

**AFFIDAVIT OF SCOTT THOMAS SHAW, PG**

1. My name is Scott Thomas Shaw and I reside at 13625 Bare Island Drive in Chantilly, Virginia (20151).
2. I am a geologist by training and experience. I earned a Bachelor of Science Degree in Geoscience (Geology) from the Pennsylvania State University in 1983 and a Master of Science Degree in Environmental Engineering from Johns Hopkins University in 1998. My areas of expertise include environmental site investigation and characterization, and assimilation, storage and evaluation of large amounts of environmental data. I have extensive experience utilizing geographic information systems (GIS) and statistical 3-D visualization tools to develop, evaluate and present site conditions and site conceptual models. My resume is included in Attachment 1.
3. I am a Registered Professional GeoScientist in the State of Louisiana. My registration number is 911.
4. I have provided my geologic expertise to the Bayou Corne project through lithologic review, analysis and interpretation of Cone Penetration Testing (CPT) results. My evaluation of gas zone thickness interpretation combined with CPT evaluation of site lithology was used to describe the conceptual understanding of gas zones across the site and assisted in the evaluation of the effectiveness of the observation relief well (ORW) network. From September 30, 2013 through October 4, 2013 I took part in field activities at the site including oversight of well testing near the bubble site located adjacent to PMW-008 (S&M).

5. My work has contributed a great deal to the conceptual understanding of site conditions through analysis of field data. I have contributed extensively to, many reports prepared by Tetra Tech on behalf of Texas Brine through the mapping of site lithology and the occurrence of gas zones encountered during CPT investigations. Attachment 2 includes a list of the references I have relied upon to form the opinions expressed in this affidavit.
6. Bubble sites represent locations where subsurface gas reaches the surface and enters the atmosphere. It is widely recognized that bubble sites occurred in the vicinity of the site prior to the Oxy Geismar 3 cavern collapse. According to the Blue Ribbon Commission Gas Group (BRC) "natural background levels of biogenic swamp gas are a traditionally accepted low-risk hazard to residents" (Tetra Tech, 2016b). Recent bubble site monitoring has determined that the number of active bubble sites in the vicinity of the occupied residences have drastically declined. Further, recent bubble site gas evaluation has determined that breathing zone gas emitted from each location contains little or no measurable methane and no hydrogen sulfide (H<sub>2</sub>S) (Tetra Tech, 2015a).
7. Tetra Tech, on behalf of Texas Brine installed and manages a continuous air monitoring system in residential buildings where the occupants have granted permission for installation. Each monitoring station continuously collects methane and H<sub>2</sub>S concentration data. The lower explosive limit (LEL) of methane is 5% of atmospheric air and the upper explosive limit (UEL) of methane is 15% of atmospheric air. The residential monitoring system is set to issue an alarm, both audible and electronic, should a concentration of 10% of the LEL for methane or 10 ppm H<sub>2</sub>S be detected at any of the monitoring locations. No reportable occurrences of methane or H<sub>2</sub>S have been encountered at the site (Tetra Tech, 2016c).

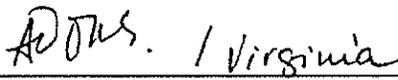
8. Migration of methane from the subsurface to the atmosphere takes place along a pressure gradient. In order for migration to occur in saturated sediments, the gas must be present at a pressure that is greater than the hydrostatic pressure at the same elevation. For a gas to move through lithologic materials it must be present at pressures greater than the air entry pressure of the materials it has to move through. Lithologic sampling and subsequent geotechnical analysis, directed by LDNR found that the air entry pressure for the aquitard clays and silts is 7.8 psi. Gas in the sands of the MRAA and in aquitard sand lenses must be present at a pressure that is 7.8 psi (18.0 ft gas cap thickness) greater than hydrostatic pressure in order to migrate into the aquitard (Tetra Tech, 2016b). Continuous monitoring data from the Pressure Monitoring Well (PMW) network indicates that systematic gas venting has reduced the hydrostatic/gas pressure differential to less than 0.5 psi near the occupied residences (Tetra Tech, 2016a).
9. It is my professional opinion that a serious threat does not exist at any of the occupied residences from methane. My opinion is based upon the following: 1) According to the BRC "natural background levels of biogenic swamp gas are a traditionally accepted low-risk hazard to residents" (Tetra Tech, 2016b); 2) The occurrence of bubble sites near occupied residences has dramatically declined (Tetra Tech, 2015a); 3) Gas in the breathing zone measured above the bubble sites consistently contained low, less than 10% LEL concentrations of methane and no measurable concentration of H<sub>2</sub>S (Tetra Tech, 2015a); 4) The residential air monitoring system constantly samples indoor air quality and is designed to trigger an alarm should the concentration of methane exceed 10% of the LEL and 10 ppm of H<sub>2</sub>S. The system has been in operation for 3 years and an alarm has never been triggered (Tetra Tech, 2016c); 5) Gas migration in the saturated

