J. Daniel Arthur, P.E. , SPEC

President, Petroleum Engineer

Education

B.S., Petroleum Engineering, University of Missouri-Rolla

Professional Registrations

Professional Engineer: Oklahoma, Wyoming, Montana, Texas
Certified Senior Project Manager

Distinguishing Qualifications

Mr. Arthur is a registered professional petroleum engineer specializing in fossil energy, planning/engineering analysis and environmental issues. He has over 25 years of diverse experience that includes work in industry, government and consulting. Mr. Arthur is a founding member of ALL Consulting and has served as the company's President since its inception in 1999.

Prior to founding ALL Consulting, Mr. Arthur served as a Vice President of a large international consulting engineering firm and was involved with a broad array of work, including supporting the energy industry, various federal agencies, water and wastewater projects (municipal/industrial), environmental projects, various utility related projects, and projects related to the mining industry. Mr. Arthur's experience also includes serving as an enforcement officer and National Expert for the U.S. Environmental Protection Agency (EPA); a drilling and operations engineer with an independent oil producer; and direct work with an oilfield service company in the mid-continent.

In 2010, Mr. Arthur was appointed to serve as a Sub-Group Leader for a National Petroleum Council study on North American Resource Development. His Sub-Group focuses on technology that is and will be needed to address development and environmental challenges through the year 2050. Mr. Arthur was also appointed to a U.S. Department of Energy Federal Advisory Committee on Unconventional Resources. Further, Mr. Arthur has been asked to support the U.S. Department of Energy through the Annex III Agreement between the United States and China to provide support relative to coal bed methane and shale gas development in China.

Mr. Arthur has managed an assortment of projects, including regulatory analysis (e.g., new regulation development process, commenting/strategizing on new proposed regulations, negotiating with regulatory agencies on proposed regulations, analysis of implementation impacts, etc.), engineering design (including roads, pits & impoundments, water recycling/management, well pads, water and wastewater systems, and oil & gas facilities); life cycle analysis and modeling; resource evaluations; energy development alternatives analysis (e.g., oil, gas, coal, electric utility, etc.); feasibility analyses (including power plants, landfills,

injection wells, water treatment systems, mines, oil & gas plays, etc.); remediation and construction; site closure, reclamation site decommissioning; reservoir evaluation; regulatory permitting and environmental work; geophysical well logging; developing new mechanical integrity testing methods, standards, and testing criteria; conducting and interpreting well tests; restorative maintenance on existing wells and well sites; extensive hydrogeological and geochemical analysis of monitoring and operating data; sophisticated 2-dimensional and 3-dimensional modeling; geochemical modeling; drilling and completion operations; natural resource and environmental planning; natural resource evaluation; governmental and regulatory negotiations; restoration and remediation; environmental planning, design, and operations specific to the energy industry in environmentally sensitive areas; water management planning; alternative analysis for managing produced water; beneficial use of produced water; water treatment analysis and selection; produced water disposal alternatives; contract negotiation with wastewater treatment companies accepting produced water; data management related to water and environmental issues; property transfer environmental assessments; assessing environmental issues/impacts associated with unconventional resource development; expert evaluation of alleged environmental impact from oil & gas activity and operations; and data management of oil and gas producing and related injection well data and information. He has given presentations, workshops and training sessions to groups and organizations on an assortment of related issues as well as provided his consulting expertise to hundreds of large and small clients – including several major international energy companies and government agencies.

As a petroleum/environmental engineer and senior project manager, Mr. Arthur's experience includes evaluating large scale resource plays, conducting implication analysis of new laws and regulations, evaluating options for developing resources (based on economics, environmental impacts, water management challenges, and other factors), and conducting analysis specific to broad program development. Mr. Arthur's experience uniquely qualifies him for dealing with the complex issues associated with projects and concerns of the energy, natural resource, and environmental industries. Mr. Arthur is a recognized expert in the areas of produced water management and environmental law/regulations. He has managed large multi-discipline projects, has completed more than 100 publications/presentations, and has been a distinguished lecturer on numerous topics.

Relevant Experience

The following information is intended to demonstrate Mr. Arthur's experience and qualifications:

Mr. Arthur is currently the Principal Investigator on four (4) research projects related to unconventional resource development and/or water. Two of the projects (for the U.S. DOE's NETL) are focused on shale gas water issues, including lifecycle water management in the Marcellus shale, water pre-treatment and post production treatment, cumulative impact analysis, shallow system naturally occurring natural gas analysis, and various related issues. The third project (for the U.S. DOE's NETL) relates involves investigation of alternate water supplies for coal fired power plants and the development of an on-line tool to be used by the power industry

for researching alternative water supplies. The fourth is being done for the Petroleum Technology Alliance of Canada (PTAC) and the Science and Community Environmental Knowledge (SCEK) Fund pertaining to the risks of hydraulic fracturing.

For Enduro Resources, a Fort Worth based energy company, Mr. Arthur serves as the Program Manager for all environmentally related issues facing Enduro, ranging from pits to air issues. This has included managing environmental assessments for new acquisitions, assessing environmental issues for both operated and non-operated sites, permitting, site development, etc. Most recently, Mr. Arthur is managing the due diligence for properties being acquired in two unconventional resource basins. As part of this work, both historic and more recent environmental issues are evaluated as well as assessing future potential issues. Mr. Arthur reports to various individuals within Enduro depending on the situation and/or issue, often including the President/CEO.

For a confidential law firm, Mr. Arthur has managed projects relative to shallow system naturally occurring methane and related alleged impacts to shallow groundwater and hydrogeological systems. Further, Mr. Arthur assessed and coordinated detailed analysis of testing, well completions, remedial activities, assessment activities, and planning. This has included evaluation of well completions (existing and proposed) in northeastern Pennsylvania and in both the Susquehanna River Basin and the Delaware River Basin.

For a confidential law firm, Mr. Arthur is serving as an expert in an East Texas case of alleged groundwater contamination from natural gas development operations. Mr. Arthur has managed research and investigation, site reconnaissance, water and gas sampling/analysis, and other activities associated with the complaint. This included coordination with the landowner, the Texas Railroad Commission, the insurance carrier, and other individuals and organizations.

For the New Mexico Oil & Gas Association, Mr. Arthur is currently serving as an expert on the proposed new rules for pits in the state. This has included review and assessment of proposed rules, providing comments/consultation, and assessment of the plausibility and environmental safety of the new proposed rules.

For a confidential client initiated development of unconventional oil resources (shale) in New Zealand, Mr. Arthur has managed an effort to assess development and regulatory strategies for development to occur in an environmentally safe and prudent manner. Activities also include review of various government and independently prepared documents and studies on issues such as hydraulic fracturing and site development, consultation, and compilation of data and information. Further, review of hydraulic fracturing procedures and designs were assessed and comments provided from an environmental protection standpoint for purposes of field implementation.

For a confidential client, Mr. Arthur is currently managing a water management study in the Eagle Ford Shale play of south Texas. The project is structured as a lifecycle water study ranging

from sourcing to final reuse and/or disposal. Regional demand constraints, regional supply constraints, area post fracturing constraints are included. Data collection has included obtaining information on water supply and disposal well capacities, aquifer production and management details, sustainable development of the Carrizo-Wilcox aquifer, regional and area demands and competition, surface water sourcing options, existing and emerging regulations, development plans, water requirements for fracturing (including chemistry and blending analysis), treatment alternatives, flowback analysis, reuse/recycling alternatives, NORM analysis, detailed water chemistry analysis, formation analysis (e.g., lignites and potential release of methane from source water aquifer), sustainable development alternatives, water transportation issues, alternative water sources (e.g., brackish water, industrial sources, etc.), drought analysis, permitting and timeline analysis, and other miscellaneous tasks and analyses.

For an industry coalition, including Chesapeake, Hess, Newfield, the Marcellus Shale Coalition, and API, Mr. Arthur is managing a project pertaining to new regulations being proposed by the Delaware River Basin Commission (DRBC) in the Northeastern United States. ALL was asked to provide a third-party objective analysis of the Commission's proposed regulations and to provide supporting information that could be used by the Commission in responding to comments. Some of the key analyses conducted during the study included detailed constraints analysis, permitting timeline analysis, economic impacts of the proposed rules, comparisons of the proposed rules to the Commission's regulation of other industries, a regulatory comparison of the proposed rules with other regulatory programs, impacts of the rules on resource development, detailed "line-by-line" comments, and a variety of other technical analyses. The document submitted to the Commission is available on ALL's web site at www.all-llc.com.

