, development of design drawings and specifications, bid document preparation and evaluation, construction management, field supervision and inspection, system start-up and operations, long-term monitoring, 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 the Office Manager of SSP&A's San Francisco, California office.

REPRESENTATIVE EXPERIENCE

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

- **Hanford, (DOE) Washington** – Part of multi-firm team developing remedial alternatives and strategies for RI/FS and post-ROD CERCLA activities, and developing engineering reports, monitoring reports and monitoring plans for RCRA facilities. As Engineer of Record, led the preparation of engineering evaluation reports utilizing groundwater flow models and other techniques to evaluate groundwater monitoring well locations, identify additional locations, and propose analyte sampling for 20 waste areas located on the Central Plateau.
- **Former Pesticide Manufacturing Site, East Palo Alto, California** — Served as Project Manager for the remediation of this site impacted by approximately 100 tons of arsenic and related compounds. Responsible for implementing extensive groundwater and soil investigations, coordinating risk assessments, and preparing feasibility studies and multiple remedial action plans according to state and federal requirements. Remedial actions at the site are performed in accordance with California Regional Water Quality Control Board and U.S. Environmental Protection Agency requirements. Remediation to date includes excavation and characterization of over 5,000 cubic yards of soil for disposal at a hazardous waste landfill, in situ treatment of over

YEARS OF EXPERIENCE: 35+

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
 - Maryland: No. 26732
 - Missouri: No. 2015023711
 - New Jersey: No. GE42584
 - Oregon: No. 16372
 - Pennsylvania: No. PE080761
 - Tennessee: No. 00114477
 - Texas: No. 89969
 - Washington: No. 41213
 - Wyoming: No. PE14256
 - U.S. Virgin Islands: No. 901219

PROFESSIONAL HISTORY

- S.S. Papadopoulos & Associates, Inc.**
Vice President and Principal,
1999 to present
- Geomatrix Consultants**
Project to Principal Engineer,
1987–1999
- University of California, Berkeley**
Research Assistant, 1986–1987
- Bechtel Corporation**
Project/Senior Field Engineer,
1980–1985
- Aerojet Corporation**
Engineer, 1979–1980

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18,000 cubic yards of arsenic-containing soil, and installation of a subsurface barrier wall and a three-layer asphalt cap. Special features of this project involved evaluation of environmental exposure to a nearby sensitive wetland environment, restoration of a nearby salt pond to a functioning wetland, and remediation of residential and school properties. Remedial design activities included bench and pilot scale studies of innovative technologies including soil stabilization and phytoremediation.

- **Natural Resource Damage Claims, New Jersey** — Served as an expert witness for five cases brought by the State of New Jersey seeking damages for groundwater contamination against responsible parties. Testimony focused on the cost and time to remediate groundwater to cleanup levels below MCLs.
- **Former Federal Facility, Missouri** — Served as engineering lead for developing the corrective measures for a 230-acre RCRA facility with extensive VOC and PCB contamination in soil and groundwater. Evaluated *in situ* soil treatment using a range of oxidants as well as soil mixing using zero-valent iron with bentonite. The proposed alternative incorporated low-permeability subsurface barrier walls along with 1000 feet of groundwater interceptor trenches and new extraction wells to replace an extensive network of building drains throughout the 3 million square-foot facility being demolished. Evaluated capping requirements for the 45 SWMUs at the site, as well as RCRA and TSCA disposal requirements for the proposed 35,000 cubic yards of VOC- and PCB-affected soil to be disposed offsite.
- **Groundwater and Soil Remediation Projects** — Served as Project Manager for several projects involving groundwater and soil remediation at facilities where chlorinated solvents were found in the subsurface. The remedial actions at these projects included soil aeration, design and installation of soil vapor extraction systems, groundwater containment, in situ groundwater treatment by aeration and oxidation, and groundwater extraction and treatment by air stripping, and activated carbon adsorption. Responsibilities included design, negotiation of permits, field supervision of investigation phases as well as system construction and operation phases, documentation and inspection, and all aspects of contract administration.
- **Former Manufacturing Site, Virgin Islands** — Coordinated the preparation of a feasibility study to evaluate, screen, and select remedial action alternatives for treatment and control of contaminated groundwater at a site in the Virgin Islands. The selected remedial action was designed to prevent the discharge of contaminated groundwater to an adjacent channel while reducing the potential for saline intrusion using a series of extraction and injection wells. The remedy also included a 5,200-foot-long groundwater collection trench along the perimeter of historical waste ponds and a treatment system for extracted groundwater.
- **Sediment Remediation of Ship-Repair Facilities, Southern California** — Served as Project Manager for a diverse team of engineers, geochemists, ecological risk assessors and surface-water and sediment modelers evaluating the client's liability and potential remediation costs associated with two ship-repair facilities. 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 a cleanup order at the other site.
- **Insurance Litigation for Remediation Costs** — Served as a testifying and non-testifying expert for insurance companies and for responsible parties in cases involving 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 involved mining wastes in Arizona and chlorinated solvent and rocket propellant releases in California for claims in excess of \$100 million.
- **U.S. Department of Justice Environmental Litigation Cases** — Served as an expert witness for several environmental litigation cases. *Examples:*

