2014 Underground Injection Control Conference

Aquifer Management & Underground Injection

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GROUNDWATER RESEARCH & EDUCATION FOUNDATION

Event Handbook:

- **Agenda**
- **Abstracts**

Hotel Monteleone

JANUARY 21-23, 2014
NEW ORLEANS, LOUISANA

GWPC 2014 UIC Annual Conference

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<table>
<tr><th colspan="3">Tuesday, January 21</th></tr>
<tr><td>1:00 -5:00</td><td>Royal Salon C (ground floor)
Class I UIC Operator Training
Steve King, Subsurface Technologies abstracts: 1
*Certificates of Attendance will be provided for Professional Development
Part 1 – Power Point presentation/training, Class overview/basics
- History of Injection and Overview of UIC Program
- Permitting
- Petitioning
- Siting Criteria, Geology, and Reservoir Properties
- New Class I Well Construction Well Repair & Workovers
- Operating Procedures
- Fluid Quality
- Inspections
- Mechanical Integrity Testing
- Reservoir Testing
This is an interactive course. Questions from the participants are encouraged.

Part 2 – Roundtable well discussion
We are planning an interactive UIC roundtable discussion and training session to cover areas of interest to each and every person attending. If you have a specific well problem or just an area you may like to get a more thorough understanding, please let us know and we will cover those items. If you do not have a specific item you want covered we also encourage you to attend.</td><td>La Nouvelle Orleans West (mezzanine level)
Oil and Gas Development and Environmental Protection Workshop
Dan Arthur, & Paul Hagemeier, ALL Consulting, and
David Overstreet, K&L Gates abstracts: 1
*Certificates of Attendance will be provided for Professional Development
The focus of the workshop is environmental protection, with an emphasis on groundwater and surface water protection. This has become a critical aspect of energy development and can have a broad array of technical considerations. An example of the technical details that will be covered in the workshop are presented below:
- Well casing and cementing design
- Well integrity testing
- Well Integrity evaluations related to “stray gas”
- Well pad design and construction
- Discussion of well pad design alternatives
- Managing design alternatives under varied environmental conditions
- Use of Geomembrane plastic liners
- Advances in containment systems
- Well pad containment
- Installation and containment related to well cellars
- SPCC Plans (storage facilities, flow-through process equipment
- Preparedness and planning for emergencies
- Effective containment systems
- Variations between shale plays
- Recommended practices during drilling, cementing, completion, and operations
- Responding to spills</td></tr>
<tr><td>5:10-6:10</td><td colspan="2">La Nouvelle Orleans West (mezzanine level)
FracFocus / RBDMS / RBDMS Environmental / Gateway (Portal) Update: What is coming in 2014
Stan Belieu, Nebraska O&G, Paul Jehn, GWPC, and Mike Paque, GWPC</td></tr>
</table>

Ground Water Research & Education Foundation Spotlight series

The 2014 UIC Conference is part of the Spotlight Series
is a tech transfer initiative of the
Ground Water Research & Education Foundation

GROUNDWATER RESEARCH & EDUCATION FOUNDATION

To receive event *Certificates of Attendance for Professional Development* see GWPC registration desk

Wednesday, January 22		
8:00-10:00	*La Nouvelle Orleans West (mezzanine level)* *Aquifer Management & Underground Injection* Moderator: **Jamie Crawford**, Mississippi DEQ & GWPC President & GWREF Board Member - **Ron Bergman**, USEPA - EPA Overview of UIC Program abstracts: 1 - **Bob VanVoorhees**, Underground Injection Technology Council – National UIC Update abstracts: 1 - **Susan Fernandes**, US Business Council for Sustainable Development – Louisiana Water Synergy Project abstracts: 2 - GWPC / GWREF Project Update and Announcement - **Stan Belieu**, NE O&G and **Mike Wireman**, EPA Region 8	
10:20-12:00	*Iberville (mezzanine level)* *National UIC and Aquifer Management: Issues and Activities* Moderator: **Kevin Frederick**, Wyoming DEQ -Aquifer Storage and Recovery (ASR) September 2013 EPA letter clarifying EPA regulations as they apply to the injection and storage of water in underground formation for later withdrawal for use. • A Summary of ASR Findings from a Comprehensive National Survey: Update July, 2013 - **Frederick Bloetscher**, Florida Atlantic University abstracts:3 • Impact of EPA's Letter to FDEP on ASR in Florida - **Joe Haberfeld**, FL DEP abstracts: 4 • EPA overview **Holly Green**, USEPA abstracts: 4 • Regulatory Implications of EPA's ASR Letter – **Bob VanVoorhees**, Underground Injection Technology Council abstracts: 5	*La Nouvelle Orleans West (mezzanine level)* *Oil & Natural Gas Stray Gas Incident Response, Environmental Sampling, Analysis and Risk Assessment Workshop* **Certificates of Attendance will be provided for Professional Development* Moderator: **Paul Jehn**, GWPC Instructors: **Fred Baldassare**, ECHELON Applied Geochemistry, and **Debby Yost** , Chesapeake Energy abstract: 2 This workshop will provide the protocol, investigative techniques, data requirements, and mitigation techniques that are fundamental to stray gas incident response. The workshop will also highlight considerations for monitoring, laboratory methods, and interpretations of methane concentration data, and gas and groundwater geochemistry data. • Introduction • Research, Regulatory & Policy Initiatives • Physical/chemical properties of methane & light gases o Gas phase o Dissolved phase • Sampling for dissolved and gas phase methane • Protocol for dissolved phase & gas phase sampling o Evaluation of field and laboratory methane data o Isotope sampling protocol
12:00-1:00	*GWPC 2014 UIC Conference Luncheon* *La Nouvelle Orleans East (mezzanine level)* • Guest Speaker: **Paul Doucette**, General Electric Oil and Gas -- Shale Gas Development and Water Resource Management abstracts: 6	

