ANCHOR E. HOLM

Geoscientist / Petroleum Engineering Specialist
New Mexico State Land Office, Oil Gas & Mineral Division
310 Old Santa Fe Trail, Santa Fe, NM 87504 aholm@slo.state.nm.us Ofc.: (505) 827-5759
6167 Cottontail Road, NE, Rio Rancho, NM 87144 aholmpe@aol.com Res. & Cell: (281) 639-0693

CREDENTIALS/REGISTRATION:

- B.S. Geological Engineering, College of Mines, University of Arizona, 1967 (dual major – Geology & Civil Engineering with minor in Ground Water Hydrology)
- Graduate Studies, Environmental Engineering, University of Texas at El Paso, 34 hours 1976-1981
- Registered Professional Engineer, State of Texas #40079
- Advisory Board for AutoCad &Engineering, Houston Community College NE, Houston, TX 2009-2012.

FIELDS OF SPECIALIZATION:

- Groundwater Contamination Investigation, Aquifer & Site Geology Characterization, & Remediation
- Oil and Gas Properties: Environmental & Petroleum Engineering – Primary, Secondary & E.O.R.
- Geological Engineering for Deep Well Injection, Class I and II
- Permitting, Regulatory Testimony, and Project Management
- Uranium Mill Tailings Remedial Engineering & Technical Management
- Civil Design and Value Engineering
- Expert Witness Testimony / Litigation Support: Environmental, Geology & Petroleum Engineering

PROFESSIONAL AFFILIATIONS

- Society of Petroleum Engineers- Member 1962, Past Officer in 3 Sections.
- Association of Environmental & Engineering Geologists – Member
- American Association of Petroleum Geologists - Member
- Rocky Mountain Association of Geologists – Member
- Albuquerque Geological Society – Member
- American Society of Civil Engineers – Past West Texas Branch Chairman
- National Ground Water Association – Past Member
- Society of American Military Engineers, Houston Post - Environmental & Readiness Committees

EXPERIENCE SUMMARY

Mr. Holm has over 45 years of engineering experience in designing, conducting and managing environmental, petroleum, geological, acid mine and milling, civil, natural gas and oil projects and investigations. Mr. Holm joined the New Mexico State Land Office, Oil Gas & Minerals Division (OGMD) as a geoscientist/petroleum engineering specialist in September 2012. He is responsible for overseeing reservoir drainage and lease/unit plan of development as well as the oil well royalty rate reduction program and other duties, such as business lease mineral evaluations for oil, natural gas, carbon dioxide and helium. Mr. Holm also taught at Santa Fe Community College during the summer and fall terms of 2013, field geology and historical geology lab. During the prior 25 years, his experience has included expert testimony on petroleum engineering, ground water contamination and protection and stormwater flooding; CERCLA, RCRA and RCRA-exempt and UMTRA environmental assessment and remediation of gas and oil production operations, uranium mill sites, facilities, plants, and service facilities with soil and groundwater impacts; groundwater management of water well drilling, testing and field development for municipalities, water districts and industrial users; solid waste landfill and transfer station design and permitting, civil design for subdivisions, apartment complexes and assisted living facilities, and technical management of uranium mill tailings remedial action (UMTRA) Department of Energy (DOE) project for surface and groundwater characterization and remediation with design review, design and groundwater construction responsibilities. His prior 18 years of oil and gas engineering experience included 3 years in oil field waterflood operations; 4 years in drilling oil and gas wells; 6 years in reservoir evaluation engineering for oil and gas companies; and 7 years in evaluating oil and gas wells, leases, drilling equipment and processing facilities for banks and industrial clients. As a result, his effective leadership and development of the big picture, combined technical approach to problem solving with teams of multiple disciplines resulted in timely and effective site closures and project success.

Expert witness testimony and support provided by Mr. Holm includes oil and gas as well as groundwater, petroleum engineering, civil engineering and environmental matters before U.S. District Courts, Texas District courts, New Mexico State Court, the Texas Natural Resources Conservation Commission (TNRCC), Texas Railroad Commission (TRC), Federal bankruptcy court, the oil conservation commissions, or the equivalent, of the states of Texas, Colorado, New

Mexico, North Dakota and Wyoming, plus agency/client negotiations with Texas Department of Health (TDH), Texas Water Commission (now, TCEQ), Department of Energy (DOE), Nuclear Regulatory Commission (NRC), Colorado Dept. of Public Health and Environment (CDPHE), and the New Mexico Environmental Department (NMED).

