

## **G.D. BECKETT, Hydrogeologist & President**

Mr. Beckett is the President and founder of **AQUI-VER, INC.**, providing specialized hydrogeologic and environmental consulting services to major petroleum companies, DOD, consultants, and others. Mr. Beckett was also a research associate and has instructed at San Diego State University where he investigated various aspects of contaminant hydrogeology. At a prior company, Mr. Beckett was a senior hydrogeologist assisting that company with internal technical quality as well as working on client projects. He has directed site characterization studies (geologic, hydrogeologic, and chemical), risk assessment, and remediation designs leading to site regulatory compliance and closure. These job functions require a comprehensive understanding of the controlling chemical, hydraulic, and physical phenomena. Mr. Beckett has reviewed and/or generated closure strategies for hundreds of sites and has demonstrated an ability to find effective solutions for even the most difficult problems.

Under Mr. Beckett's guidance and publishing, **AQUI-VER, INC.** (AVI) has developed new scientific techniques and analyses to evaluate multiphase contaminant transport, remediation, and environmental risk. These new and rigorous science applications have led to an outstanding cleanup and closure record. Science has been shown to describe real processes that control site environmental risk and the design of efficient and effective cleanup systems (as needed). These technical credentials have allowed Mr. Beckett to provide training to regional regulatory agencies, including the EPA and others, on behalf of industry groups including the American Petroleum Institute. Mr. Beckett is a leader in the field of non-aqueous phase liquid (NAPL) contamination and cleanup including petroleum products, solvents, oils, and other compounds.

### ***EDUCATION & CERTIFICATIONS***

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- \* California Registered Geologist
- \* California Registered Hydrogeologist
- \* M.S., Geology, Hydrogeology Emphasis, San Diego State University (4.0/4.0 GPA)
- \* B.S., Geology, Hydrogeology Emphasis, San Diego State University.
- \* 40 hour OSHA 29 CFR 1910.120; 8 hour OSHA Annual Refresher
- \* Pertinent Course Work
  - Hydrogeology
  - Sedimentology
  - Well Hydraulics and Testing Methods
  - Exploration Techniques in Ground Water (audit)
  - Solute Transport

## ***EDUCATION (continued)***

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- Numerical Modeling of Fluid Flow in Geologic Media
- Immiscible-Phase Fluid Hydraulics in Porous Media
- Behavior of Subsurface Organic Contaminants (audit)
- Vapor Phase Dynamics and Transport of Organic Compounds
- Conference; Immiscible-Phase Organic Contaminants in Porous Media. Conference focused on the principles and modeling of immiscible-phase organic contaminants in the subsurface, and remediation strategies.
- Organic Chemistry
- Geochemistry
- Ground Water Geochemistry
- Environmental Chemistry
- Risk Assessment
- Conservation of Environmental Quality
- Other related science and math course work

## ***ACADEMIC AND PROFESSIONAL HONORS***

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- \* Awarded Outstanding Senior Thesis by Faculty and Peers
- \* Awarded a Scholastic Scholarship for Master of Science work by the Academic Rewards for College Scientists (ARCS) Foundation
- \* Guest Lecturer, 1993 Graduate Course in Vapor Phase Dynamics and Transport of Organic Compounds in the Vadose Zone, Department of Geological Sciences, San Diego State University. Instructor: Donn L. Marrin.
- \* Guest Lecturer, 1994, 1995, Graduate Course in Well Hydraulics, Department of Geological Sciences, San Diego State University. Instructor: David Huntley.
- \* Certificate of Honorable Mention, 1997. In Recognition of Presentation Excellence and Scientific Quality of the Paper. Division of Environmental Geosciences, American Association of Petroleum Geologists (AAPG).
- \* Instructor, 1997, 1998, 1999, 2000, 2001, 2003, 2004, 2005. Conference work shops on various aspects of multiphase mechanics, LNAPL recovery, model parameterization, and risk. Hosted by the American Petroleum Institute and preceding the Petroleum Hydrocarbons & Organic Chemicals in Ground Water Conferences, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Graduate Course Instructor, 1998, Multiphase Flow, Geology 651, Department of Geological Sciences, San Diego State University. Course in multiphase flow, remediation and risk.

