



# TERRATHERM

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## **JAMES P. GALLIGAN, P.E.** **Vice President of Engineering**

### **PROFESSIONAL HISTORY**

TerraTherm, Inc.	(2000 – present)
ENSR Consulting and Engineering	(1994-2000)
Coneco Environmental Corporation	(1991-1994)
ANEPTEK Corporation	(1989-1991)

### **EDUCATION**

M.B.A. Northeastern University, 2011  
B.S. Mechanical Engineering, Boston University, 1991

### **REGISTRATIONS AND TRAINING**

Professional Engineer: Massachusetts, Colorado, Tennessee  
Industrial Waste Water Treatment Plant Operator (Grade 4), Massachusetts  
40-Hour OSHA HAZ-MAT Operational & Supervisor w/current 8-Hour Annual Refresher  
National Fire Fighter I/II (NFPA 1001) Operational Certification  
First Responder & IAFF Haz-Mat First Responder Certifications  
Electrical Power System Design Training; NFPA 70E Electrical Safety Training  
MA Class 2A/1C Hoisting License; Powered Industrial Truck Operator Trainer  
FEMA Radiological Awareness Course  
American Society of Civil Engineers; National Ground Water Association

### **SUMMARY OF EXPERIENCE**

Mr. Galligan has over 20 years experience with in-situ and ex-situ remediation system design, installation, operation and troubleshooting, including over 10 years experience with in-situ thermal treatment projects. He has managed dozens of remediation projects from design and bidding through construction, start-up and operation. He has conducted numerous remedial technology pilot tests, feasibility studies and life-cycle cost evaluations. He has extensive experience in cost estimating and health and safety management.

**TerraTherm, Inc.**, Fitchburg, MA. Vice President of Engineering (2000 – present)

Mr. Galligan has been with TerraTherm since the company was founded in February 2000, serving as Lead Engineer, Engineering Manager and now VP of Engineering. In this role, Mr. Galligan has been responsible for building and directing TerraTherm's staff of engineers,

technicians and support staff since the company's founding to the current group of over 15 individuals. He has overall responsibility for TerraTherm engineering and design work, including selection of materials and methods, review of design work products, technical scopes and specification/selection of company-owned capital equipment related to thermal remediation field projects utilizing the TerraTherm's patented ISTD remediation process and steam enhanced remediation. In addition to his engineering function, Mr. Galligan also served as TerraTherm's Company Health and Safety Manager and lead cost estimator and now directs TerraTherm's cost estimating efforts.

### **Completed Projects**

- Arnold AFB, Tennessee – Lead Engineer for design and implementation of full-scale thermal remediation project utilizing a combination of thermal conduction heating and steam enhanced remediation. Primary contaminant was PCE with other chlorinated solvents to a depth of 90 ft bgs. Design: 2009/2010; Implementation 2010/2011; Project value: \$5.5MM, without power.
- Confidential Client, Sao Paulo, Brazil – Oversaw ISTD “micro-pilot” demonstration test at a former industrial chemical landfill in Sao Paulo, Brazil. Contaminants consisted of a wide range of CVOCs, aliphatic and aromatic hydrocarbons and heavy-end hydrocarbons present as LNAPLs and DNAPLs. Oversaw development of detailed design work plans, equipment specifications and pilot implementation. Project value: \$350K, 2009.
- Former Manufacturing Site, Danville, PA – Provided senior engineering support for a Steam Enhanced Extraction (SEE) system for the remediation of 68,000 cy of soil containing LNAPL and CVOCs. Treatment depth to 42 feet, with dual level steam injection intervals. Project was performed in partnership with a local remedial contractor who provided drilling services, as well as vapor and groundwater extraction. Project duration: November 2006 to May 2009. Total TerraTherm project value: \$2.7M
- Memphis Depot – Memphis, TN – Provided senior engineering support for a full-scale ISTD treatment system at a former Department of Defense (Defense Logistics Agency) storage facility to treat CVOc contaminated soils. Treatment depth to 30 feet. 48,000 cubic yards. Project Duration: October 2007 to April 2009. Total project value: \$3.5M
- Krüger, Various Sites, Denmark – Primary engineering support for several ongoing projects treating CVOCs in saturated and unsaturated silty/clay soils. Working with Krüger A/S, our partner in Denmark, two recently completed pilot tests are now moving to full-scale field construction. Treatment depths to ~30 ft. Project Duration: Fall 2005 to Present.
- U.K. Atomic Energy Authority, Harwell, U.K. – Primary technical contact and engineering support for this ongoing multi-year project to treat CVOCs in saturated and unsaturated chalk bedrock underlying former waste disposal pits. The seventh seasonal phase is ongoing with TerraTherm partners in the UK. Treatment depth to ~65 ft. Project Duration: August 2005 to Present.