SELECTEDPUBLICATIONS AND PRESENTATIONS

- Presenter: Oil and Gas Petroleum Engineering Application of Science, Math and Physics, Energy Institute, Houston Community College NE, Houston, TX 2011.
- Presentation and White Paper: "Analysis of Natural and Man-Made Groundwater Recharge Conditions and Protection Needs, Southeaster Val Verde County Region including the City of Del Rio, Texas", 2009.
- Presentation entitled "Use of Math and Science for the Design, Permitting, Construction and Closure of Various Sites of the DOE-Uranium Mill Tailings Remedial Action (UMTRA) Project – Surface and Ground Water Programs," Math and Physics Classes, San Jacinto College South, Houston, Texas, 2005.
- Presentation entitled "Design of New Concept for Control of Shallow Ground Water Flows in Deep Offshore Wells," for selected clients, 2002.
- Presented "Discussion of the Design, Permitting, Construction and Closure of the Falls City, Texas DOE-Uranium Mill Tailings Remedial Action (UMTRA) Disposal Cell, Tailings Piles Consolidation and Ground Water Closure," at S.A.M.E., Environmental Committee Meeting, Houston, Texas, August 4, 1998.
- Authored: "Shallow Water Flows in Deep-Water Can Be Controlled," Offshore Magazine, May, 1998, p. 76+.
- Presented: "UMTRA Disposal Cell Designs for Closure & Minimum Maintenance," "UMTRA Disposal Cell Cover & Subgrade Design for Stabilization," and "UMTRA Long-Term Performance Monitoring Lessons-Learned," at Multilateral Exchange - Decommissioning Uranium Mine/Mill Facilities, Vancouver, British Columbia, Canada, June, 1997
- Presented: "Review of Ground Water Investigations - UMTRA Surface Project," and "Site Characterization, Selection & Design of Disposal Cells," Lessons Learned Workshop, DOE-ERD, Albuquerque, NM, May, 1997
- CE-691 Seminar lecturer, "Engineering Overview of Uranium Mill Tailings Remedial Action Program," University of New Mexico, 1995.
- Environmental short course co-instructor, "Ground Water Hydrology and Possible Contamination from Oil and Gas Production," Texas Natural Resources Conservation Commission, District Training, Lubbock, TX, 1992 & 1993.
- Environmental lecture, "Introduction to Hydrogeologic Evaluation of Groundwater Contamination Related to Oil and Gas Production," Odessa Junior College, Odessa, TX, 1991 & 1992.
- Petroleum Engineering lecture, "Evaluation of Oil & Gas Properties by Bankers", Colorado School of Mines, Golden, CO, 1984.
- Coordinator & Lecturer: Introduction to Oil & Gas Well Drilling and Completion, Permian Basin Graduate Center, Midland, Texas 1979-1982.
- Coordinator & Lecturer: Introduction to Oil & Gas Reservoir Engineering, Permian Basin Graduate Center, Midland, Texas 1979-1982.
- Paper Presentation - "Oriented Density Evaluation of Multi-String Gas Well Completions, Rio Arriba County, NM," 50th Fall Meeting, SPE, Dallas, TX, Oct. 1975. (SPE 5519).
- Paper Presentation - "Perforation & Fracture Treatment Results, San Juan Basin, NM," Drilling & Production Operations, SPE Regional Meeting, Oklahoma City, OK, March 1975. (SPE 5412)

EXPERT WITNESS PROJECTS

Litigation Testimony & Support

- Served as an Expert Witness petroleum and hydrogeological engineer before a State Court jury trial for an independent oil & gas produced with salt water disposal operations. The lawsuit alleged that the salt water spill from an inactive produced water injection line had done damage to the landowners property and included crude oil in the spill. Investigations revealed that the site had spilled produced saltwater (31,000 mg/L chloride) with very minor amounts of crude oil carryover from the tank battery. Less than half of the salt water produced from the oil operations was capable of being released from the spill which appears to have lasted up to one year, beginning as a small leak and expanding as corrosion of the old steel pipeline accelerated the release. After the initial soil remediation treatment of clearing and application of gypsum, the site soils were sampled and all but one sampling site had been successfully remediated for chloride and three sampling sites for TPH. Jury found largely in favor ot the client. Final remedial action is underway following the plan developed by ABEngineering LLC.