zone requires that the gas be present at a pressure that is higher than the hydrostatic pressure of the surrounding saturated strata. Data from the pressure monitoring well network demonstrates that the differential between hydrostatic pressure and the gas zones has declined to less than 0.5 psi near the occupied residences (Tetra Tech, 2016a). Little pressure gradient exists to support the migration of gas; 6) LDNR directed lithologic sampling and geotechnical testing demonstrates that the air entry pressure of the aquitard clays and silts is 7.8 psi (Tetra Tech, 2016b). The difference between the air entry pressure of the aquitard and the hydrostatic/gas zone pressure differential at the top of the MRAA and in sand zones within the aquitard does not support migration of the gas.

  
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Scott Shaw, Affiant

**NOTARY PUBLIC**

Before me appeared Scott, and after being duly warned and sworn, stated that the above statements are true and correct on this 29<sup>th</sup> day of July, 2016.

  
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Notary Public, State at Large

My Commission Expires: \_\_\_\_\_

<b>ANA V TURMERO-MADRIZ</b> <b>NOTARY PUBLIC</b> <b>REG. #7589178</b> <b>COMMONWEALTH OF VIRGINIA</b> <b>MY COMMISSION EXPIRES JULY 31, 2017</b>
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**ATTACHMENT 1**

**RESUME**



More than Thirty years of experience in management of site characterization investigations; management of Geographic Information Systems (GIS), preparation of site conceptual model visualizations using Mining Visualization System (MVS) software, oversight and quality assurance of field programs; groundwater resource evaluation; and underground storage tank closure and investigations.

**EXPERIENCE**

Texas Brine Company, Bayou Corne Sinkhole, Louisiana – Developed extensive Geographic Information System that included well installation data, lithologic information and methane distribution in the area near a partially collapsed salt dome. Mr. Shaw assisted with the development and analysis of a complex and very effective in-situ gas zone assessment program using CPT geotechnical direct push rigs with sounding tools using gas pressure sensors to determine the location and extent of sediment with constant pore pressure over depth, indicative of the presence of gas pockets. Results of the exploration method were used by Mr. Shaw to create 3D visualizations of potential methane pockets in the subsurface. Mr. Shaw analyzed numerous aquifer tests designed to evaluate the effects of methane recovery activities at the site.

Confidential Client, Waynesboro, Virginia – Tetra Tech Site coordinator. Supervising Resource Conservation and Recovery Act (RCRA) administrative consent order remediation activities. The ongoing pump and treat remedy includes two bedrock groundwater extraction wells discharging to a packed tower air stripper. Reporting tasks include semi-annual groundwater monitoring (USEPA), monthly remediation system operations and maintenance activities reporting to the Virginia Department of the Environment and Virginia Pollution Discharge Elimination permit reporting.

Confidential Client, Fort Washington, Pennsylvania – Senior technical lead responsible for directing the successful achievement of closure under Pennsylvania’s land recycling program (Act 2). Evaluated the results of historic remedial actions that included soil vapor extraction and natural attenuation of groundwater contaminated with chlorinated hydrocarbons. Guided client council through the complex notification and reporting requirements implicit in obtaining site closure. Took part in successful negotiations with Pennsylvania Department of Environmental Protection.

Confidential Client, Carson, California – Managed database containing records from extensive site investigations evaluating the nature and extent of petroleum contaminated soil and groundwater. Used historic site data from numerous sources to evaluate site topography and determine the location of potentially contaminated soils. Used sampling data and soil boring information to create visualizations comparing historic site use and existing conditions.

Confidential Client, Knoxville, Tennessee – Project manager supervising the completion of natural attenuation evaluation of chlorinated solvents contamination at a site near Knoxville, Tennessee. The project worked closely with the Tennessee Department of Environment and Conservation. Project included the development of work plans and health and safety plans to complete well installation, soil sampling and groundwater sampling to evaluate the natural

**Education:**

M.Sc., Environmental Engineering, Johns Hopkins University, 1998

B.S., Geosciences, The Pennsylvania State University, 1983

**Registrations/Certifications:**

Certified I Registered Professional Geologist,

#PG 001585G, PA  
#911, LA

**Office:**

Sterling, Virginia

**Years of Experience:**

Thirty-Three

**Years with Tetra Tech:**

Thirty-Two



attenuation of chlorinated hydrocarbons. Results of the field investigation were used to complete estimations of potential degradation pathways and natural attenuation rates. Data from the investigation was used to complete a USEPA compliant risk assessment that demonstrated minimal risk to human health.