For a confidential client in Pennsylvania, ALL Consulting has been asked to independently manage the company's program related to dealing with shallow system stray gas (methane intrusion), including handling all complaints, evaluating potential sources and pathways (including production wells), coordinating activities with the State, coordinating investigations and well evaluations, coordinating well remedial work, coordinating sampling and environmental data collection, and all other activities. The area is being developed with more than 25 active drilling rigs. Mr. Arthur is serving as a Senior Consultant for this program.

For a confidential gas developer in East Texas, Mr. Arthur has managed an assortment of projects, including management of all environmental requirements for the company on a contract basis. This has included monitoring and evaluating new regulations, regulatory and government affairs activities, permitting & compliance activities, design of well pads and for environmental related projects (e.g., mitigation controls, pipeline crossings, injection wells, etc.), compliance testing (e.g., engine testing), water sourcing/disposal, emergency response, pipeline/safety, and other miscellaneous related activities.

For Southwestern Energy, Mr. Arthur has served as the Program Manager for various activities in the Fayetteville Shale of Arkansas. This has included permitting, evaluation of water and water treatment technologies, development of best management practices for handling and

management of produced water, support for impoundment siting/design/permitting, and regulatory evaluation. Mr. Arthur has providing consultation on several issues for development of the Fayetteville Shale.

For Apache Canada, Mr. Arthur served as the Project Manager and lead in an effort to provide environmental support and consultation regarding shale gas development in various regions of Canada. Mr. Arthur provided multiple training workshops to Apache Canada staff as wells as governmental staff from New Brunswick. This included review of the broad spectrum of environmental allegations gaining press in the United States related to shale gas development in plays such as the Marcellus, Fayetteville, Haynesville, Barnett, Woodford, Eagle-Ford, Collingwood, and Utica.

For a confidential client, Mr. Arthur has supported research and evaluation related to the possibility of injection induced seismicity for injection wells. Research on induced seismicity has encompassed North America and all known induced seismic events, including alleged cases resulting from enhanced oil recovery (e.g., waterflooding), geothermal wells, solution mining wells, brine disposal wells, hazardous/industrial waste disposal wells, and CO2 Sequestration wells. Analysis has included case study evaluation, pressure and geological analysis, volumetric analysis, zone of endangering influenced analysis and modeling, well test analysis, statistical and probability analysis, along with other technical analysis.

Mr. Arthur has been working with the Horn River Basin Producers Group (HRBPG) to provide general support/guidance and information related to public communications efforts for shale gas development in the Horn River Basin of northeastern British Columbia. For example, Mr. Arthur assisted with materials related to water use details in the basin, ranging from surface water use to saline groundwater supplies requiring treatment.

In 2009-2010, Mr. Arthur managed projects for several services seeking to enter into or expand their support to the unconventional gas industry. Further, some projects to this mix of clients has included advising companies on improving the environmental nature of their business. This has included trucking companies, railroads, water treatment companies, large integrated service companies, investment and marketing groups, and technology developers.

Continental Resources has been a client of ALL Consulting's for several years. ALL has conducted several type of projects for Continental over the years, including such things as well permitting, air permitting, compliance evaluations, environmental auditing, pilot projects, expert testimony with state agencies, water disposal, water sourcing, SPCC, etc. Mr. Arthur is currently managing a project in the Williston Basin of North Dakota related water sourcing challenges with the U.S. Army Corps of Engineers.

For Energy Corporation of America, Mr. Arthur provided assistance relative to the permitting of brine disposal wells in Pennsylvania and West Virginia. This included evaluating potential sites,

evaluating disposal zones and capacities, wells that could be converted, well testing performed, and preparation of materials for submittal to the U.S. Environmental Protection Agency.

For a confidential client, Mr. Arthur managed a project that involved critical analysis and benchmarking of water treatment alternatives in the Marcellus and Utica Shale. This included review of existing treatment technologies, existing systems, costs, environmental risks, and current/potential regulatory challenges and risks.

For a large international and confidential Oil & Gas client, Mr. Arthur managed a detailed benchmarking study of the major shale plays in the United States. The study was included environmental concerns, water issues, land and operational issues, and other issues of concern. Plays evaluated included the Marcellus, Collingwood, Utica, Antrim, Fayetteville, Woodford, Barnett, Eagle Ford, Niobrara, and Haynesville. The study was done in advance of leasing and acquisition to aid in decision-making. As part of the project, Mr. Arthur coordinated with technical and management staff and briefed the company's senior management team.

For the Independent Oil & Gas Association of New York, Mr. Arthur served as the Program Manager for an extensive effort of coordinating industry input and response to the New York Department of Environmental Conservation on the New York Supplemental General Environmental Impact Statement. This has included coordination of a multi-disciplinary team within ALL Consulting and coordination of input from several different industry participants.

For the Arkansas Oil & Gas Commission, Mr. Arthur has provided support and technical review of injection well permitting for brine disposal activities in the Fayetteville Shale of northern Arkansas. This has included review of permitting procedures, review of permits, and preparation of comments and recommendations on future permitting.

For a confidential energy client, Mr. Arthur is currently providing guidance and support relative to development of the Utica Shale, coal bed methane, and conventional gas in the Northeastern United States. This has included well evaluations relative to current and historic production activities, evaluation of potential development of coal bed methane and shale gas, and expansion of existing conventional gas throughout the area of interest.

For a large confidential Canadian Energy company, Mr. Arthur managed an effort to assist with evaluation of various shale plays in the United States, including detailed review of environmental issues, environmental laws and regulations, standard practices, water sourcing and disposal, horizontal drilling technologies, technologies and practices used for hydraulic fracturing, operational/development challenges, and other details. This included all of the major shale plays in the United States as well as emerging and developing plays.

Mr. Arthur has served as the Project Manager for a project performed for the Domestic Energy Producers Alliance (DEPA). DEPA is a new organization headed by Mickey Thompson Formerly OIPA Executive Director) along with Harold Hamm (Continental Resources) and others. ALL is

assisting DEPA in evaluating issues related to prices Oklahoma producers are getting for crude oil, pipeline limitations/issues, and other factors. This includes updating an economic analysis performed by ALL for the Northern Alliance of Independent Producers (NAIP), which Mr. Arthur was the Project manager.

For multiple energy industry exploration and production clients, Mr. Arthur has managed and technically supported a variety of projects. These have included supporting leasing activities, environmental assessments as part of property acquisitions, all types of permitting applicable to oil & gas operations, compliance support, support specific to enforcement actions, expert testimony, plan development (e.g., SPCC), environmental reporting (e.g., Tier II, Community Right-to-Know, permit reporting, etc.), emergency response, pit closures, impoundment and landfill design/siting, injection well design/permitting, water management and handling, hydraulic fracturing issues, regulatory and government affairs, training, federal requirement support (e.g., paying well determinations, federal exploratory units, etc.), coordination with state and federal agencies (e.g., OCC, BIA, BLM, USACE, MMS, etc.), wetlands delineation/permitting, archeological survey/clearances, ROWs, stormwater management/erosion control, production optimization, cost engineering, facilities design, NEPA and state environmental policy act support, along with support of many other issues. Mr. Arthur is a recognized authority in many areas has experience in every oil & gas producing state throughout the United States.

For multiple confidential coal bed natural gas (CBNG) and unconventional gas developers, Mr. Arthur serves or has served as the Project and Client Manager for services provided by ALL Consulting. Work performed has included support of development activities in Arkansas, Colorado, Kentucky, Louisiana, Maryland, Montana, New Mexico, New York, Ohio, Pennsylvania, Wyoming, Texas, Louisiana, Oklahoma, Illinois, Michigan, Virginia, West Virginia, and outside the United States. Mr. Arthur has managed and supported the preparation of Plans of Development (PODs); cradle-to-grave project cost analysis (including both capital and operational costs); permit applications; training; DOT pipeline compliance; economic and alternative analysis (including use of Monte Carlos simulation and other LCA modeling); water management planning/implementation/analysis; regulatory planning efforts; financial planning; MEPA/NEPA/SEQRA issues; engineering design; water treatment planning; expert testimony; and other issues relative to development activities. This has also include specification/design/management of "all" surface equipment (e.g., compressors, physical metering, well head configurations, etc), "all" subsurface activities/equipment (e.g., well drilling, tubulars, stimulation, etc.), and all other applicable contracts and/or decision processes.