- Pioneer Companies, Syracuse, NY – Provided senior engineering support for a full scale ISTD system for the remediation of 16,200 cy of soil containing CVOCs. Site soils consisted of low-permeability silts and clays located below the water table. TerraTherm installed and operated over 200 ISTD wells to a treatment depth to 30 feet, with thermal oxidation and wet-scrubbing of the extracted vapors. Achieved all remedial goals. Project duration: July 2006 to August 2007. Total project value: \$2.6M without power
- NASA Marshall Space Flight Center, Huntsville, AL – Project engineer for an ISTD Pilot Test to treat 1,000 cy of TCE contaminated soils. Soils consisted of clay over rubble over limestone. Treatment depth to 37 feet, with ISTD wells extending into the underlying bedrock. Pilot test utilized an innovated compression/condensing extraction system to remove and treat CVOCs from the subsurface and a high-vacuum multi-phase extraction (MPE) system for groundwater control. The project achieved all remedial goals. Project Duration: September 2006 to May 2007. Total project value \$650K without power
- Confidential Client, Taunton, MA – Provided senior engineering support for ISTD remediation of former drum disposal area contaminated with chlorobenzenes, BTEX, and CVOCs, including a significant amount of tarry DNAPL. Total volume of treatment zone was ~3,000 cy to 20 ft depth, utilizing thermal oxidation and wet-scrubbing of the extracted vapors. Achieved client's remedial goals of mass reduction in treatment zone and thermally enhanced biodegradation in downgradient zone. Period of performance: April 2006 to January 2007. Total project value: \$1.2M
- Confidential Client, SE US – Project engineer for remediation of former solvent tank area contaminated with CVOCs (TCE) using ISTD. ISTD heaters extended to a depth of 95 ft, approximately 10 ft into the underlying bedrock. Total volume of treatment zone was 9,000 cy. Met all clean-up goals for constituents of concern: TCE  $\leq 0.6$  mg/kg. Period of performance: July 2006 – June 2007. Total project value: \$1.3M
- National Grid USA, North Adams, MA – Provided senior engineering support for a full-scale ISTD treatment system at a former Manufactured Gas Plant (MGP) facility for treatment of coal tar-contaminated soil and tarry DNAPL wastes located in a former gasholder. Treatment depth to 18 feet. The project included an initial dewatering and thermally enhanced free-product recovery phase, follow by high temperature ISTD treatment, with extracted vapors treated by thermal oxidation. Achieved all remedial goals. Project Duration: October 2003 to May 2005. Total project value: \$850K
- Richmond Redevelopment Agency, Richmond, CA – Provided senior engineering support for remediation of former tank farm area contaminated with CVOCs (TCE, PCE, DCE, DCA, VC) using ISTD, coupled with vapor-phase carbon treatment. Total volume of treatment zone was 7,000 cy to 20 ft depth in saturated Bay Mud clays. Successfully achieved clean-up goals, allowing planned residential re-development of property to proceed. Period of performance: January 2005 – November 2005. Total project value: \$2M
- Confidential Client CVOC Site, Carson, CA – Project engineer for implementation of ISTD system for the remediation of 6,700 cy of soil containing 1,1-DCA. Site soils consisted of low-permeability, dense clays located above and below the water table to a depth of ~37 ft. The ISTD system was installed within an operating MPE system that had reached

asymptotic removal limits, to address a hot-spot that was not being effectively cleaned by the existing MPE system. Clean up objectives included attaining 1 mg/kg of 1,1-DCA in soil within treatment zone and reducing concentrations in groundwater in the underlying permeable aquifer. Remedial goals were met, and COCs have been below detection limits in subsequent groundwater sampling events. Project duration: November 2003 to June 2005. Total project value: \$1M

- Confidential Client CVOC Site, Midwest US - Project engineer for an ISTD system for the remediation of 11,500 cy of TCE, 1,1,1-TCA, and PCE impacted soil. Site soils consisted of low-permeability, dense clays that were partially to fully saturated with water. Achieved clean up objectives of less than 1 mg/kg of TCE in soil within treatment zone. Project duration: September 2002 to December 2003. Total project value: \$1.4M
- Southern California Edison (SCE), Alhambra, CA – Deputy Project Manager of a full-scale ISTD system at an SCE facility for treatment of creosote-contaminated soil from a former wood-treatment plant. Successfully remediated 16,500 cy. Treatment depth to 105 feet. Achieved all remedial goals. Project Duration: November 2002 to March 2006. Total project value: \$13.7M