Confidential Client, Southern California – Developed a Geographic Information System that included historical soil and groundwater contamination associated with a former manufacturing facility. Well construction information, geologic and hydrogeologic data and historical plant operation records were used to evaluate travel times and potential impacts to the surrounding community.

Confidential Client, Ontario, Canada – Project Manager coordinating the evaluation and development of site investigations near Toronto, Ontario. The project included the evaluation of historical groundwater and soil contamination data as well as the development of an extensive Geographic Information System. The compiled data was used to support the conceptual understanding of site geology and hydrogeology and develop a groundwater flow model. Results of the investigation have been used to support negotiations between potentially responsible parties. Information maintained in the GIS was used to provide input to Mining Visualization System (MVS) software to create visualizations of site geology and hydrogeology. The site conceptual model was used to create the groundwater flow model.

Confidential Client, Southern California – Managed the development of an extensive GIS that integrated historical data with information collected in the field on a day-to-day basis. Information was used to support ongoing litigation and direct future investigations of fate and transport of groundwater contaminants. Mining Visualization System (MVS) software is frequently used to review contaminant distribution and groundwater extraction information.

Confidential Client, Kentucky – Project manager investigating the nature and extent of groundwater and soil contamination at a chemical manufacturing facility in western Kentucky. The investigation included the review of data collected over more than 20 years of plant operation and investigation. Directed the development of a Geographic Information System (GIS) that used existing maps and chemistry data to support expert witness testimony and oversight. Data from the GIS was input to Mining Visualization System (MVS) software to guide future drilling and soil boring investigations.

Confidential Client, Alabama – Managed the development of a Geographic Information System (GIS) used to support expert witness testimony, management of water resources and design of a quarry expansion project. Used historical water level and pumping data to evaluate the local groundwater resource. The information processed included the location and dimensions of residential wells, quarry production wells and sinkholes. The GIS was used to successfully support court proceedings and develop a three-dimensional model of regional groundwater flow. Data from the GIS was integrated into the flow model and used to complete calibration and parameter estimation.

Willow Grove Air Reserve Station, Pennsylvania – United States Air force Reserve Command – Chief Technical Lead providing oversight to excavation, soil management and dewatering. Project was completed on behalf of the United States Air Force Reserve Command during the recoating of three high-pressure natural gas pipelines adjacent to the base POL Area. Project included the management of numerous site contractors and personnel, soil screening and groundwater treatment. Treated groundwater was discharged to a nearby stream through the use of temporary National Pollution Discharge Elimination System permit administered by the Pennsylvania Department of Environmental Protection

Willow Grove Air Reserve Station, Pennsylvania – United State Department of Justice – Evaluated spill records maintained by base facility management and engineering group. Results of review were used to determine potential impact of recent spills to an area of the Base impacted by a larger historic release. The result of the review was used to complete an affidavit on behalf of the United States Air Force and the United States Department of Justice.



Willow Grove Air Reserve Station, Pennsylvania – United States Air Force Reserve Command – Senior Technical Lead directing the investigation of jet fuel contamination in a natural gas pipeline Right-of-Way. Project was completed to evaluate the nature and extent of contamination in an area of an existing spill that had not been investigated due to the presence of a transcontinental natural gas pipeline. Oversaw the selection and performance of a specialty excavation contractor. Final report integrated the results of field observations, geologic interpretation and chemical analysis of groundwater and soil samples to describe the nature and extent of contamination in the right-of-way.

Willow Grove Air Reserve Station, Pennsylvania – United States Air Force Reserve Command - Project Manager directing the first phase of remedy implementation. Based on the results of previous investigations, directed the completion of baseline groundwater and soil sampling events to fully characterize the nature and extent of petroleum hydrocarbon contamination at the site. Collected soil and groundwater samples and directed the completion of bench-scale treatability tests to determine the efficacy of using Fenton's Reagent to reduce the amount of free-product in the subsurface. Results of these investigations were used to successfully negotiate State acceptance of the remedial approach.