- Served as an Expert Witness petroleum and ground water engineer before a State Court jury trial for a large independent oil company in a lawsuit where an offsetting operator claimed damages from their adjoining waterflood operations in Eddy County, New Mexico. No direct evidence of leakage of injection water out of the waterflood intervals was found. No indirect evidence of past waterflooding leakage in the region of the natural solution depression was found. Flow from the plaintiff bradenhead was very low pressure and corrosion of the shallow surface casing indicated historically high water levels of the brine aquifer inside the surface casing from a natural source. Jury decision pending.
- Served as an Expert Witness petroleum engineer and engineering geologist for a major oil company in a lawsuit where ground water contamination was alledgedly caused by the oil and gas operations in the Gulf Coast Aquifer. Evaluated data in oil well histories on leases nearby the contaminated water well. Discovered that the wellhead pressure data did not support the geologic model of the plaintiffs. Correlated the sand intervals and discovered a channel system rather than a widespread sand system. Provided the input to a ground water model of the channel system that confirmed that the pressure observed could only have been from such a limited channel sand system. Discovered surface expressions of recent movement of geologic faults in the vicinity of the contaminated water well. Case currently under appeal.
- Served as an Expert Witness for stormwater runoff and subsequent flooding of a property in Bacliff, Texas for an insurance company. Defined the rainfall event(s) which lead up to the flooding and the stormwater drainage changes and development over time, including diversion of the natural drainage system through a single drainpipe. Subsequent to the storm event, the drainpipe was expanded to two pipes. Examined photos of all first floor water damages and indicated those consistent with a short-term flood event. Case was settled.
- Served as an Expert Witness for geological engineering evaluation of a leaking underground storage tank site for a defendant major oil company. Two gasoline stations were accused of causing the hydrocarbon (BTEX) dissolved contamination of shallow ground water. Through careful field examination and location of a significant fault in the Austin Chalk formation, the client company station was found not to be a contributor to the offsite contamination. Case appears to have been dropped by the plaintiff.
- Served as Project Director for a major oil pipeline company in west Texas on a crude oil spill from a low-pressure pipeline with groundwater at depths of 3 to 8 feet and within a flood plain in preparation for litigation support. Protected natural springs were located downstream. Developed storm water control recommendation leading to construction of surface water diversion works and closure of open recovery trenches at the site just prior to rainy season. Provided ongoing advice for free product recovery, remediation and negotiations / reporting to the TRC.
- Served as Project Director on litigation for major oil pipeline company in west Texas at a crude oil spill from a pressurized interstate pipeline, with groundwater over 60 feet below the sandy ground surface and a caliche deposit at a depth of 3 to 5 feet. Performed a site assessment of the 2,000+ foot long spill with installation of 7 monitor wells, several soil borings and shallow trenches, developed a remediation work plan, negotiated with plaintiff landowner's attorney and expert. Evaluated excavation, bioremediation in-situ and partial excavation, vapor recovery with enhanced bioremediation in-situ, and no action along the multiple pipeline right-of-way. Client chose excavation of shallow impacted soils with surface disposal under the regulation of the TRC with concurrence of landowner.
- Served as an expert witness for First Interstate Bank of Denver before Federal District Court of Bankruptcy in Eldorado, Ark. Evaluated oil & gas properties of owner and their related collateral value dedicated to the bank. Judgment found in favor of the Bank, then assisted bank to negotiate title to the properties with minimum oil & gas production liabilities to the bank and environment.
- Served as professional engineering support for expert testimony for plaintiffs in a Wyoming lawsuit concerning coalbed methane escaping upwards into the shallow aquifer and vadose zone in the Powder River Basin near Rawhide Village. Methane levels had reached the LEL for ignition in some home basements. Methane evolved in response to activities related to the mining of coal. Suit was settled out of court favorably to our clients.
- Served as professional engineering support and Project Manager retained by a major oil company for expert testimony and engineering design for a Colorado lawsuit concerning coalbed methane escaping upwards into the shallow aquifer and water wells. Methane levels were below the LEL for ignition, but the odor from related chemical changes in the water affected the end users. Provided information regarding the migration of the gas as well as designing a low cost, very effective, individual-well water treatment system for removal of the natural gas and other ions of concern.
- Served as professional engineering support for expert witness testimony for a large oil company on an Oklahoma lawsuit regarding the brine contamination of the shallow aquifer by oil and gas well drilling, completions and production activities. The oil company client successfully delineated and defended their activities, reducing their liabilities significantly.
- Served as professional engineer and Project Manager retained by a major oil company for expert witness testimony and site investigation on an Oklahoma lawsuit regarding natural gas seepage into the shallow aquifer and vadose zone near the client's abandoned gas well. The seepage had affected a water well nearby and was affecting crops in

the adjacent field. Analysis concluded the gas well was currently abandoned properly, but loss of natural gas likely occurred during the period prior to abandonment. The site is being remediated with minimum of additional costs.

Regulatory Testimony & Support

- Served as an Expert Witness petroleum and hydrogeological engineer for the New Mexico State Land Office (NM SLO) by preparing testimony and exhibits to have been used before the NM Oil Conservation Division Hearing of Case No 15060. Due to lack of a complete Application being submitted by the applicant to the OCD and some questions of the applicant's expert, Dr. Kay Havenor, by the attorneys representing the State Land Office, Yates Petroleum and Endurance Resources, the OCD Hearing Officer denied the application without prejudice.
- Served as an expert witness for a Texas independent oil operator before the TRRC for the engineering and hydrologic evaluation of alleged contamination of the shallow alluvial aquifer potentially resulting from the accidental sinking of an oil field drilling rig as a result of fluidization of the saturated alluvial sands beneath the rig during a blowout of a shallow, naturally occurring nitrogen gas pocket. Depth to groundwater was about 10 feet with base of alluvium below 80 feet. The well location was near an ephemeral streambed and had a variable water table. Rapid recovery of the lubrication skid and disconnection of the fuel tanks mitigated potential impacts to the aquifer. Monitoring of the site for possible diesel fuel contamination continues since the small day tank was lost with the rig. Landowner concerns focused upon the irrigation well located in the edge of the alluvium slightly down river from the blowout site. Litigation support in related lawsuit was minimized by the effective coverage of the situation in testimony before the TRRC. No additional testimony was needed in court beyond the record from the TRRC testimony, saving the client time and money.
- Served as Project Engineer and expert witness for an oil company's protest of an application by a Texas firm for a Class I hazardous waste deep well injection permit from the TWC for two proposed wells to be located on a 20 acre tract adjacent to their producing oil wells. Investigation included permit review of the subsurface portion with a focus on known occurrences of natural fractures in nearby wellbores, review of producing oil well performance in response to disposal of produced oil field waters into the client's Class II disposal well located within 1.5 miles of the proposed site, presentation of known information on deep faulted structures beneath the area and their potential effects upon the proposed injection interval, and presentation of analogous seismic information of microseismic events in the interval correlative to the proposed injection and related to oilfield production from overpressured zones above nearby deep faulted structures. The objective was to ensure protection of the oil and gas rights of the client as well as to minimize any surface impacts. Following testimony, the applicant was given additional information needs from the TWC for the application to proceed.
- Served as Project Engineer for the City of Fort Stockton with potential expert testimony for the City's protest of the application of a Texas venture to obtain a permit for a class I hazardous waste deep injection utilizing an existing deep gas well which had been abandoned. Location of the site was approximately 1.5 mile upgradient from the municipal ground water supply of the City's Blue Ridge farm, which are planned to be developed for future use by the City. Protests and questions have led to the applicant's failure to respond to the TWC and it's return of the application to the applicant.
- Served as Project Advisor and expert witness for underground injection of hazardous wastewater effluent from a west Texas petrochemical facility, convincing the TWC of the reasonableness to continue underground injection in the aquifer which has shown bottomhole pressure increases. This resulted in the continuation of current injection with consideration for an injection permit for a limited number of years with increased bottomhole pressure and injection testing requirements. Evaluated other effluent disposal options for the client including deeper well injection, surface disposal in naturally occurring salt lakes, delivery to oilfield waterfloods nearby, and surface disposal in ephemeral streambeds or playas. Provided oversight, analysis and expert testimony concerning the falloff testing of the injection wells including analyses for fracturing.
- Served as Project Advisor for the groundwater modeling at a large pesticide facility with extensive arsenic contamination of the groundwater, surface waters and soils located in Texas. Two affected shallow aquifers merge in the man-made reservoir built on a surface drainage going through the site. The MODFLOW modeling program was used to demonstrate individual aquifer performance prior to initiation of recovery in shallow and middle aquifers, then to demonstrate containment of the plumes by the groundwater recovery 6 wells. Provided expert testimony support for negotiation of the Consent Order that has been signed between the client and the TWC, including ongoing modeling of observed drawdown and effective containment of contamination.
- Served as Project Advisor for the hydrogeologic assessment of the new and old municipal landfill sites for the Town of Pecos City, Texas. Assisted with negotiations by the City with the Texas Department of Health to obtain the permit for the new 40-acre landfill, as well as for closure planning of the nearby old landfill. Project included installation and sampling of five and nine monitor wells at the old and new landfills respectively. The shallow perched aquifer near 25 feet of depth contained poor quality water (4,000 to 8,000 TDS) with some nitrates not related to the landfills. The deep aquifer near 120 feet of depth is a regional aquifer utilized primarily for irrigation