#### **ENSR Corporation, Acton, MA. Senior Project Engineer/Project Engineer (1994-2000)**

- Designed and implemented over 35 soil and groundwater remediation systems for industrial, military and petroleum sites throughout the eastern and mid-western U.S. Remediation technologies included multi-phase extraction, air sparging, soil vapor extraction, bioventing, bioslurping and groundwater extraction coupled with a variety of above-ground treatment technologies.
- Managed various remediation projects from conceptual design through construction and start-up. Selected and procured equipment and managed construction subcontractors to ensure that projects were completed on-time and on-budget.
- Provided hands-on engineering and construction support for remediation projects. Diagnosed and repaired mechanical, electrical and operational problems with operating remediation systems. Recommended adjustments and modifications as needed to optimize system performance and reduce life-cycle costs.
- Acted as the process/mechanical engineer for preparation of an Engineer Manual on multi-phase extraction technology (*U.S. Army Corps of Engineers, Multi-Phase Extraction Engineer Manual [EM1110-1-4010]*). Responsible for authoring sections on piping and above-ground components, including sections on design and selection of piping, valves, manifolds, blowers, pumps, motors, oil-water and multi-phase separators. Also authored sections on electrical power requirements, electrostatic charge hazards, instrumentation and process control systems, waste treatment alternatives, and design documentation requirements.
- Responsible for mentoring and training junior engineers, presenting “brown bag” seminars on a variety of topics for in-house technical staff, and acting as in-house resource for information on *in-situ* thermal remediation technologies.

#### **OTHER PROFESSIONAL EXPERIENCE**

- **Town of Medway - Fire Department, 2000-Present**  
*Call Firefighter*
- **US Army Reserve/Massachusetts Army National Guard, 1992-1998**  
*Sergeant (E-5), Infantry, Team Leader*

#### REPRESENTATIVE PUBLICATIONS

- Heron, G., K. Parker, J. Galligan, T.C. Holmes. "Thermal Treatment of Eight CVOC Source Zones to Near Non-Detect Concentrations." 2009. *Groundwater Monitoring & Remediation*. National Groundwater Association. Vol. 29, Issue 3, Summer 2009. pp. 56-65.
- Baker, R.S., J.M. Bierschenk, J. LaChance, J.P. Galligan, D. Tarmasiewicz, G. Heron and W.R. Leach. 2008. Why In Situ Thermal Desorption Can Be the Most Cost-Effective Remediation Method for Many Sites. Paper N-003, in: Bruce M. Sass (Conference Chair), *Remediation of Chlorinated and Recalcitrant Compounds—2008*. Proceedings of the Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2008). Battelle Press, Columbus, OH.
- Bierschenk, J.M., J. LaChance, J. Galligan, G. Heron, D. Tully, A.-M. Kozłowska and S. Langford. 2008. Thermally Enhanced Soil Vapor Extraction Closing DNAPL Sites - Case Studies. Paper P-012, in: Bruce M. Sass (Conference Chair), *Remediation of Chlorinated and Recalcitrant Compounds—2008*. Proceedings of the Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2008). Battelle Press, Columbus, OH.
- LaChance, J.C., R.S. Baker, J.P. Galligan, and J.M. Bierschenk. 2004. "Application of 'Thermal Conductive Heating/In-Situ Thermal Desorption (ISTD)' to the Remediation of Chlorinated Volatile Organic Compounds in Saturated and Unsaturated Settings." Submitted to *4th Int. Conf. on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 2004*.
- LaChance, J.C., R.S. Baker, J.P. Galligan, and J.M. Bierschenk. 2004. "Application of 'Thermal Conductive Heating/In-Situ Thermal Desorption (ISTD)' to the Remediation of Chlorinated Volatile Organic Compounds in Saturated and Unsaturated Settings." *Proceedings of Gas Technology Institute's Natural Gas Technologies II Conference*, Phoenix, AZ, Feb. 8, 2004.
- Baker, R.S., J.C. LaChance, M.W. Kresge, R.J. Bukowski, J.P. Galligan and M. Kuhlman. 2004. "In-Situ Thermal Destruction (ISTD) of MGP Waste in a Former Gasholder: Design and Installation." *Proceedings of Gas Technology Institute's Natural Gas Technologies II Conference*, Phoenix, AZ, Feb. 8, 2004.
- Baker, R.S., J.P. Galligan and J.M. Bierschenk. 2004. "In-Situ Thermal Destruction (ISTD) at Rocky Mountain Arsenal Hex Pit" Vendor Report In: Superfund Innovative Technology Evaluation (SITE) Program, *Field Evaluation of TerraTherm In Situ Thermal Destruction Treatment of Hexachlorocyclopentadiene: Final Report*. at the Hex Pit, Rocky Mountain Arsenal, Commerce City, CO. Prepared for: U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory Cincinnati, Ohio, Prepared by: Tetra Tech EM, Inc., Cincinnati, OH, EPA Contract No. 68-C-00-181, Task Order No. 0019.