Willow Grove Air Reserve Station, Pennsylvania – United States Air Force Reserve Command – Project Manager directing the completion of a natural attenuation evaluation and remedial alternatives review. Directed a series of investigations that included: the quantification of contaminant concentration and distribution in the subsurface; determination of rate of attenuation of petroleum hydrocarbons in the subsurface; and, prediction of attainment of regulatory concentration standards. Results of the investigation were presented to the public as well as Base and Headquarters personnel on a frequent basis. As a result of the investigation, Base and Air Force Reserve Command Headquarters personnel were provided with a mechanism that yields an understanding of remedial alternatives for site remediation in terms of attainment goals and biodegradation processes.

Willow Grove Air Reserve Station, Pennsylvania – United States Air Force Reserve Command / United States Army Corps of Engineers - Project Manager for pilot study testing the efficacy of oxygen release compounds on the enhanced aerobic bioremediation of petroleum hydrocarbons in the subsurface. Provided Base and Air Force Reserve Command Headquarters personnel with regulatory compliance support and assistance. Frequently presented project status reports to the public and State officials on behalf of the Army Corps of Engineers and the Air Force Reserve Command.

Confidential Client, Knoxville, Tennessee – Project Manager directing the investigation of trichloroethene contamination in soils and groundwater. Completed State compliant investigations describing the subsurface distribution of TCE and supervised the excavation and removal of contaminated media. Successfully participated in negotiations that lead to the site being included in the State Voluntary Remediation Program. Other duties include interactions with Corporate Council and the director of environmental safety health to maintain compliance with State and federal environmental regulations.

Waste Management of North America, Sandy Hill Creative Disposal Facility, Prince Georges County, Maryland – Supervised the collection of zero head-space groundwater samples at the perimeter of the closed landfill facility. Duties included the preparation of a work plan, sampling and analysis plan and health and safety plan. Coordinated the activities of a number of subcontractors including direct push contractors, analytical laboratories and utility locating services. Results of the investigation were used to delineate the extent of contamination at the site and quantify the nature and extent of groundwater contamination that is attributable to landfill gas / groundwater interaction. Results of the investigation were used to satisfy regulatory compliance requirements.

St. Mary's and Charles County, Maryland – Project Manager directing the completion of site investigation determining the capacity of sites for sewage disposal. Duties include direct negotiation with State of Maryland personnel concerning the scope of onsite facilities, the nature and appropriateness of measurement methods and design specification of disposal systems. As a result of my participation, our clients have successfully obtained discharge permits for a number of facilities including a church and urgent care facility.



Carrs Mill, New Cut, and Alpha Ridge Landfills, Howard County, Maryland – Project Manager of site characterization activities including fracture trace analysis, soil gas surveys, well design and installation, packer tests, groundwater sampling, and aquifer testing. Duties included development of work plans, quality assurance project plans, and field sampling plans consistent with CERCLA guidance. Supervised and managed multiple subcontractors and personnel within a strict budget. Assisted County officials in presentations describing ongoing and completed investigation activities at public meetings. Deliverables included three extensive Remedial Investigation/Feasibility Study reports.

Carrs Mill Landfill, Howard County, Maryland – Project Manager of drum removal and compliance activities. Duties included supervision of daily site activities, client/PRP liaison, and Health and Safety supervision. The project included geophysical surveys, excavation of buried drums, contents compatibility testing, and shipping. Conducted detailed presentations describing ongoing and completed investigation activities at public meetings. Compiled photographic log and field documentation of all excavated materials and evidence, including 900 drums. Prepared Interim Remedial Investigation/Feasibility Study report consistent with RI/FS findings from site characterization activities. All drum excavation activities were performed in Level B personal protective equipment.

Oaks Landfill, Montgomery County, Maryland – Project Manager for geophysical investigations including terrain conductivity and resistivity studies for early contaminant plume detection. Responsible for the interpretation and delivery of quarterly reports of geophysical investigation results and coordination of field activities.

Two Landfills, Fairfax County, Virginia – Project Manager for installation of a dedicated monitor well sampling system. Implemented quarterly sampling schedule to comply with state reporting requirements.

Gude Landfill, Montgomery County, Maryland – Assistant Project Manager supervising the design, location, and installation of a monitor well network. Duties included geophysical, geologic, and hydrologic interpretation; completion and evaluation of aquifer tests; and field supervision and fiscal oversight of subcontractor.

Superfund Hazardous Waste Site, Florida – Performed groundwater sampling, trench soil sampling, and PCB sampling as well as monitoring of well installation supervision in a field program at a PCB, lead, and arsenic impacted site. Trench soil sampling and PCB sampling were performed in Level B personal protective equipment.