and limited drinking supply by livestock and area residents, containing water not meeting the recommended municipal drinking water standards of the state of Texas.

- Served as Project Director for the evaluation of a solvent supplier and waste handling facility in the panhandle of Texas by delineating the underground storage tanks, drilling shallow soil borings, and documenting site facilities and usage. Report was prepared for the client to submit to the TWC for ongoing expert witness support.
- Serving as Technical Director for the DOE - Uranium Mill Tailings Remedial Action (UMTRA) ground water and surface project to remediate acid milling activities. Project has included design oversight and construction of the ground water initial action for the Tuba City site, as well as, additional soil and water characterization activities at 23 sites. The project includes surface remedial actions and closure of 24 Title I sites under NRC Regulations and EPA clean up standards for UMTRA, with the teaming partners of Jacobs Engineering Group, Weston and AGRA. Primary responsibilities include staff utilization for engineering and scientific work in support of the project and its negotiations requiring expert testimony as needed before the NRC, states (CO, UT, NM, TX & WY) and tribes (Navajo, Hopi, Shoshone).
- Served as chairman of the technical committee for the unitization of the Sooner Waterflood Unit, Weld County, Colorado, including expert testimony before the Colorado Oil Conservation Commission and negotiations with the working interest owners for the independent oil operator. Identified the deepest U.S.D.W. used in the area and its need for additional protection efforts. Utilized two reservoir engineering models to evaluate the proposed waterflood primary and secondary recoveries, as well as participation acreage.
- Served as Senior Reservoir Engineer and expert witness for oil company to obtain a new field discovery classification of an oil field in Wyoming. Provided testimony before the Wyoming Oil and Gas Commission for the oil operator, obtained new field discovery status for the wells.
- Provided expert testimony for an oil company before the TRRC to obtain a new gas field discovery classification, including two deep, overpressured gas well in a field with multiple sand channels and gas/water contacts. Included reservoir pressure testing and modeling to delineate the channels and their isolation from other productive zones, as well as optimization of producing rates.

OTHER SELECTED PROJECTS

CERCLA Program/State Superfund

- Served as Inspection Engineer for a west Texas landowner during the closure of a sour natural gas processing plant with arsenic contamination of soils within the vadose zone of an alluvium-filled karst structure above deep, excellent quality groundwater. Project included construction of a Class I hazardous waste landfill onsite, filling it with contaminated soils and old plant debris, and capping under the guidance of the TWC, plus capping of four areas to immobilize contamination in old pits, process areas and lagoons. Oversight of shallow and deep monitor wells completed at the base of the alluvium (top of limestone) and within the fresh water aquifer below 470 ft. Final closure transferred to the TRRC.
- Provided engineering design support and field oversight for the west Texas landowner during the gas company cleaning out and plugging of a deep monitor well containing a malfunctioning West Bay multiport system, which was allowing arsenic-containing waters to percolate down the wellbore toward the aquifer. The well was successfully plugged in five cement stages within the vadose zone and fractured limestone of a karst, effectively protecting the aquifer at a minimum of cost to the plant owner. Assisted in the development of a stormwater plan to control site erosion as well as prevent standing of rainwater on the site near any capped areas. Following site closure under the TRRC, ongoing site monitoring is underway.