Mr. Arthur managed a U.S Department of Energy (DOE) research project involving the preparation of a Primer on shale gas development throughout the United States. The project has involved analysis of natural gas supplies, the regulatory framework applicable to the oil & gas industry, geology and development approaches applicable to shale gas, and research and analysis related to a broad array of environmental issues. The environmental review included research on issues such as horizontal drilling, hydraulic fracturing, water sourcing, water management, water treatment/disposal, and other issues and impacts pertaining to issues such as transportation,

wildlife, stormwater, underground injection, noise, visual impacts, drilling in rural vs. metropolitan areas, etc.

For a confidential developer in Michigan, Mr. Arthur has and continues to provide both environmental and operational support on development of both conventional and unconventional resources. The project includes development of heavy oil, shale gas from the Antrim/New Albany Shale, and conventional oil development. Mr. Arthur has supported efforts working with both state and federal agencies, landowners, and production operations staff. This work is ongoing.

Mr. Arthur currently manages services provided by ALL to the largest and most active natural gas developer in the United States. Services have ranged from basic environmental permitting to high-level consultation to upper management on environmental, water sourcing, and water management/disposal issues (including water characterization, transport and treatment) for operations in 22 states. Unconventional natural gas development has been a priority and included analysis of all aspects of operations, especially those related to water. This has included water sourcing, transport, surface handling, hydraulic fracturing, gas and water production, handling of produced water, water treatment alternative analysis, analysis of municipal and third party water treatment companies, deep injection of produced water, cost analysis, related regulatory analysis, and a variety of related research. Significant work was also performed by Mr. Arthur and under his direction with regard to hydraulic fracturing, including design analysis, water and wastewater handling, water and chemical management, environmental impact/threat analysis, etc.

Mr. Arthur is currently the Principal Investigator on a DOE funded research project involving water treatment technology analysis and selection for use in the oil & gas industry for produced water. The project involves analysis of various treatment and beneficial use alternatives, developing a detailed catalog of produced water treatment technologies, and development of a model for use in identifying applicable treatment systems for a given quantity/quality of water and area. The project is being done in collaboration with the Ground Water Protection Council and several State Regulatory Agencies in various parts of the United States, including the Rocky Mountain and Appalachian States.

Mr. Arthur has managed a technical support contract with the U.S. Department of Energy's National Energy Technology Laboratory (NETL) in Tulsa, Oklahoma and Morgantown, West Virginia. Through this contract, ALL has performed multiple projects, including research relative to frontier and emerging unconventional gas development, stormwater regulations relative to the upstream oil & gas industry, produced water reduction methods, feasibility studies, TMDL modeling, well completion technology, naturally occurring radioactive materials (NORM), and other technical support projects.

Mr. Arthur has managed research which studied CBNG impoundments in the Powder River Basin of Montana and Wyoming. ALL's co-researchers include the Montana Board of Oil & Gas

Conservation (MBOGC), the Wyoming Department of Environmental Quality (WDEQ), DOE NETL (Morgantown, WV and Pittsburgh, PA), and the Bureau of Land Management (BLM).

In the active area of East Texas and Louisiana, Mr. Arthur has and continues to manage ALL's support of environmental and operational issues for active drilling programs for multiple confidential companies. Work has primarily been for gas development and has included both conventional and unconventional gas plays. This work includes serving as the environmental staff for smaller companies that do not maintain environmental or regulatory staff. Work has included wetland delineation studies, air permitting, SPCC plan development, emergency response for spills and unintentional releases, pipeline permitting, environmental due diligence on new acquisitions, Tier II reporting, injection well permitting and compliance, environmental auditing, interfacing with local government agencies as well as with river authorities, and various regulatory agencies. Mr. Arthur has conducted stormwater surveys, evaluated water resources, and laid out and designed well pads where necessary. Work in this area has essentially included a variety of tasks that were required for drilling and operational activities to move forward without delay.

Mr. Arthur currently serves as the lead technology expert on a U.S. Department of Energy Research efforts involving water resources, water treatment, and produced water. The project involves assessing unconventional water supply alternatives for coal fired power plants and coal mines on a national basis. This includes assessing water treatment alternatives, impacts to water resources, and regulatory barriers.

For a confidential large international Oil & Gas company, Mr. Arthur managed and worked with company staff on a variety of issues pertaining to unconventional gas development on a worldwide basis. This has included cost engineering on a comprehensive basis and including all components of a large development project, including operations, staffing, equipment selection, engineering/design practices, and optimization. Additionally, Mr. Arthur and a select team from ALL supported the company on issues such as water supply, water management, water treatment analysis/selection, wastewater disposal, regulatory analysis, equipment acquisition and leasing, vendor evaluations, safety considerations, and alignment with various company standards. Work involved projects in the United States and in several different countries that included areas of the Rocky Mountains, jungle environments, and remote areas of other countries having minimal infrastructure for oil or gas development.

Mr. Arthur provides technical support to multiple companies that are or are seeking to provide water treatment or commercial water handling of produced water. This has included treatment methods such as ion exchange, electrodialysis/electrodialysis reversal, electrocoagulation, reverse osmosis, floatation, and others. This has included addressing issues involving design, operation, compliance, engineering, and other aspects of treatment alternatives.

Mr. Arthur manages and provides senior consulting to ALL's work in the Cherokee Basin specific to unconventional gas development, primarily involving coal bed natural gas development. This

work has included supporting and advising clients on environmental, engineering and operations issues, including DOT pipeline requirements.

For the Montana Department of Natural Resources and Conservation (MDNRC), Mr. Arthur managed a data management project to develop a new comprehensive system to facilitate the management of data maintained by the MDNRC's Trust Land Management Division. The project was completed in approximately two (2) years and the system is currently utilized by the TLMD. The system addressed all areas of the TLMD's responsibilities and provided Mr. Arthur with an opportunity to gain a detailed understanding of how the TLMD functions. As part of this project, Mr. Arthur managed a multi-disciplinary team to address all resources managed by the TLMD, including oil & gas, mining, agriculture, recreation, etc.

Mr. Arthur currently has served as the Project Manager and Lead Engineer on an assortment of projects involving oil & gas operations in Wyoming, including a broad range of operations from large historic fields having nearly 100 years of operations to smaller less established areas. Due to the significant federal land and minerals in Wyoming, much of this work has involved coordination with many BLM field offices, BLM's State office, and work with other federal agencies as well as a myriad of state and local governmental and non-governmental organizations. Mr. Arthur's work has included collaborative research with the State of Wyoming's Governor's Office, the Wyoming Oil & Gas Conservation Commission, the Wyoming Department of Environmental Quality, the BLM, and dozens of oil & gas producing companies having operations in Wyoming. His experience includes work in areas such as the Greater Green River Basin, Elk Basin, Powder River Basin, and others. Some of the projects Mr. Arthur has been involved in include, but are not limited to, environmental assessments, plant decommissioning, site closure and reclamation, site remediation, permitting, environmental planning, engineering evaluations, design engineering, interfacing with various governmental entities, and more. Mr. Arthur is well versed with federal oil & gas and related resource management and environmental issues throughout the Wyoming and is expert with regard to the National Environmental Policy Act (NEPA).

While working in Oklahoma for an independent oil and gas producing company, Mr. Arthur was involved in many aspects of drilling, completion, and production operations for both production and injection wells throughout Oklahoma and northern Texas. In this position, he provided resident engineering services during design, drilling, construction, and acid stimulation of many potential production wells ranging from approximately 6,000 feet to approximately 11,000 feet in total depth. He also performed injection well feasibility studies, economic evaluations, well workover designs, reservoir calculations, and reserve estimates. He worked with numerous equipment vendors and suppliers of current technologies.

Mr. Arthur has continued to manage environmental projects provided to confidential oil & gas developers throughout the country. Projects have included preparation of SPCC plans, stormwater data collection and permitting, environmental audits, site reclamation evaluation and waste management; litigation support; acquisition support, environmental planning,

environmental permitting, preparation of applications for permit to drill, preparation of development plans, preparation of paying well determinations and participating area expansions, leasing support, exploration and exploitation support, water management, federal access, expert testimony, support of location exceptions and spacing, support of water rights issues, NEPA support, and other tasks.