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- 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 feasibility of remediation of a site with lead contamination resulting from historical use as a shooting range;
 - 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 that included extensive grading and cap designs for the site.
 - **Spring Discharges Containing PCBs**, Tennessee — Served as Project Manager for the design of a treatment plant to remediate variable spring flows containing PCBs from historic natural gas compressor station operations. The treatment system design flow rates ranged from 10 to 500 gallons per minute.
 - **Abandoned Sites Investigations and Cleanup** — 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 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 projects 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.
 - **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 and characterization of contaminated soils. Assisted Habitat in arranging for *pro bono* and at-cost services from drilling and remediation contractors and landfills.

OTHER

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.

PROFESSIONAL SOCIETIES

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

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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, Science Direct*. p. 26.
- Cohen, H.A. and M. Rafferty, 2010, The Former Richards-Gebaur Air Force Base, Kansas City – Strategies and Practice for Risk-Based Corrective Action (RBCA) and Closure of Contaminated Sites. Air Force Restoration and Technology Transfer Workshop, April 6-9, 2010, San Antonio, Texas.
- Binard, K., K. Chiang, M. Rafferty, P. Greer, and J. Semion, 2008. Vegetation Coverage in Cooley Landing Salt Pond Restoration Area. Presentation at the 2006 South Bay Science Symposium for the South Bay Salt Pond Restoration Project, June 6, 2006, San Jose State University, San Jose, CA. [Edited and Compiled November 12, 2008. Trulio, L., ed.].
- 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, 2006, San Francisco, CA.
- 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. Presentation 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, CA.
- 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 Implications for Mitigation*. O'Day, P., D. Vlassopoulos, X. Meng, and L. Benning, eds. Washington, DC: American Chemical Society: ACS Symposium Series, v. 915, pp. 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*, v. 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*, v. 30, no. 4.
- Rafferty, M.T., K. Binard, M. Orr, and J. Haltiner, 2003. Successful Design for Wetland Restoration in the San Francisco Bay. Presentation at the 2003 American Water Resources Association Annual Conference, November 3-6, 2003, San Diego, CA. 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. Presentation at the 226th American Chemical Society National Meeting, September 7–11, 2003, New York City, NY.
- 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. Presentation at the 226th American Chemical Society National Meeting, September 7–11, 2003, New York City, NY.

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- 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, CA. Gavaskar, A.R., and A.S.C. Chen, eds. 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, CA. Gavaskar, A.R., and A.S.C. Chen, eds. 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*, v. 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, CA. In *2000 Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds*. Wickramanayake, G.B., and A.R. Gavaskar, eds. *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. In *Proceedings of the First International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, Monterey, CA, May 18–21, 1998. And in *1998 First International Conference on Remediation of Chlorinated and Recalcitrant Compounds*. Hinchee, R.E., ed. *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. In *Proceedings of the International Business Communications' Second Annual Conference on Phytoremediation*, Seattle, Washington, June 18–19, 1997.
- Johl, C.J., L. Feldman, and M.T. Rafferty, 1995. Put Risk-Based Remediation to Work: *Environmental Engineering World*, v. 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. Presentation at the 88th Annual Meeting of the Air and Waste Management Association, San Antonio, TX, June 1995.
- Chu, P., M.T. Rafferty, T.A. Delfino, and R.F. Gitschlag, 1991. Comparison of Fixation Techniques for Soil Containing Arsenic. Presentation at Emerging Technologies in Hazardous Waste Management II, ACS Symposium Series 468, pp. 401-415.

DEPOSITION AND TESTIMONY EXPERIENCE

DEPOSITIONS

- 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.

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- 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

- 2016 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. January 26.
- 2010 New Jersey Department of Environmental Protection, et al. vs. Essex Chemical Corp. Superior Court of New Jersey Law Division – Middlesex County, Docket No.: MID-L-5685-07. March 23
- 2009 Carla M. Clark, et. al. vs. 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.