Engineering Planning, Analysis and Design

- Served as Project Engineer for the civil design of assisted living facilities on three separate tracts of land in Harris County (Pasadena-1 and Houston-2). One required a water line extension along the opposite side of the street as well as a stormwater line extension along the near side of the street. One site required detention of stormwater. All required design of streets and parking, drainage and utilities. All have obtained the construction permits and are proceeding with construction.
- Served as Lead Engineer for the development of Subdivision Regulations and Specifications for Chambers County, Texas. Reviewed all standard design specifications and drawings and ensured linkage to current ASCE, ASTM and other appropriate State and Federal standards.
- Served as Project Engineer for the design of all civil works for a 12.9 acre tract development for the Regatta Bay Apartments, Seabrook, Texas. Conducted a Phase I Environmental Site Assessment prior to civil design. Design included all streets, parking, paving, stormwater and utilities. Project was permitted and constructed in a timely manner.

- Served as Project Engineer and Advisor for a RCRA facility in west Texas including the design, construction, and operation and maintenance of an on-site bioremediation cell of excavated soil using an electric blower to pull air through the soils with intermittent application of untreated well water and nutrients as needed. Remediation of soils was completed in less than one year resulting in significant disposal savings for the client and early application to the TNRCC for closure.

Exploration and Production - Oil and Gas

- Served as Project Advisor for major oil company at a closed natural gas plant site with chromium contamination from cooling waters in the perched groundwater and the deeper water table aquifer in west Texas. Remediation includes pumping of groundwater from shallow and deep recovery wells with disposal of the waters into a pipeline for reuse at a sister active natural gas plant. Subsequent to cooling tower reuse, the waters are injected into a deep aquifer Class II injection well under the regulation of the TRRC. Innovative techniques to increase chromium recovery volumes and rates from the vadose zone/perched aquifer are being evaluated, while operation and maintenance of the 50+ monitor and recovery wells accomplishes recovery and plume containment.
- Served as Project Advisor for a major oil company during investigation of shallow oil and gas seeps in an oil field located upgradient from natural springs in west Texas. Multiple casing leaks from oil wells were the potential sources of the hydrocarbons, but no effect has been detected to date at the springs. Investigation of wells showed only minor losses of oil or gas. Natural attenuation appears to be containing any contaminants of concern.
- Served as Project Director for a major oil company operator of a waterflood unit in west Texas, which has extensive brine contamination within the shallow fresh water aquifer. Evaluation using surface geophysical methods with limited monitor well installation was done and determined the optimum strategy to contain the multiple source plumes and effect long-term remediation cost effectively.
- Supervised the drilling and completion as a drilling engineer of over 300 gas and oil wells within the San Juan Basin of northwest New Mexico and southern Colorado, including expert testimony before the New Mexico Oil Conservation Division for El Paso Natural Gas Co. Evaluated hydraulic fracturing completions utilizing cased hole geophysical tools (density, neutron, electric resistivity, temperature, gamma ray, and geophones), surface geophones and pressure/production bottom hole tests. Presented a technical paper (SPE) with the observed results showing upward migration of the induced fractures.
- Served as Project Advisor for a major oil company in Texas during conceptual design, final design, excavation and encapsulation of brine drilling fluid contaminated soils from a site used to drill two oil wells and hauling of the soils to site owned by the company where the encapsulation landfill was authorized by a minor permit from the TRRC. The excavation was backfilled with clean fill and covered with top soil allowing use of the surface by the landowner, resulting in closure of litigation.
- Served as Project Director for a Texas bank trust department for the closure under the regulation of the TRRC of a oilfield brine evaporation pond, which had been lined with asphalt. Salt contamination beneath the pond was identified by angle borings and resulted in the design of a partial removal and closure of the pond utilizing a cap, since no groundwater was detected. The regulators approved closure plan with landowner concurrence.
- Served as Project Engineer for a major oil company on the design and installation of a 5,400 foot class II water injection well in the Aneth Unit, San Juan County, Utah for waterflood secondary recovery project, injecting alternately produced water followed by fresh water from the water well field in the San Juan River alluvium.
- Conducted reservoir engineering design, interpretation and field supervision of bottom hole pressure testing of an over pressured natural gas well with water production problems located in Loving County, Texas for an oil company. Identified the complex channel reservoir geometry and likely gas/water contact allowing optimization of gas production.
- Conducted for a major oil company a reservoir engineering analysis and evaluation of openhole geophysical well logs, with correlation of waterflood response at the Aneth Unit, San Juan County, Utah, resulting in the identification of bypassed oil within the carbonate oil reservoir. Recommended and obtained approval from management for the subsequent successful infill drilling of the unit (the first well flowed over 100 barrels of oil per day without any injection water production and paid out within 6 months).
- As a Drilling Engineer for El Paso Natural Gas Co., performed borehole geophysical surveys in gas wells with multiple casing production strings utilizing an oriented density tool calibrated to field conditions. Subsequently remediated successfully several wells and presented a technical paper before the annual national meeting of the Society of Petroleum Engineers (SPE).
- As an Evaluation Engineer for oil and gas companies as well as banks, prepared evaluations of natural gas plants and storage facilities including material balance calculations for production of natural gas liquids and residue gas volumes, sales and loan values in Texas, New Mexico, Oklahoma, North Dakota, Kentucky and Colorado.