For the Ground Water Protection Council, DOE, and BLM, Mr. Arthur managed a feasibility study which investigated alternatives for beneficially using produced water from CBNG development in the western states. An emphasis was placed on a five-state region, which included Montana, Wyoming, Colorado, Utah, and New Mexico. Through this study, water management and treatment alternatives were investigated in the field and multiple case studies were prepared. Further, regulatory and water rights issues were evaluated in cooperation with relevant local, state and federal agencies. A guidebook was prepared as a result of the project and serves as key reference for water management planning for CBNG development.

Mr. Arthur also worked for Halliburton Services in Oklahoma City, Oklahoma. While serving in this position he became familiar with standard and innovative well cementing practices and was involved in acid stimulations, well pressure transient and hydraulic testing, and formation isolation, fracturing and stimulation projects on approximately 300 wells.

Since 1999, Mr. Arthur has managed numerous projects and serves as the "Key Consultant" for a Consulting Services Agreement between ALL Consulting and Encore Acquisition Partners (www.encoreacq.com) - an independent oil and gas producing company based in Ft. Worth, Texas. Through ALL Consulting's relationship with Encore, the firm has provided an assortment of services, which include acquisition support, environmental permitting and compliance work, data management, reserve analysis and production certifications for tax incentive programs, remediation, waste management and remediation, and other miscellaneous activities as necessary. These services have been provided for all of Encore's properties with work occurring in several states and in Canada. Furthermore, Mr. Arthur has supported Encore with a variety of marketing and new venture projects. Mr. Arthur served as the Project Manager for all of the work provided by ALL Consulting to Encore.

For a commercial waste management company in the Williston Basin, Mr. Arthur served as the Project Manager and primary technical consultant supporting regulatory compliance, site closure, identification of a new site, and support of business operational practices. This has included technical evaluation of oilfield waste management and bioremem dation practices. Mr. Arthur provided high-level business management consultation to the company's management and assisted with legal issues facing the company.

For a large multi-national energy company, Mr. Arthur provided project management and consultation for business, operations and environmental planning for CBNG development activities in the Powder River Basin of Wyoming, including development in the Big George Coal. Additionally, Mr. Arthur managed the preparation and presentation of a detailed

workshop concerning CBNG activities and challenges in the Wyoming portion of the Powder River Basin.

For the American Petroleum Institute, Mr. Arthur managed the planning, coordination, and presentation of a national workshop on CBNG development nationally. The workshop was structured to attract attendees from across the nation and include speakers from government and industry addressing key issues facing the energy industry. Access to federal lands; regulatory challenges, and technical hurdles were key aspects of the workshop.

Mr. Arthur served as the Project Manager and Senior Technical Consultant for a statewide Oil and Gas/Coal Bed Methane Environmental Impact Statement and Resource Management Plan Amendment in the state of Montana. The project was done for the Bureau of Land Management and the State of Montana through a direct contract between ALL and the BLM. As the Project Manager, Mr. Arthur managed a team of more than twenty (20) technical specialists as well as coordinating with dozens of technologists and regulatory specialists throughout Montana and in the federal government. When the FINAL plan was issued in 2003 and ALL Consulting met every deadline for the project. The plan was heavily litigated and found to be technically adequate through 16 separate court judgments. Mr. Arthur has also made dozens of presentations and coordinated with Native American Tribes (Northern Cheyenne and Crow), various federal agencies, irrigators, ranchers, oil and gas producers, regulatory officials, and others through this process on a broad variety of technical issues. The overall cost of the project exceeded $1 million.

For the Bureau of Land Management, Mr. Arthur serves as a Senior Technical Consultant and Project Director for the preparation of a Resource Management Plan for the Miles City RMP area. The project encompasses a variety of resource issues for what is essentially the eastern third of Montana. Mr. Arthur's role in the project included project management support, technical and planning advisor to the project team and BLM, and he support project staffing and scheduling for the project. This project has included analysis of coal resources and evaluation of options for either shipping coal outside the state or generating power locally and transporting electricity via power lines. The current costs for this project are approximately $1.5 million.

For the Bureau of Land Management, Mr. Arthur served as a Senior Technical Consultant and Project Director for the Supplemental Environmental Impact Statement (SEIS) to the Statewide plan previously completed by ALL in 2003. The SEIS is a comprehensive plan addressing a broad range of resource areas and further addressing issues such as phased development, wildlife, water resources, and air quality in particular detail. The project included regional air modeling and coordination with dozens of state and federal agencies as well as non-governmental agencies, Native American Tribes, industry, and the general public. Because CBNG development has been stalled until this plan can be completed, it has been done on an accelerated schedule and required above average planning and coordination among all involved. The current costs for this project exceed $1.7 million.

For the U.S. Department of Energy, Mr. Arthur served as the Project Manager for a project to evaluate stormwater management practices specific to the oil & gas exploration & production (E&P) industry on a national basis and support efforts to derail U.S. EPA plans to increase the stringency of this program. The project was coordinated with E&P industry organizations, such as the American Petroleum Institute and the Independent Producers Association of America, and several state regulatory agencies. The project involved review and compilation of stormwater management rules and practices on a national basis, documents relevant to stormwater and the management and prevention of siltation to surface waters resulting from construction practices. An additional and critical component of the project involved ALL coordinating and leading a field tour of oil & gas operations and construction practices in the mid-continent for the U.S. EPA staffers leading EPA's efforts on their stormwater program. This project played an instrumental role eliminating federal stormwater requirements for the E&P industry.

For the U.S. Department of Energy, ALL Consulting supported two (2) separate projects supporting the United State's Annex III Agreement with China as pertains to the development of coal bed natural gas in the two countries. For these projects, ALL Consulting lead a presentation on coal bed natural gas development activities in the United States on issues including environmental, drilling, completion, exploration, regulatory, and others to a contingency of approximately thirty (30) Chinese Officials. The presentation was made in Washington, D.C. at the DOE's Office of Fossil Energy's Headquarters office. ALL also conducted a field tour for the Chinese contingency of CBNG development areas in the Power River Basin and San Juan Basin. Most recently, Mr. Arthur and Dr. Bruce Langhus (also of ALL Consulting) prepared and presented a workshop in China on a variety of CBNG and coal mine methane issues, including exploration, equipment design and selection, drilling, production operations, and other relevant technical issues.

Mr. Arthur serves as the Lead Researcher on three (3) separate research projects in association with the Interstate Oil & Gas Compact Commission (IOGCC). The projects are primarily funded by the U.S. Department of Energy's National Energy Technology Laboratory (NETL). The projects included evaluation of produced water management technologies associated with onshore oil & gas development; access to federal lands; and further developing methods for lessening impacts specific to natural gas and oil development. These projects included collaboration with dozens of local, state and federal agencies; energy companies; and non-governmental organizations.

For Shell Western E&P, Inc. (SWEPI), Mr. Arthur managed a large project for major oil producing field in the Rocky Mountain Region of the United States. The project generally involved petitioning the U.S. EPA for a regulatory exemption for SWEPI's operations. The project's goal was to eliminate or substantially reduce regulatory requirements, including monitoring and area of review requirements applicable to approximately 280 Class II injection wells and several hundred oil and gas producing wells. Another goal of the project was to substantially reduce review and issuance times on injection well related permits. Mr. Arthur's role in the project was to serve as a primary negotiator with regulators and assist SWEPI

personnel in the preparation of the petition. Petition preparation included the review and analysis of several hundred drill stem tests, geophysical logs, various maps and reports, and interviews with a variety of personnel experienced with the hydrogeological setting in the area. Furthermore, numerous tasks were required for the petition, including generating more than 100 maps of various types, performing statistical analyses, and detailed geologic and hydrogeological analyses.

Also for SWEPI, Mr. Arthur managed a project to petition the EPA to decrease unnecessary regulatory requirements for the operation of approximately sixty (60) Class II injection wells operated by SWEPI in Michigan. As part of this project, Mr. Arthur held negotiations and numerous discussions with EPA staff in Region V as wells as representatives from the Michigan Geological Survey. Regulatory reduction areas targeted by the petition included requests to reduce monitoring and reporting requirements for active wells, reduce and modify monitoring, reporting, and testing requirements for idle/shut-in wells, elimination of unnecessary injectate analyses, and other minor requirements that provided no environmental benefit. The project also included developing an electronic data management system to facilitate data storage and analysis, which could also be used by SWEPI to automatically perform required EPA reporting and track potential non-compliance activities. Mr. Arthur has also assisted SWEPI on regulatory cost reduction efforts in California, Texas, Louisiana, and Montana.