**ACADEMIC AND PROFESSIONAL HONORS (continued)**

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- \* Short-course Instructor, March 2000, Multiphase Screening Methods to Determine Fuel Immobility in Soil, AEHS West Coast Conference, San Diego, California.
- \* Short-course Instructor, March 2002, Assessment of LNAPL Sources; Distribution, Mobility, Risk and Risk Reduction. AEHS West Coast Conference, San Diego, California.
- \* Chairman, ASTM E50.04 Task Group on LNAPL 2002 - 2006. This E50.04 task group is responsible for preparing a Guide entitled: *Working DRAFT 2: Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Non-aqueous Phase Liquids Released to the Subsurface*. The first document ballot was in July 2005.
- \* Invited Speaker, 2005 National Underground Storage Tank Fund Administrators Meeting, Salt Lake City, Utah, sponsored by EPA OUST and ASTSWMO.
- \* Instructor, 2006, American Petroleum Institute University Course on LNAPL principles, and instruction on use of the API Interactive LNAPL Guide.
- \* Instructor, 2008, Course on Applied LNAPL principles and tools for the Hawaii Department of Health, U.S. EPA, U.S. Navy, U.S. Air Force and related participants.
- \* Member of the AEHS West Coast Conference Science Advisory Board.
- \* Journal reviewer; Groundwater Monitoring and Remediation
- \* Journal reviewer; Journal of Contaminant Hydrology

**PUBLICATIONS**

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- \* Beckett, G.D., Huntley, D., 1994, Characterization of Flow Parameters Controlling Soil Vapor Extraction: Ground Water, Vol. 32, No. 2, pp. 239-247.
- \* Beckett, G.D., Huntley, D., 1994, The Effect of Soil Characteristics on Free-Phase Hydrocarbon Recovery Rates: Proceedings of the Petroleum Hydrocarbon and Organic Chemicals in Ground Water; November 2-5, 1994, Houston, Texas, NGWA, API.
- \* Beckett, G.D., Huntley, D., Panday, S., 1995. Air Sparging: A Case Study in Characterization, Field Testing, and Modeling Design. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection and Restoration, Houston, Nov. 1995.
- \* Beckett, G.D., Benson, D.A, 1996. Diffusion Limited Soil Vapor Extraction: Geologic and Bed Thickness Controls. AAPG Annual Convention, San Diego, California, May 1996.

***PUBLICATIONS (continued)***

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- \* Beckett, G.D., Huntley, D., Wiedlin, M.P., 1996. Hydrocarbon Fate and Transport Predictions: When Are One-dimensional Solute Transport Calculations Valid? AAPG Annual Convention, San Diego, California, May 1996.
- \* Beckett, G.D., Huntley, D., 1997. Hydrocarbon Fate and Transport Predictions: When Are One-dimensional Solute Transport Calculations Valid? (Updated). AEHS West Coast Annual Convention, Oxnard, California, March 1997.
- \* Huntley, D., Beckett, G.D., 1997. The Life and Times of LNAPL Pools. An investigation into the lifespan and time-dependent magnitude of dissolved-phase impacts from free-phase hydrocarbon pools. AEHS Annual Convention, Oxnard, California, March 1997.
- \* Beckett, G.D., Lundegard, P.D., 1997. Practically Impractical - The Limits of LNAPL Recovery and Relationship to Risk. Conference Proceedings of the 1997 Petroleum Hydrocarbons & Organic Chemicals in Ground Water. Houston Texas, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Huntley, D., Beckett, G.D., 1997. Persistence of LNAPL Sources and Relation to Risk. Conference Proceedings of the 1997 Petroleum Hydrocarbons & Organic Chemicals in Ground Water. Houston Texas, sponsored by the NGWA and API.
- \* Beckett, G.D., Huntley, D., 1998. Soil Properties and Design Factors Influencing Free-phase Hydrocarbon Cleanup. January 1998, Environmental Science and Technology.
- \* Huntley, D., Beckett, G.D., 1999. Relationship Between Risk Reduction and LNAPL Recovery. Conference Proceedings of the 1999 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Houston, Texas, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Peargin, T.R., Wickland, D.C., Beckett, G.D., 1999. Evaluation of Short Term Multiphase Extraction Effectiveness for Removal of Non-Aqueous Phase Liquids from Groundwater Monitoring Wells. Conference Proceedings of the 1999 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Houston, Texas, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Lundegard, P.D., Beckett, G.D., 2000. Practicability of LNAPL Recovery - Implications for Site Management. Battelle 2nd International Conference on Remediation of Chlorinated and Recalcitrant Compounds; May 2000.
- \* Beckett, G.D., 2000. Soil Vapor Extraction under Capped and Uncapped Surface Conditions. Geotechnical Fabrics Review; vol. 18, #4.