Federal Facilities (DOE, DOD, Other)

- Served as Project Director for a DOE funded hydrogeologic study of seven oil and gas producing basins within the U.S.A. for a patent owner of an oil field downhole gas/water separator with capabilities to inject separated waters directly into underlying strata. Assisted the patent owner to obtain the DOE funding by submitting a proposal with the application documents. Individual basin studies have been developed and a compendium prepared for the patent owner to utilize to market his device.
- Served as Geraghty & Miller Support Manager and Technical Director for the Technical Assistance Contract on the DOE Uranium Mill Tailings Remedial Action (UMTRA) project with the associated SAFE Program. Project includes closure of 22 Title I sites under NRC regulations within the continental U.S.A., with contract partners of Jacobs Engineering, Weston, and A.G.R.A. under the teaming agreement.
- Served as Senior Project Engineer and Technical Representative(TR) on the design and construction of groundwater remediation ponds with erosion protection system at a DOE UMTRA uranium mill tailings disposal cell site in northern Arizona. New construction included 21 monitoring wells, 4 extraction wells, one water source well, three lined ponds, potable and contaminated water piping systems, electrical distribution systems with two segments, potable water tank storage, water and electrical support to a greenhouse, mobile water treatment system, and general maintenance within the disposal cell site.

Hydrocarbon Investigation/Remediation

- Served as Project Advisor for the installation, operation and maintenance of a vapor recovery system at a southeast New Mexico oil refinery truck wash-water pit utilizing four vapor recovery wells with one explosion proof blower to recover volatile and semi-volatile organic compounds from the vadose zone. Depth to groundwater exceeded 80 feet at this successfully operated system which was monitored for organic vapors plus biorespiration to measure both recovery and biodegradation rates. Interaction with the new refinery owner was required to stop reoccurring spills. Site is approaching RCRA closure under the NMED.
- Served as Project Advisor for a major oil marketing company in Texas for a gasoline UST spill site including vapor extraction pilot testing, installation of vapor recovery wells with a vapor remediation modular system built by GMEE. The gasoline station was closed and converted to an alternate retail use while operation and maintenance of the system continued. Closure of the site was received from the TWC within one year of the installation of the GMEE equipment and the equipment moved to another site for the client.
- Served as Project Director for a major oil marketing company for the investigation of a product bulk plant located in New Mexico to assess potential impacts to the soils in the vadose zone above the deep groundwater. Report was prepared for the client for submittal to the NMED, with a separate letter of additional recommendations to the client. Conducted a quality assurance (QA) visit to the site with very positive results for the bulk plant operator and the client. Additional work on the site is planned.
- Served as Project Director for a major oil company in New Mexico of a product bulk plant assessment including shallow soil borings. Site was adjacent to a railroad with an oil refinery across the tracks, and an ephemeral stream passing nearby. Report was prepared for the client to submit to the NMED.

International Projects

- Served as Project Engineer for a mining company to develop a sulfur ore body hydrologic investigation plan using groundwater modeling of two aquifers at a site located near the Mediterranean Sea in the Sinai Peninsula. The shallow water table aquifer was in contact with the sea waters, and the deeper ore body aquifer appeared to be artesian. The aquifer pump testing plan is on hold due to their discovery of a significant ore body in the Gulf of Mexico.
- Served as Project Engineer while a 1st Lieutenant, U.S. Army, Corps of Engineers, for a rock quarry design and development at a site adjacent to a fire support base in the Republic of Vietnam including crusher site preparation, crusher installation, quarry access and working face development utilizing heavy equipment, drilling and blasting of granite for the 24-inch feedstock to the crusher, clearing of the area for security and removal of military ordinance, Development of a site safety plan including the local Vietnamese resulted in only one lost time (24-hours) accident and no hostile damage to equipment, quarry or personnel.

RCRA Pre-RFA/RFI/Permitting/Underground Injection

- Served as Project Director for the removal of chromium contaminated soils beneath an active cooling tower at a New Mexico oil refinery utilizing angle hollow stem augers for delineation and a soil vacuum extraction system in an excavation requiring shoring for wall support and foundation stabilization. Site was taken to closure under the NMED regulation.

- Served as Project Advisor for a Texas facility for the preparation of RCRA part A and B application with subsequent revisions. Site had the permit issued including consolidation of the lagoon closure begun several years earlier with the UST closure.

Site Characterization/Assessment/Remediation

- Served as Project Engineer/Advisor for RCRA facility in a Texas city for the offsite characterization, assessment, delineation of groundwater plumes containing TCE and carbon tetrachloride and their daughter products in an area with individual water supply for small industry and residents both within the city and the county. Installed carbon filtration systems on about 20 water wells to isolate water users from the contaminants, and continue operation and maintenance of the systems while working with the residents and well owners for the client. Interaction with the TWC and residents has been favorable for the client during initial disclosure resulting in a good relationship with the regulators and area residents. Preparation and provision of litigation support and regulatory assistance with the TWC.
- Served as Project Engineer for ground water pumping test, Diqla project, North Sinai, Egypt evaluation of a sulphur mine for development of shallow mining. Evaluated the natural ground water flow toward the Mediteranian Sea from the ore deposit several kilometers inland within an undocumented mine field. Water supply well was located just inland of the beach, and water truck lost a wheel when it swung wide off the road and hit a mine. All test design, mapping and cross-sections were done from his office in Midland, Texas in 1988-89.