For a confidential industrial client in northwest Michigan, Mr. Arthur provided reservoir management and well services. The industrial operation involved the production of mineral laden brine, which is striped of select minerals. The resultant striped brine is then re-injected into the source reservoir to enhance brine recovery rates. As part of this project, Mr. Arthur provided assistance in managing the operation of the reservoir, providing efficiency analyses, performing prediction analyses pertaining to the expected life of production wells, and evaluation of reservoir fluid levels to assure protection of underground sources of drinking water. This project also included evaluation of dilapidated nearby wells that may be within the area of endangering influence and the use of sophisticated modeling to perform long-term analyses to allow for plant financial planning.

For the Montana Petroleum Association, which is composed of oil and gas companies operating in Montana and includes Shell Western E&P, Inc., Meridian Oil Company, JN Oil Company and is part of the Rocky Mountain Oil & Gas Association, Mr. Arthur managed a project involving the successful pursuit of gaining primary regulatory authority over the Class II UIC program by the Montana Board of Oil and Gas Conservation (MBOGC). This project involved review of primacy application efforts at various states throughout the country, preparing the primacy application, coordination with MBOGC staff and Board members, and negotiating with EPA personnel on behalf of the MBOGC in regards to primacy delegation. Included in the primacy application effort was the development of a Class II Underground Injection Control Program, which was used to satisfy Section 1425 of the Safe Drinking Water

Act. As a result of Mr. Arthur's efforts on this project, the MBOGC successfully obtained Class II UIC primacy in November of 1996.

Through a direct contract with the Kansas Corporation Commission's (KCC's) Oil & Gas Conservation Division (OGCD), Mr. Arthur has provided assistance with an effort by the state to migrate the various databases maintained by the KCC to the Risk Based Data Management System (RBDMS). This project has included training, system setup, data handling and reformatting, data translation, and data migration. The RBDMS program used by the KCC was developed by ALL Consulting as a PC-Based comprehensive fully-relational, normalized electronic data management system designed for oil and gas state regulatory agencies and industry. Twenty state agencies and assorted private industry groups currently rely on RBDMS to maintain oil and gas and associated injection well data. Mr. Arthur has worked on similar project in virtually every oil and gas producing state throughout the United States.

For a confidential major oil and gas producing company, Mr. Arthur provided engineering and regulatory support of a proposed aquifer exemption on Alaska's North Slope. Mr. Arthur's role in the project included reviewing engineering and hydrogeological studies and data pertaining to the exemption of aquifers to facilitate disposal of wastewater via Class I injection wells. He also provided regulatory guidance on pursuing and obtaining the exemption, preparing the exemption petition, and related construction and permitting of proposed injection wells.

For a major oil company, Mr. Arthur conducted an investigative study to determine the feasibility of potential salt water disposal options for a proposed coal bed methane extraction field in Alabama. During construction of a pilot well, the targeted injection zone was found to have formation water with total dissolved solids (TDS) concentrations of approximately 1,800 mg/l at a depth of nearly 10,000 feet. As a result of the low TDS concentrations in the proposed injection zone, the potential feasibility of utilizing the zone if exempted and the feasibility of petitioning the EPA for an aquifer exemption were evaluated. The evaluation resulted in additional pilot wells being drilled to confirm the projects feasibility.

For the Solution Mining Research Institute (SMRI), Mr. Arthur managed a research project pertaining to external mechanical integrity (EMI) testing of Class III salt solution mining wells. The project was divided into three phases, including performing a detailed literature search and information review (including previously performed tests); developing and EMI testing manual for use by well operators and regulatory agencies; and presenting the manual to the SMRI membership. The manual provided information and guidance on how to prepare and select testing methods; quality control standards and specifications; listings of necessary background and well construction information; procedural standards for various tests; recommended methodologies for interpreting/evaluating tests; advantages, disadvantages, and limitations of tests; and regulatory testing requirements or guidelines. The manual also included details on numerous testing methods, including information on similar logging tools offered by different logging companies.

For a confidential client in Arkansas, Mr. Arthur coordinated the plugging and abandonment of approximately 60 abandoned wells in the state. Mr. Arthur served as technical expert and provided testimony to the State of Arkansas on abandonment procedures and successfully achieved obtaining a variance on plugging procedures which has resulted in substantial savings to the client and has not sacrificed any environmental protection concerns. Mr. Arthur also served as lead investigator and designer for investigative activities, which included performing a detailed geophysical investigation of the area and designing well plugging procedures.

For a major salt mining and manufacturing company, Mr. Arthur developed and modified a new approach for external MI testing for 5 Class III salt solution-mining wells in St. Clair, Michigan. The new (or modified) testing program was developed to account for the unique nature of some of the Class III wells that had been completed into a salt cavern and utilized as both injectors and producers. The testing included the use of a single pass temperature log under static well conditions and compared the resultant log to temperature logs collected from nearby wells to assure thermal stabilization at tested wells had occurred, to assist in the external MI interpretation, and to assist in resolving lithologic and hydrogeologic effects predominant in the area. Comparisons were performed in area wells having multi-pass and single pass temperature with varying stabilization periods and on wells completed with and without tubing. A detailed hydrogeological evaluation was also done to establish how temperature logs would be affected by the local geology and hydrogeology at the site. EPA in Region V approved the methodology, procedures, and test results.

For the Ground Water Protection Council, Mr. Arthur presented several workshops and demonstrations pertaining to the RBDMS project as part of an aggressive technology transfer initiative. Workshops ranged from being very brief (a few hours) to multiple days and were given to state, federal, and private industry representatives. The presentations and workshops provided under this project have included the American Petroleum Institute, U.S. Department of Energy, U.S. Environmental Protection Agency, Bureau of Land Management, U.S. Geological Survey, Alaska Oil & Gas Conservation Commission, Arkansas Oil & Gas Commission, California Division of Oil, Gas, and Geothermal Resources, Mississippi State Oil & Gas Board, Montana Board of Oil & Gas Conservation, Ohio Department of Natural Resources, Texas Railroad Commission, New Mexico Oil Conservation Commission, Oklahoma Corporation Commission, Kansas Corporation Commission, and numerous oil and gas producing companies (majors and independents).

For a confidential client, Mr. Arthur completed a full-scale evaluation and assessment of a Class I hazardous waste injection well system in northwest Indiana. The effort included review and evaluation of the facilities hazardous waste land ban petition (including modeling), well construction details and records, long-term monitoring data, well workover data and reports (including those related to well failures), mechanical integrity tests, injection well permits, related and technical publications and literature. Mr. Arthur also provided

estimations for long-term operating costs of the well system (including the potential for well replacement costs), including preparation of plans should any particular well go out of service.

For a large industrial client in the southeastern portion of the United States, Mr. Arthur provided engineering and regulatory assistance in support of a proposed major aquifer exemption for a Class I industrial waste injection well. As part of the aquifer exemption process, Mr. Arthur gathered statistical information pertaining to aquifer exemptions nationally and has met and interfaced with both State and Federal regulatory officials. Mr. Arthur also worked with regulatory officials and client representatives to define the scope of required submittals in the aquifer exemption petition. In addition, Mr. Arthur spearheaded negotiations with upper level management in the Underground Injection Control Programs from EPA's Region IV and EPA Headquarters offices.

For the City of Enid, Oklahoma, Mr. Arthur has provided "Technical Expert Services" pertaining to the development and negotiation of agreements between the City and oil and gas producing companies operating within the boundaries of the City's sole source water supply wellfield. As part of this project, Mr. Arthur reviewed detailed production reservoir and injection zone information and analyses, developed operating practices, well construction specifications, surface facility specifications, testing requirements for injection well operations in this sensitive area of northern Oklahoma. Mr. Arthur's role in this project also included witnessing construction and testing operations, testifying to members of the City Council, and consulting with the City Attorney and technical staff. Since the development of the initial agreement for this project, other cities and municipalities in Oklahoma have requested the agreement and used the agreement as a baseline from which to develop similar type agreements.

For the South Florida Water Management District (SFWMD), Mr. Arthur provided regulatory support and technical guidance for a proposed regional aquifer exemption that would permit reclaimed water injection and recovery into brackish water bearing aquifers in south Florida. Throughout the project, Mr. Arthur also prepared material in support of the exemption, reviewed both state and federal regulatory statutes applicable to aquifer exemptions, endangerment to underground sources of drinking water (USDWs), and how classifications of USDWs vary nationally. Mr. Arthur also researched the legislation that ultimately led to the aquifer exemption variance clause, which is now in the Code of Federal Regulations.