***PUBLICATIONS (continued)***

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- \* Beckett, G.D., 2000. Remediation is Enhanced Oil Recovery: Know Your Source. AAPG & SPE Convention, Long Beach, California, June 2000.
- \* Huntley, D., Beckett, G.D., 2002. Persistence of LNAPL Sources: Relationship Between Risk Reduction and LNAPL Recovery. *Journal of Contaminant Hydrology*, #59, pp 3 - 26.
- \* Huntley, D., Beckett, G.D., 2002. Evaluating Hydrocarbon Removal from Source Zones and Its Effect on Dissolved-Phase Plume Longevity and Magnitude. API Publication 4715.
- \* Beckett, G.D., Joy, S.P., 2003. Light Non-Aqueous Phase Liquid (LNAPL) Parameters Database, Version 2.0, Users Guide. API Publication 4731, December 2003.
- \* Beckett, G.D., 2003. Light Non-Aqueous Phase Liquid (LNAPL) Parameters Database, Professional Poster, 2003 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Costa Mesa, California, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Parcher, M., Beckett, G.D., & Thota, P., 2004. The API Interactive LNAPL Guide. This is a digital publication of instructional material and quantitative tools related to LNAPL interactions and remediation in the subsurface. Introduced at the 2004 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Baltimore, Maryland, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Lyverse, M.A., Beckett, G.D., 2004. Field Study of LNAPL and Dissolved-Phase Plume Genesis. Presented at the 2004 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Baltimore, Maryland, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Beckett, G.D., Lyverse, M.A., 2004. NAPL Immobilization; When & Why It Stops, & Other High-Level Observations. Presented at the 2004 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Baltimore, Maryland, sponsored by the National Ground Water Association & American Petroleum Institute.
- \* Beckett, G.D., 2004. Got NAPL? Editorial. *Groundwater Monitoring and Remediation*. 2004, Volume 24; Number 4, Pages 4-6.
- \* Beckett, G.D., 2004. The LNAPL Parameters Database; Content, Parameter Ranges & Implications. Presented at the 2004 Petroleum Hydrocarbons & Organic Chemicals in Ground Water, Baltimore, Maryland, sponsored by the National Ground Water Association & American Petroleum Institute.