Solid and Hazardous Waste Management

- Served as Project Advisor on the hydrogeologic assessment of the new landfill site for the City of Stanton, Texas, including an area water well inventory and aquifer delineation. A baseline geophysical (resistivity - Price array) survey was conducted along with installation of 8 piezometers in the Triassic shales of the site. No groundwater aquifers were found within 45 feet of depth below the site, correlation of oil well openhole logs indicate potential groundwater near 150 feet of depth, which appears to contain water quality containing greater than 4,000 mg/L total dissolved solids (TDS). The TDH issued the new permit without monitor well installation and allowed overfilling of the old landfill during the permitting period. An arid exemption application for the new landfill has been prepared and the city has submitted it to the agency for approval.
- Served as Project Director for the hydrogeologic support to the Town of Pecos City, Texas for the permitting and construction a new municipal landfill located just south of their city airport. Obtained Federal Aviation Authority for installation of monitoring wells near the end of a runway. Worked closely with the City Engineer and made presentations to the City on progress and at decision points.
- Served as Project Advisor of the Red Bluff (irrigation) dam for the Red Bluff Water and Power Control District, Texas during routine monthly review of seepage monitoring of volumes, quality, solutioning and turbidity as a function of time and reservoir water level elevation. Prepared and presented the proposed regrouting of the dam (third program) in response to the volumes of gypsum salts dissolved from the foundation rocks, proposal included installation of installation of piezometer wells within the dam, foundation rocks and downstream toe. Prior studies by Ed Reed & Associates had demonstrated the error in trying to control the gypsum solution seepages by applying downstream covers at the toe of the dam slope. All grouting had to be done on the upstream side of the dam in order to prevent excess pore pressures within the dam. We regularly monitored the seepages along the toe of the dam by measuring the flow rates with weirs, measuring the turbidity, and analyzing the water quality of the seeps. Seep water quality was compared to reservoir water quality to estimate the gypsum solution rates in the area of each major seep. Solution cavities were located by drilling along the reservoir shoreline on the dam, then pumped full with cement grout. Site topography was monitored to determine any changes in the known solution collapse structures and to watch for any new surface collapses.

Storm-Water/Surface-Water Management

- Served as Project Advisor on the stormwater evaluation of a closed RCRA facility in west Texas utilizing automatic sampling equipment at the surface water outfall point of the old agricultural chemical storage and repackaging plant. Successfully sampled the required storm event allowing the facility to proceed with obtainment of a stormwater permit after approximately 3 months.
- Served as Project Director on the development of SPCC plans for several Texas gas plants and oil storage facilities. These included limited runoff modeling and sampling requirements following engineering inspection of the site.

Water Supply

- Served as Project Engineer for the evaluation of groundwater resources beneath two tracts containing about 18 sections of land by conducting a test well drilling, irrigation well logging and pump testing, water quality and reserve evaluation; the study resulted in the acquisition of the surface and water rights of the tracts by the City of Fort Stockton, Texas for their municipal water supply.
- Served as Project Director for a west Texas city to evaluate their groundwater municipal water resources, prepared a presentation to the City Council about their water supply needs, developed a plan to focus groundwater exploration efforts, developed a plan to explore two areas for groundwater resources, and initiation of efforts to obtain needed water supplies with the City, City Manager and City Engineer under the regulation of Texas Department of Health (now, Texas Natural Resources Conservation Commission).
- Served as Project Director for a hydrologic investigation of groundwater resources for municipal water supply to a Texas city with waters contained varying amounts of nitrates from natural and agricultural sources. Water rights ownership were limited at most water supply fields to wellbore ownership with the right of capture which limited the city's ability to own the groundwater and to provide wellhead protection. Prepared report for submittal to the Texas Water Commission by the city.
- Served as Project Advisor to the City of Fort Stockton for the evaluation of options for planned disposal of effluent from a proposed reverse osmosis plant to be installed on the city's water supply, options included deep well injection, surface application of diluted effluent, discharge into the Pecos River, and the chosen recombination of effluent with the POTW effluent.
- Served as Project Director for the development of the Water Information Management System (WIMS) by Geraghty & Miller's Midland hydrologic staff and Los Angeles programmers for the City of Lubbock, Texas, to improve their management and reporting of the groundwater well fields in conjunction with use of surface water supplies from Lake Meredith for their municipal water supplies. Developed on Dbase, WIMS is supported by the Midland hydrologic staff with a local contract programmer. The system is performing well since the initial development and startup time. Further enhancements are contemplated as additional municipalities are showing interest in obtaining the program with associated hydrologic support.
- Served as Project Advisor of the Red Bluff (irrigation) dam for the Red Bluff Water and Power Control District, Texas during routine monthly review of seepage monitoring of volumes, quality, solutioning and turbidity as a function of time and reservoir water level elevation. Prepared and presented the proposed regrouting of the dam (third program) in response to the volumes of gypsum salts dissolved from the foundation rocks, proposal included installation of installation of piezometer wells within the dam, foundation rocks and downstream toe. Prior studies by Ed Reed & Associates had demonstrated the error in trying to control the gypsum solution seepages by applying downstream covers at the toe of the dam slope. All grouting had to be done on the upstream side of the dam in order to prevent excess pore pressures within the dam. We regularly monitored the seepages along the toe of the dam by measuring the flow rates with wiers, measuring the turbidity, and analyzing the water quality of the seeps. Seep water quality was compared to reservoir water quality to estimate the gypsum solution rates in the area of each major seep. Solution cavities were located by drilling along the reservoir shoreline on the dam, then pumped full with cement grout. Site topography was monitored to determine any changes in the known solution collapse structures and to watch for any new surface collapses.