For the Ground Water Protection Council, Mr. Arthur managed a project involving the preparation of a technical handbook pertaining to mechanical integrity testing methods applicable to Class II injection wells. The handbook was used in a national seminar series presented by the Ground Water Protection Council and will be structured for presentation to both industry and regulatory professionals. Mr. Arthur served as one of the instructors for the seminar series.

Through an indirect contract with the United States Environmental Protection Agency, Mr. Arthur completed the evaluation of external mechanical integrity demonstrations for approximately twenty-five (25) Class I hazardous waste injection wells all located in Texas. Evaluations were focused toward the review and interpretation of radioactive tracer surveys and logging methods used for assessing cement bonding (including cement bonds logs, segmented bond tools, ultrasonic imagery tools, cement evaluation tools, pulsed echo tools, etc.) Reviews and interpretations were documented and forwarded to the EPA in Region VI through the Prime Contractor. The project provided Mr. Arthur with an opportunity to evaluate numerous logs performed by a variety of logging companies for a wide variety of well construction types. Levels of documentation and log presentation as well as interpretations were also reviewed/evaluated when available.

Mr. Arthur has managed several injection well projects for the City of St. Petersburg, Florida. These projects have included all facets of the City's injection system program. The City of St. Petersburg's injection system consists of ten Class I municipal injection wells located at four separate injection facilities, with a total combined maximum injection capacity of approximate 60 million gallons per day. These injection wells serve as a backup to the City's reclaimed water irrigation system and utilize an injection zone consisting of a highly fractured dolomite. A semi-confining layer of low permeability carbonates contains the reclaimed water injected in St. Petersburg. As part of an ongoing monitoring program at these facilities, Mr. Arthur has conducted detailed evaluations at each of the St. Petersburg sites to determine the effects of reclaimed water injection on the hydrogeologic systems. Data and information considered in these evaluations include monitoring well hydraulic and geochemical data, injection well flow and pressure data, injection well hydraulic testing data, area and regional geologic and hydrogeologic data, tidal data, reclaimed water (i.e., injectate) data, rainfall data, mechanical integrity results, and numerous applicable publications from such agencies as the United States Geological Survey (USGS), the Southwest Florida Water Management District (SWFWMD), Environmental Protection Agency (EPA), and others. In addition to support permitting and reclassification efforts, geochemical analysis (including geochemical modeling and sample analysis), environmental risk assessments, well inventories (including field verifications), and regional water use surveys were conducted under Mr. Arthur's supervision.

As a result of the above detailed engineering evaluations for the injection wells in St. Petersburg and as part of a preventive maintenance program, Mr. Arthur also has designed, conducted, and evaluated acid treatment programs (i.e., well stimulations) for the City to restore injection capacities. These stimulations have resulted in injection capacity restorations of over 300 percent. In fact, capacities at some wells have exceeded original "pre-injection" capacities.

For the City of St. Petersburg, Mr. Arthur assisted in the development and provided resident engineering services for sensitivity testing of a new alternative mechanical integrity testing method in Florida. The new alternative test was used for the first time to demonstrate both internal and external integrity of two (2) 30-inch diameter municipal injection wells at the

City's Northwest Water Reclamation Facility (WRF). The sensitivity testing and demonstrations conducted at these wells resulted in significant savings to the City of St. Petersburg and ultimately, approval of the test by the State. During the sensitivity testing, a leak detection capability of 0.1 gpm was demonstrated. Confirmation of the test's effectiveness and overall usability was confirmed during additional testing conducted at the City's Southwest WRF's by the U.S. EPA and in confirmation testing which compared sensitivities of the test with the results of the standard packer pressure test. The test has now been used on ten (10)Class I municipal injection wells in Florida.

For a confidential industrial client, Mr. Arthur served as task manager and lead Hydrogeologist for the feasibility evaluation (including modeling), design, permitting, construction, and testing (including mechanical integrity) of a Class V aquifer remediation injection well in Citrus County, Florida. The injection well was part of a comprehensive plan designed to remediate an aquifer contaminated with organic compounds within an area having karst features and significant tidal and regional hydrogeologic influences. This project was of particular interest because it involved a city municipal well field that was being potentially threatened by the contamination, and due to the high transmissiveness of the aquifer, extraction rates of up to 500 gpm were proposed. In addition to the injection well portion of the project, Mr. Arthur was responsible for the installation of monitoring wells for delineation of the horizontal and vertical extent of contamination; recovery well design and construction; preparation of technical reports supporting the contamination assessment and injection well permitting efforts; regulatory negotiations; and related hydrogeologic assessments of the site pertaining to both the contamination assessment and injection well feasibility evaluation.

For a confidential Southwest Florida Utility Company, Mr. Arthur served as technical lead and was one of two resident engineers involved with the conversion of a deep exploratory well (3,500 feet) and water supply well (700 feet) to a Class I municipal injection well (3,000 feet) and dual zone monitoring well (2,300 feet), respectively in Port Charlotte, Florida. Mr. Arthur was responsible for analysis of reverse-air drilling samples; preparation of daily and weekly construction reports; observation of construction and testing activities (including geophysical logging and the mechanical integrity demonstration); geologic sample description; routing of contractor submittals; processing of contractor pay requests; and preparation of the final injection well report and operation and maintenance manual.

For the same utility company, Mr. Arthur managed the feasibility evaluation, design, and permitting of a test injection and monitoring well system at a separate site in western Charlotte County, Florida. Additionally, after a detailed area of review (AOR) evaluation, a number of wells were found to penetrate potential confining units; an exploratory oil test well discovered during the AOR investigation was found to penetrate through the injection zone itself. As a result, a corrective action plan was prepared to plug and abandon these wells in a sound technical manner which would still allow construction and utilization of the injection well system.

Because of his extensive experience with MI testing methodologies, especially the oxygen activation (OA) log, Mr. Arthur was asked to evaluate technical reports pertaining to the use and testing of the OA log by EPA's Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma. The reports, prepared by the lab, were a result of extensive testing performed at experimental wells maintained by the EPA. Mr. Arthur also was extensively involved in the development and initial field-testing of the OA log as a method of demonstrating external MI while working for the EPA in Region V and as a member of the EPA's National Mechanical Integrity Test Workgroup. While working in the EPA's Region V office, Mr. Arthur was the prime author of the federal register notice giving interim approval to the OA log.

Mr. Arthur has managed an assortment of projects for a Class I industrial injection system in Pensacola, Florida for American Cyanamid Company (now Cytec Industries). Some of the tasks Mr. Arthur has performed include planning, performing, and evaluating internal, and external MI testing at the facilities' two Class I wells; evaluating the effectiveness of the annular monitoring systems for the injection wells; development of plugging and abandonment plans and procedures (including cost estimates); providing technical support for the facilities' state water quality exemption and federal aquifer exemption; and review of monitoring data from both the injection and monitoring wells. He also provided technical support during regulatory negotiations and Technical Advisory Committee (TAC) meetings.

For the Englewood Water District in Sarasota County, Florida, Mr. Arthur managed and provided resident engineering services for mechanical integrity testing of a Class I injection well. The well is used to dispose of reverse osmosis concentrate and utilizes fiberglass-reinforced plastic as the final and innermost casing. As part of the mechanical integrity demonstration, both internal and external integrity of the well were established with only minimal disruption to ongoing plant activities. Mr. Arthur coordinated work efforts with representatives of the Federal Department of Environmental Regulation (FDER) and prepared the final engineering report, which summarized the test results.

For a confidential client, Mr. Arthur managed and completed a feasibility study for a proposed Class I industrial waste injection well in DeSoto County, Florida. The study included evaluating regional and area hydrogeologic and geophysical data in southwest Florida and DeSoto County, Florida. Waste characterization and preliminary injection and monitoring well design were prepared as well as sequential construction procedures and a well inventory. The project required coordination and data acquisition from several state and federal agencies.

For a confidential client, Mr. Arthur performed a preliminary feasibility study and conceptual design of a Class I industrial waste injection well to be located in central Illinois. The study and design included reviewing construction and operating data for existing Class I and II wells in the area, Illinois EPA regulations and requirements, and numerous publications pertaining to the geologic framework and operations of injection wells in the region.