***PUBLICATIONS (continued)*** \_\_\_\_\_

- \* Beckett, G.D., Parcher, M.A., 2005, editors & key authors of the API Interactive LNAPL Guide (V. 2.04), a digital compendium of LNAPL resources, calculation tools, and educational materials. Copyright American Petroleum Institute, 2005.
- \* Charbeneau, R. Beckett, G.D., 2006, User's Guide for the LNAPL Distribution and Recovery Model (LDRM), American Petroleum Institute, 2007.
- \* Beckett, G.D., 2007, The Vapor Pathway; It's a Gas. A Panel Presentation & Discussion on Vapor Pathway Issues Pertaining to Property Redevelopment. RTM Conference on Contaminated Property Transactions, Promoting Sustainable Deals and Redevelopments. San Francisco, November 2007.
- \* Beckett, G.D., 2008. Improving the California UST Cleanup Process; Where Are We Now & Where Do We Go from Here to Better Targeting the "Source" Zone. AEHS Annual Convention, San Diego, California, March 2008.
- \* Beckett, G.D., 2008. The ASTM LNAPL Guide: What it Is, Why It's Needed, What it Can Do. AEHS Annual Convention, San Diego, California, March 2008.
- \* Beckett, G.D., 2008. Session Chair & Speaker: Remediation Retrospective: What Can We Learn from Failed Remediation Efforts. AEHS Annual Convention, San Diego, California, March 2008.

***ANALYTIC EVALUATIONS AND MODELING EXPERIENCE*** \_\_\_\_\_

- \* Extensive familiarity with analytic modeling and analysis techniques, including development of related software. Testing and evaluation conditions include confined, unconfined, leaky, fractured, anisotropic, and other flow conditions by any of several analytic techniques.
- \* Vadose Zone Testing - Familiar with Guelph and open-hole permeameter testing and analysis. Working knowledge of tensiometer, lysimeters, gamma logs, and other vadose zone monitoring equipment and down-hole geophysics.
- \* SVE Testing - Developed transient vapor extraction test methodologies as published by Journal of Ground Water (1994). Extensive evaluations of vapor recovery and chemical partitioning data as pertain to cleanup design, cleanup limits, and vapor-phase health/environmental risk.
- \* Sparge Testing - Developed physical/chemical testing methodologies to relate field effectiveness diagnostics to cleanup goals and system design. This study was part of a Petroleum Environmental Research Forum (PERF) investigation.

***ANALYTIC EVALUATIONS AND MODELING EXPERIENCE (continued)***\_\_\_\_\_

- \* Dual-phase Recovery - Developed diagnostic data collection protocols for a prime contractor working on several military installations. Determined that many standard methods of dual-phase cleanup often fail to treat zones of interest below the water table.
- \* Extensive familiarity with numerical models pertaining to ground water flow, unsaturated zone flow, multiphase flow, contaminant transport, and remediation, as well as programming capability in Basic, VisualBasic and C.
- \* With coauthor David Huntley, developed a multiphase analytic model and software to evaluate the relationship between fuel sources in the water table region, cleanup strategies, contaminant transport, and risk. Funded by the American Petroleum Institute.

***PROFESSIONAL WORK HISTORY***\_\_\_\_\_

- \* October 1993 - Present: President and Hydrogeologist at **AQUI-VER, INC.** (AVI), Hydrogeology, Water Resources & Data Services. AVI specializes in quantitative hydrogeologic services including contaminant fate and transport evaluations, remediation design and feasibility assessment, and human health risk assessment. Mr. Beckett directs research and projects in those areas.
- \* January 1992 - 2004: Research Associate, San Diego State University. This unsalaried position focused research on better understanding of contaminant migration, cleanup and risk. Research includes extensive use of computer modeling and field data examination.
- \* December 1989 - March 1992: Project Manager (promoted to senior at 2 year review), Alton Geoscience. Responsible for the direction of environmental studies, site closure strategies, reporting, and regulatory coordination. Duties included point person to Texaco Refining and Marketing Inc., technical leader in the Subsurface Testing and Remediation Planning Group, corporate hydrogeologic peer reviewer, hydrogeologic trainer, and other tasks.
- \* January 1989 - December 1989: Environmental Analyst, ERCE Environmental and Energy Services Company. Responsible for field data collection, report generation, and general support tasks at a variety of sites including military bases, service stations, and industrial sites. Duties were later expanded to include field project management.
- \* March 1988 - December 1988: Hydrogeologic Field Technician, working part-time with Dr. David Huntley, Professor of Geological Sciences, San Diego State University.