SEMINARS AND TRAINING COURSES

"PHDWin," short course to renew proficiency in oil and gas reserves and economic modeling for oil and gas companies and energy lending, PHDWin, Houston, Texas, May 2008.

"EOR/IOR & Future of Global Oil Supply," PennWell Publishing Webinar, April 2008.

"Houston Area Active Faults – What Makes Them Move," Dr. Carl Norman, Engineering & Environmental Gp. HGS, February 2008.

"IS-100 Introduction to Incident Command System (ICS 100)," Dr. Cortez Lawrence, FEMA Emergency Mgmt Inst., January 2008.

"Horizontal Well Remediation and Brownfields," by Darren DeFabo, Engineering & Environmental Gp. HGS, September, 2007.

"Dam Safety Workshop - Design and Operation Training," TCEQ, Temple, Texas, August, 2007.

"Coastal Erosion Control Conference" TxGLO, Clear Lake, Texas, September 2005

"Environmental and Engineering Geology of the Houston Ship Channel," Assoc. of Engineering Geologists, Houston, Texas, 2005

"Coastal Erosion Control Conference" TxGLO, Galveston, Texas, September 2003

"Geologic Fault Seminar," Association of Engineering Geologists, Houston, Texas, 2003

"Hurricane Allison Update," Harris County Flood Control, ASCE, Houston, Texas, 2002

"Hurricane Preparedness Exercise," Galveston County, Texas, 2001

"Hurricane Preparedness Exercise," Houston County, Texas, 2000

"Readiness Committee Annual Banquet – Hurricane Preparedness," SAME-Houston, Texas, 2000 & 2001

"Bridge Design and Historic Bridge Restoration", TxDOT, Austin, Texas 2001

"S.A.M.E. '99, National Training Conference," Attendee & Volunteer with Houston Post, Houston, TX, 1999.

"Fault and Fault Seal Forum," Houston Geological Society, Houston, TX, 1999.

"Readiness Workshop," Houston Post, Society of American Military Engineers, Houston, TX, 1998.

"Communicating for Project Success," UMTRA Project Seminar, Albuquerque, NM, January, 1995.

SPE/EPA, "Exploration and Production Environmental Conference - 95," Society of Petroleum Engineers, Houston, TX, March, 1995.

"Total Quality Management," UMTRA Project Seminar, Albuquerque, NM, April, 1994.

"Office Managers Training Course, II," Geraghty & Miller, Inc., Denver, CO, May, 1993.

"Team Building," American Management Association, Denver, CO, May, 1993

SPE/EPA, "Exploration & Production Environment Conference," Society of Petro. Engrs, San Antonio, TX, March, 1993.

"RCRA Training Program," Geraghty & Miller, Inc., Midland, TX, July, 1992.

"Office Managers Training Course," Geraghty & Miller, Inc., Tampa, FL, February, 1992

"Winter Meeting," Underground Injection Practices Council, Corpus Christi, TX, January, 1992.

"Bioremediation of Petroleum Hydrocarbons Seminar", Geraghty & Miller, Austin, TX, January, 1991.

"Expert Testimony Seminar", Geraghty & Miller, Inc., Austin, TX, October, 1990.

"Project Management Training Seminar", Geraghty & Miller, Inc., Denver, CO, August 2, 1990.

"SPE Hydrocarbon Economics and Evaluation Symposium", Soc. of Petro. Engrs., Dallas, TX, March, 1983.

"Reservoir Engineering: Applied", H.K. VanPoollen & Associates, Denver, CO, May, 1981.

"1981 Deep Drilling and Production Symposium", Soc. of Petroleum Engrs., Amarillo, TX, 1981.

"Permian Basin Oil & Gas Recovery Conference", Soc. of Petroleum Engrs., Midland, TX, 1981.

"Pressure Transient Analysis in Tight Rocks", Oil & Gas Consultants Int'l, Colo. Springs, CO 1980.

"Petroleum Industry Seminar", Purvin & Gertz, Inc., Dallas, TX, 1978.

"Cased Hole Client Seminar, Schlumberger Well Services", Midland, TX, 1978.

"Applied Reservoir Engineering", Oil & Gas Consultants International, Inc., Tulsa, OK, 1977.

"Symposium on Stratigraphy & Structure of Franklin Mountains", El Paso Geol. Soc., El Paso, TX 1976.

"Well Control School", Univ. of Southwestern Louisiana, Lafayette, LA, 1975.

"Exploration from the Mountains to the Basin", Jt. Mtg, Southwestern Section of A.A.P.G. and Permian Basin Section of the S.E.P.M., El Paso, TX, 1975.

"Production Operations School", Oil & Gas Consultant Int'l, Inc., Newport Beach, CA, 1973.

"Drilling Practices School", Preston L. Moore, Norman, OK, 1972.