Prior to beginning his consulting career, Mr. Arthur worked as an Environmental Engineer for EPA in Region V (Chicago, Illinois). He was responsible for enforcement and compliance activities relating to the Safe Drinking Water Act (SDWA) as amended and applicable 40 Code of Federal Regulations for the Underground Injection Council (UIC) Program. Mr. Arthur was involved extensively with the enforcement, permitting, tracking, construction, testing, and plugging of Class I through V injection wells in Region V. He has reviewed numerous hydrogeologic studies to verify the effects of injection on underground sources of drinking water (including aquifer exemption petitions) and was the prime author of the regional guidelines for mechanical integrity testing and plugging and abandonment for the UIC program.

Part of Mr. Arthur's responsibilities as an environmental engineer with Region V included coordinating the field programs in Michigan and Indiana; evaluating all plugging and abandonment plans and providing oversight decision-making during pluggings; reviewing MI demonstrations; reviewing UIC permit applications; and evaluating injection well operation of various well types for compliance with federal UIC regulations. Throughout Mr. Arthur's career with EPA, he witnessed or was involved with more than 500 MITs, 400 well pluggings and plugging and abandonment plans, and personally performed more than 150 site inspections of various types on Class I through V injection wells.

As part of Mr. Arthur's responsibilities as a regional compliance officer for EPA, he was involved in multi-media site inspections to federal facilities with EPA personnel from other programs and with UIC contract field inspectors. He also conducted site inspections at two federal facilities where several types of Class V wells were identified, including storm water disposal wells and others. During the site inspections, these wells were generally evaluated for non-compliance or endangerment to USDWs. In addition, Mr. Arthur inspected storm water drainage as well as other types of Class V wells at industrial facilities in Michigan and Indiana.

While employed with EPA in Region V, Mr. Arthur was a member of the National Mechanical Integrity Test (MIT) Workgroup. As a member of the workgroup, he was responsible for witnessing and evaluating numerous alternative mechanical integrity (MI) testing methods for various types of wells throughout the country. During Mr. Arthur's tenure in the MIT workgroup, he reviewed over twenty (20) proposed alternate MI testing methods and took a lead role in ultimate approval of several tests, including the Oxygen Activation log and the Dual-Completion test.

Mr. Arthur is familiar with several techniques and methods used to identify USDWs and has evaluated aquifer exemption proposals relating to UIC permit applications and injection well permit modifications. He has evaluated engineering studies regarding maximum allowable injection pressures and area-of-review (AOR) investigations for injection well projects in Illinois, Indiana, Michigan, and Ohio. During these studies, the effects of injection were evaluated to determine the maximum injection pressure allowable while not propagating vertical fractures, endangering improperly plugged or constructed wells, or causing

contamination to USDWs in the AOR. As part of the permitting evaluation, he reviewed and evaluated several AOR proposals and the potential effects that injection might have on wells within the AOR for a variety of well completion types and under varying geologic and hydrogeologic settings.

Mr. Arthur provided technical assistance to EPA regional coordinators for EPA's hazardous waste "land ban" effort for deep well injection and is familiar with its associated regulations and requirements. While a part of Region V's land ban review team, he was responsible for land ban petitions at three hazardous waste injection facilities in Michigan and for reviewing and approving certain section of petitions, including mechanical integrity and other sections of petitions in Michigan, Ohio, Illinois, and Indiana. Mr. Arthur also witnessed numerous injection well hydraulic and integrity testing demonstrations for the petition process.

As the technical liaison between Region V's Enforcement and Program Management Units, Mr. Arthur was involved in primacy state audits and evaluations. His involvement in the Illinois Department of Mines and Minerals resulted in significant changes to the existing State Class II UIC program. Mr. Arthur provided technical support to primacy state agencies on a number of issues and on a variety of well classes. For example, he organized technical review teams, including the National MIT Workgroup and Region V MIT Committee, to evaluate potential mechanical integrity tests for Class II annular disposal wells in Ohio.

Mr. Arthur was involved in several administrative and criminal enforcement cases while working for the EPA in Region V. The most significant criminal case Mr. Arthur was involved in resulted in the first criminal conviction stemming from violations related to the SDWA as amended. For the case, Mr. Arthur prepared technical reports, briefings, and other material for the Office of Criminal Investigation. Mr. Arthur was involved in numerous other informal and formal enforcement cases for a wide variety of violation types and complexities. In addition, Mr. Arthur provided technical support and consultation for both enforcement case negotiations and settlements.

Professional Organizations:

Society of Petroleum Engineers
Society of Professional Well Log Analysts
American Association of Petroleum Geologists
Ground Water Protection Council
International Association of Hydrogeologists
Southeast Geological Society
Montana Geological Society
Society of American Military Engineers
The Nature Conservancy
Sierra Club
National Ground Water Association

J. Daniel Arthur, P.E.

Recent Publications:

Arthur, J. Daniel, Hochheiser, H.W., Coughlin, B.J. (ALL Consulting). "State and Federal Regulation of Hydraulic Fracturing: A Comparative Analysis." Society of Petroleum Engineers Hydraulic Fracturing Conference, The Woodlands, Texas, January 24-26, 2011.

Arthur, J. Daniel (ALL Consulting). "Summary of Environmental Issues, Mitigation Strategies, and Regulatory Challenges Associated with Shale Gas Development in the United States and Applicability to Development and Operations in Canada" Canadian Unconventional Resources and International Petroleum Conference (CURIPC), Calgary, Alberta, Canada, October 20th, 2010

Arthur, J.D. (ALL Consulting), "A Comparative Analysis of Hydraulic Fracturing and Underground Injection", Presented at the GWPC Water/Energy Symposium, Pittsburgh, Pennsylvania, September 25-29, 2010.

Arthur, J.D., Roberts, J., Alleman, N., Alleman, D. (ALL Consulting), "Use of Oil and Gas Produced Water for Power Plant Cooling.", Presented at the GWPC Water/Energy Symposium, Pittsburgh, Pennsylvania, September 25-29, 2010.

American Energy and Environmental Research Foundation (AEERF), *The Environmental Cost of Energy*, Presented at GWPC Annual Forum and Water/ Energy Symposium, Pittsburgh, PA, September 26-29, 2010.

Arthur, J. Daniel (ALL Consulting). "Water and Shale Gas Development." National Association of Royalty Owners (NARO), Water for Shale Gas Development, National Convention, Pittsburg, PA, October 07, 2010.

Arthur, J.D. (ALL Consulting). "Water Issues in the Marcellus Shale." Society of Petroleum Engineers (SPE), Denver, Colorado, April 2010.

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Arthur, J.D., Langhus, B., Alleman, D., "An Overview of Modern Shale Gas Development in the United States". Presented at the Society of Petroleum Engineers Annual Environmental Conference, San Antonio, Texas, March 2009.

Arthur, J.D., "Environmental and Water Management Challenges Associated with Development of Unconventional Shale Gas Resources", Presented at the Society of Petroleum Engineers Annual Environmental Conference, San Antonio, Texas, March 2009.

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Arthur, J.D. (ALL Consulting), Gray, E. (Chesapeake Energy), Bockelmann, D. (ALL Consulting), "Natural Gas Development & Production from the Marcellus Shale". Presented to the Nature Conservancy, Eastern Groups, December 2008.

Arthur, J.D., "Environmental Considerations Related to Hydraulic Fracturing of Horizontal Gas Wells of the Marcellus Shale". Presented at the Ground Water Protection Council Annual UIC Conference, San Antonio, Texas, January 2009.

Arthur, J.D., "Hydraulic Fracturing of Marcellus Wells Poses Little Danger to Water". Article published in the Practical Operator, a publication of the Pennsylvania Oil & Gas Association, July-September 2008.

Arthur, J.D., Bohm, B., Coughlin, B., Layne, M., "Evaluating the Environmental Implications of Hydraulic Fracturing in Shale Gas Reservoirs". Presented at the 2008 International Petroleum & Biofuels Environmental Conference, Albuquerque, NM, November 2008.

Bohm, B., Arthur, J.D., Langhus, B., "Observed Impacts to Groundwater Resulting from the Operation of CBNG Impoundments". Presented at the 2008 International Petroleum & Biofuels Environmental Conference, Albuquerque, NM, November 2008.

Arthur, J.D., "Prudent and Sustainable Water Management and Disposal Alternatives Applicable to Shale Gas Development". Presented at the Produced Water Society 20098 Annual Conference, Houston, Texas, January 2009. Also presented at the Ground Water Protection Council Annual UIC Conference, San Antonio, Texas, January 2009

Arthur, J.D., Bohm, B., Coughlin, B., Layne, M., "Hydraulic Fracturing Considerations for Natural Gas Development of the Fayetteville Shale". Presented at the Arkansas Environmental Federation 2008 Annual Meeting, Hot Springs, Arkansas, November 2008.