## **REPRESENTATIVE PROJECTS**

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- \* Technical Neutral Advisor to a Federal Magistrate Judge: At the request of parties to a major case involving millions of gallons of petroleum-related contamination, Beckett has served as a neutral advisor to the Federal Judge overseeing settlement proceedings in the case. The work involves extensive review of technical data, materials, and presentations, and advising the Judge in nontechnical terms as to the meaning of this information.
- \* American Petroleum Institute: Developed a toolkit entitled “Evaluating the Necessity of Hydrocarbon Removal from Source Zones: Tools for Assessing Risk Reduction.” This work incorporates multiphase flow and remediation dynamics with dissolution of chemicals from the LNAPL source to allow users to estimate the risk magnitude and longevity from different release and cleanup conditions. It also allows the user to consider the risk/benefit of remediation efforts and cost. API Publication 4715, September 2002.
- \* American Petroleum Institute: LNAPL Parameter Database. AVI’s extensive experience in multiphase applications has demonstrated that many of the controlling parameters have been non-representative in past literature. This is partly due to the focus of that literature being either agricultural or reservoir related. In situ environmental conditions differ from those, suggesting a benefit to compiling applicable parameters focused on environmental applications. Using our extensive in-house LNAPL parameter database coupled with industry contributions, a query-driven database was developed that allows the user to select from a more representative range of values for various key factors. API Publication 4731, December 2003.
- \* New Pacific Properties - Designed the field and proof of concept program for a multimillion dollar remediation of a former refinery that required cleanup of petroleum chemicals, including MTBE. The remediation program was implemented by IT Corporation. Using an innovative approach that optimized multiphase synergies, the cleanup reduced impacts to below human health-based standards in less than 6-months, and a no further action letter was received from the California Regional Water Quality Control Board, allowing residential development to proceed. Through AVI’s approach, it became clear the original remediation design by others using standard industry approaches was insufficient to meet the cleanup goals because it did not consider the multiphase/multicomponent aspects of the cleanup.
- \* Confidential Client - Designed a state-of-the-science controlled field study of air-sparging to lead to feasibility assessment and design at a hydrocarbon-affected site. Tasks included multiphase numerical modeling, pilot study work plan and direction, refinement of numerical results, feasibility assessment, and system design. The project was part of a Petroleum Environmental Research Forum (PERF) study on air sparging. The cleanup design predicted operations to be complete in less than 1 year (for benzene), actual system run-time was 6 months. This study showed common air sparging bubbling models to be physically incorrect.



**REPRESENTATIVE PROJECTS (continued)**

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- \* Confidential Client - Performed a Human Health Risk Assessment for a site underlain by a plume containing petroleum compounds significantly above regulatory action levels and overlying a utilized drinking water aquifer. Rigorous but inexpensive information was collected to ground-truth the chemical fate and transport component of the risk assessment. Results of the risk assessment indicated less than *de minimis* risk and the site received a site closure letter from the lead agency (no further action under current site operations and conditions).
  
- \* Confidential Client - In a two-party litigation, performed technical work to support the defendant in showing their contribution to a major groundwater contamination plume was *de minimis*. The binding arbitration judgment found fully in favor of the defendants, with the judge describing the plaintiff's experts and their work as non-credible. Judge's quote: "In the Arbitrator's opinion, Plaintiff's experts were not testifying as scientists; instead they were testifying as advocates. Their testimony was in every way inferior to testimony of the Defendant's experts. In short, defendant's experts were believable, plaintiff's were not."
  
- \* Confidential Client - At a terminal facility in the South, one company had been named the sole responsible party for a multiparty terminal site by the regulatory agency. In coordination with the agency and that company, AVI directed collection of a robust data set including multiphase and forensic information to support development of a rigorous conceptual site model. That conceptual site model indicated that in fact, the named party was not responsible for the majority of impacts. This work resulted in the agency reversing its original decision and naming several other parties as responsible for the cleanup. This resulted in a savings of more than \$2 million dollars for the minimally responsible party.