Confidential Client, District of Columbia – Project Manager for site characterization and initial abatement investigation of a major underground storage tank (UST) leak. Activities included utilities coordination, location, and well installation. Work was performed concurrently with stringent production, plant operating procedures, and schedules. Drilling activities were completed within parking structures and buildings in an urban setting.

Fortune 500 Industrial Client, Maryland – Project Manager for sample collection program for a groundwater quality control project. Duties included dedicated sampling equipment selection and installation, as well as monitoring well maintenance and groundwater sampling.

Florida Department of Environmental Regulation – Prepared and successfully gained approval of corporate Comprehensive Quality Assurance Plan, No. 9100HG.

Saint Johns River Water Management District, Florida – Assisted in development of a regional groundwater flow model through compilation of well construction, spring discharge, stream flow rates, and river elevations.

Gravel and Building Material Quarry, Northern Virginia – Performed data acquisition, supervised well construction, conducted aquifer tests, and performed streamflow calculations on a water resource evaluation project.

## PREVIOUS WORK HISTORY

Air Survey Corporation of Virginia, Reston, Virginia, (1983-1984), *Cartographic Assistant*  
State University of New York at Stony Brook, Stony Brook, New York, (1983), *Field Geologist*



**PROFESSIONAL AFFILIATIONS**

Association of Groundwater Scientists and Engineers

Interstate Technology and Regulatory Council

Project Team Member - DNAPL Site Characterization

Project Team Member - Groundwater Statistics and Monitoring Compliance

**PUBLICATIONS**

1. Shaw, S.T, C.P. Spalding, R.M. Cohen, and E. Tomlin, 1996, Landfill Investigation: Howard County, Maryland, American Institute of Hydrology Annual Meeting, Boston, Massachusetts.
2. Spalding, C.P., R.M. Cohen, S.T. Shaw, and M.C. Brown, 1996, Groundwater issues related to subdivision development in Loudoun County, Virginia, American Institute of Hydrology, Annual Meeting, Boston Massachusetts.
3. Cohen, R.M., A. Bryda, S.T. Shaw, and C.P. Spalding, 1992. Use of fluorescence and hydrophobic dye to select NAPL in soil and water, Ground Water Monitoring Review, Fall 1992.
4. Rumbaugh, J.O., J.A. Caldwell, and S.T. Shaw, 1987. A geophysical groundwater monitoring program for a sanitary landfill: Implementation and preliminary analysis, Proceedings of the First National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring and Geophysical Methods, NWWA, Las Vegas, Nevada.

## ATTACHMENT 2

### REFERENCES

- California Environmental Protection Agency, 2012. Evaluation of Biogenic Methane – A Guidance Prepared for the Evaluation of Biogenic Methane in Constructed Fills and Dairy Sites. 3/28/2012.
- Tetra Tech, 2013. Work Plan - In Response To: Louisiana Department of Natural Resources Declaration of Emergency for Bayou Corne Fourth Amendment, Directive No. 1: Prepared for Texas Brine Company, LLC. January 14, 2013
- Tetra Tech, 2015a. Bubble Site Air Monitoring Report – October 2015. Prepared for Texas Brine Company, LLC. 10/22/2015.
- Tetra Tech, 2015b. Figure 1. Napoleonville Salt Dome Project, Bayou Corne Occupancy Map. October 2015.
- Tetra Tech, 2016a. PMW Monitoring Report: December 2015 Results. Napoleonville Salt Dome Project, Bayou Corne, Louisiana. January 15, 2016.
- Tetra Tech, 2016b. Current Subsurface Gas Conditions & Remediation at Bayou Corne, Comparison to BRC Criteria Recommended to LDNR in Order to Lift the Mandatory Evacuation Order. Prepared for Texas Brine Company, 2/16/2016.
- Tetra Tech, 2016c. Evaluation of Potential Risk to Human Health and the Environment & NFA Recommendation for Area 6. 3/30/2016
- Tetra Tech, 2016d. PMW Monitoring Report March, April and May 2016 Results. Prepared for Texas Brine Company, 6/22/2016.
- Tetra Tech, 2016e. Response to Request for Additional Information by LDNROC to Support a No Further Action Determination for Inhabited Receptor Areas of Bayou Corne. Prepared for Texas Brine Company, 7/22/2016.
- Tetra Tech, 2016f. Project Dashboard, 7/26/2016.
- Trinity Consultants, 2016. Air Monitoring Report: Texas Brine Company, Bayou Corne Sinkhole-Quarterly Air Monitoring Report – 1st Quarter 2016. April 2016.