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Arthur, J.D., Alleman, N., "Produced Water and Global Climate Change". Presented at the Ground Water Protection Council 2008 Annual Forum, Cincinnati, OH, September 2008.

Arthur, J.D., "Treatment and Management Technologies Applicable to Produced Water in Mature Fields". Scheduled for presentation at the Society of Petroleum Engineers' Produced Water Handling and Disposal Workshop, Port of Spain, Trinidad and Tobago, June 2008.

Arthur, J.D. and Langhus, B.G., "Current and Evolving Issues Pertaining to Produced Water and the Ongoing Development of Coal Bed Methane". Scheduled for presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

Langhus, B.G and Arthur, J.D., "Green House Gas Emission Transactions and CBM/CMM". Scheduled for presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

Langhus, B.G., Crissup, J., Arthur, J.D., Bohm, B., "Siting, Design, Construction and Reclamation of Coal Bed Natural Gas Impoundments". Scheduled for presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

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Arthur, J.D., "Impacts of More Stringent Water Discharge Rules in the Powder River Basin". Presented at the Wyoming Environmental Quality Council Meeting, Cheyenne, Wyoming, January 2007.

Arthur, J.D., Winter, D., Bohm, B., "Federal Land Access and NEPA: The Need for Oil & Gas Specific NEPA Technical Information". Presented at the Interstate Oil & Gas Compact Commission Meeting, Austin, Texas, October 2006.

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Arthur, J.D., Carl, M., Langhus, B.G., Crissup, J., Bohm, B., "Management of Produced Water from Onshore Oil & Gas Operations Using a Watershed Analysis Tool". Presented at the Interstate Oil & Gas Compact Commission Meeting and the Ground Water Protection Council Meeting. 2006.

Arthur, J.D., Langhus, B.G., "Engineering Environmental Excellence in the Rocky Mountain West: A Case Study of the Cedar Creek Anticline". Presented at the Interstate Oil & Gas Compact Commission Meeting, Billings, Montana, May 2006. Also presented at other venues (2006-2007).

Arthur, J.D., Richmond, T.P., "Coal Bed Natural Gas Development in the Power River Basin: Local Objections vs. National Impacts. Presented at the International Petroleum Environmental Conference, Houston, Texas, November 2005.

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Arthur, J.D., "Overview of Heavy Oil in Michigan". Presented at the Ground Water Protection Council, January 2005.

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Arthur, J.D., "Sputnik Resources Michigan Heavy Oil Project". Presented to the Michigan Department of Environmental Quality, Lansing, Michigan, October 2004.

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Arthur, J.D., "Analysis of the Powder River Basin's Tongue River and the Imminent Development of Coal Bed Methane". Presented at the Ground Water Protection Council, New Orleans, LA, 2003.

Arthur, J.D., Halvorson, J., "Montana Internet Data Access System". Presented at the Independent Petroleum Association of Mountain States 2003 Energy Technical Conference, Denver, Colorado, January 2003.

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Arthur, J.D., "Coal Bed Methane Produced Water Management and Beneficial Use Alternatives". Presented at the SPE Environmental Conference, 2003. (also presented at the Strategic Research Institute Workshop, February 2003).

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J. Daniel Arthur, P.E.

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Arthur, J.D., Langhus, B.G., Richmond, T., Halvorson, J.W., "Status of the Montana Statewide Environmental Impact Statement and Amendment to the Billings and Powder River RMP". Presented at the Montana Petroleum Association Annual Meeting, Billings, Montana, 2001.

Arthur, J.D., Langhus, B.G., Richmond, T., Halvorson, J.W., Bohm, B., "Coal Bed Methane Development in the Powder River Basin". Presented at the Ground Water Protection Council Semi-Annual Meeting, Reno, Nevada, 2001.

Arthur, J.D., "Environmental Due Diligence, Scope of Review, Oilfield Considerations". Presented at Louisiana State University/Texas Mineral Law Workshop, November 2000.

Arthur, J.D., "An Introduction and Update of the Risk Based Data Management System". Presented at the TNRCC Annual Environmental Conference, Austin, Texas, 2000.

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Arthur, J.D., Freeman, B.D., "Aquifer Exemptions: Wise Use of Environmental Protection Resources". Technical Reviewers included Bryson, Bill (Kansas Corporation Commission), Mullican, Jerry (Texas Railroad Commission), Roberts, Paul (Nebraska Oil & Gas Conservation Commission), Warner, Don (University of Missouri-Rolla), Litzen, Lori (Shell Western E&P, Inc.), Noble, Roger (CH2M HILL, Inc.). Accepted for presentation at the Society of Petroleum Engineers/United States Environmental Protection Agency Environmental Conference, Houston, Texas, March 1995.

Arthur, J.D., "Mechanical Integrity Testing of Injection Well Tubulars". Special topics article for the American Oil & Gas Reporter, September 1994 Issue.

Arthur, J.D., Micheau, M.D., "Utilization of Modified Temperature Logging Methods for External Mechanical Integrity Testing on Class III Salt Solution Mining Wells". Presented at the Spring Meeting of the Solution Mining Research Institute in Syracuse, New York, April 25 - 27, 1993.

Arthur, J.D. "Implementation of Formal Environmental Risk Management Practices into a Class II UIC Program". Presented at the Underground Injection Practices Research Foundation/U.S. DOE Symposium on Class II Injection Well Management and Practices, Houston, Texas, November 1992.

Arthur, J.D. "Aquifer Exemptions for Injection Wells: An Overview". Presented at the Underground Injection Practices Research Foundation/U.S. DOE Symposium on Class II Injection Well Management and Practices, Houston, Texas, November 1992.

Arthur, J.D. "The Underground Injection Practices Research Foundation's Risk Based Data Management System Project - An Overview." Presented at the Ground Water Protection Council's Winter Meeting. Corpus Christi, Texas. January 1992.

With Thornhill, J. and Williams, T.M. "Oxygen Activation Logging as a Method of Demonstrating External Mechanical Integrity of Injection Wells." Presented at the Underground Injection Practices Council Summer Meeting. Reno, Nevada. July, 1991.

Arthur, J.D.; Deuerling, R.J.; and Waller, P.L. "Mechanical Integrity Demonstration and Sensitivity Testing of the Radioactive Tracer Survey on Class I Large Diameter Municipal Injection Wells in Florida." Presented at the Underground Injection Practices Council Winter Meeting. Tampa, Florida. January 1990.

With Bray, T.D. "Assessment of Background Water Quality at a Canyon Landfill Site." Presented at the Water Pollution Control Federation Specialty Conference for Water Quality Management of Landfills. Chicago, Illinois. July 16, 1990.

With Perenchio, L., Watters, E., and others. "Regional Guidelines for Conducting Mechanical Integrity Testing in Region V". Prepared for internal regional guidance regarding acceptable methods for performing internal and external MI testing in the direct implementation states of Indiana and Michigan.

With DeLashmit, J., Perenchio, L., Watters, E., and others. "Regional Guidelines for the Plugging and Abandonment of Class I and II Wells in Region V". Prepared for internal regional guidance regarding acceptable methods for properly plugging and abandoning wells within the direct implementation states of Indiana and Michigan.

Short Courses Completed:

Temperature, Noise, and Radioactive Tracer Logging, Exxon/Robert S. Kerr Lab
Successful Project Management, CH2M HILL
Successful Project Execution, CH2M HILL
Fundamentals of Cementing, Halliburton Services
Petroleum Engineering as related to Underground Injection Control, Richland College, TX
Ground Water Monitoring, Engineering Enterprises
Well Casings and Tubulars, NL Industries
Expert Witness Short Course, NWWA
Reservoir Pressure Transient Testing, Society of Pet. Engineers
Cased Hole Logging, Schlumberger Well Services
Open Hole Well Logging, Welex

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Advanced Open Hole Well Logging, Welex
Class V Injection Wells, Engineering Enterprises
Mechanical Integrity Testing, Engineering Enterprises
Simulation of Hazardous Waste Injection, Scientific Software
UIC Enforcement Training, USEPA - Headquarters
Environmental Risk Analysis, USEPA - Region V
Hazardous Waste Safety Training, HST
Hazardous Waste Safety Training For Managers, HST
Professional Liability, CH2M HILL
Speaking with Others, CH2M HILL
Various Computer Short Courses, Various
First Aid and CPR, Red Cross