GROUNDWATER PROTECTION COUNCIL

The GWPC provides a forum for stakeholder communication and research in order to improve governments' role in the protection and conservation of groundwater.

Wednesday, January 22

1:20-5:40

Iberville (mezzanine level)

National UIC and Aquifer Management: Issues and Activities (cont.)

Moderator: **Dale Kohler**, TX Commission on Environmental Quality

Uranium and Uranium Progeny in Groundwater Associated with Uranium Ore Bearing Formations - **Matt Hartmann**, Uranium Resources, Inc abstracts: 7

Class III UIC Regulatory Perspective: In Situ Uranium Mining in Texas - **David Murry**, Texas Commission on Environmental Quality abstracts: 8

Class III UIC Uranium Mining Permitting Process **Matt Hartmann**, Uranium Resources, Inc

Louisiana Sinkhole Incident and Class III Rule Revisions – **Stephen Lee**, LA Department of Natural Resources, UIC Program abstracts: 8 *(unable to attend)*

Class V Injection Wells: Back to the Future - **Lorrie Council**, Texas Commission on Environmental Quality abstracts: 8

Iowa Experience With Agricultural Drainage Well Inspection. Testing, Permitting, and Closure **Michael Anderson**, Iowa Department of Natural Resources abstracts: 9

Class V UIC and Septic Systems – **Sonja Massey**, Alabama DEM abstracts: 10 *(unable to attend but **presentation available online**)*

SAWS Brackish Desalination Project – Production to Injection Wells – **Bill Stein**, LBG-Guyton Associates abstracts: 10

Related Groundwater Issues

Subsidence and Coastal Geomorphic Changes in Central Louisiana – **Jack Kindinger**, USGS St. Petersburg Coastal Marine Science Center abstracts: 11

ASTM Activity Update – **Caryl Alfaro**, Earth Resources Systems abstracts:11

La Nouvelle Orleans West (mezzanine level)

Oil & Natural Gas Stray Gas Incident Response, Environmental Sampling, Analysis and Risk Assessment (cont.)

- Stray Gas Origin & Source Correlation – Isotope Geochemistry
  - Basis & application
  - Types of isotope analyses
  - Data evaluation/interpretation
  - Secondary processes
- Potential impacts to groundwater geochemistry
  - thermodynamic predictions
  - Redox.
- Stray Gas Case Studies
- Stray Gas Migration Response Protocol – Site Investigation/demonstration
  - Methodology to determine threat level
    - Combustible Gas Field Screening – gas phase and dissolved phase
    - Protocol for Active Soil Gas Surveys
    - Long-term monitoring for stray gas - soils & groundwater
- Data evaluation
- Subsurface gas migration: fate and transport
  - subsurface gas migration: fate and transport
  - Geologic setting
    - Mechanism of transport
    - Factors affecting subsurface gas migration
- Measures to protect public health & safety
  - Interim Remedial Measures
  - Long-term Remedial Measures
  - Principles and design

5:45-7:30 GWPC 2014 UIC Conference Reception

Event Sponsors: THANK YOU for caring about Groundwater!

Riverview Room (rooftop)

Thursday, January 23		
8:00-9:20	*Vieux Carre (18th floor)* *State / EPA Roundtable* *(State & Federal Employees ONLY)* Facilitators: **Lindsay Taliaferro**, OH EPA; **Kurt Hildebrandt**, EPA R-7; and **Ron Bergman**, USEPA-HQ *Discussion items may include:* -Class VI: New applications; Program updates -National Technical Workgroup Induced Seismicity, etc. -Diesel Guidance -UIC National Database -Stormwater Rule – OGWDW Input -RCRA Exemption Waste: Does it stay exempt after treatment? -Aquifer Exemption -Class I No Migration Petition Issues	*Royal Salon A&B (ground floor)* *Underground Injection Control Financial Responsibility* Facilitators: **Joe Tiago**, US EPA Office of Groundwater and Drinking Water In 2011 and 2012, EPA Headquarters conducted a multi-phased effort to improve its understanding of on-the-ground implementation of Underground Injection Control (UIC) financial responsibility (FR) requirements. The effort consisted of roundtable discussions, remote file reviews of FR demonstrations, and site visits to state and direct implementation UIC programs in four EPA Regions. In this session EPA summarizes the findings of this effort and identifies best practices and recommendations for FR file management and review, instrument language and provisions, and coverage criteria. Based on the results of this effort, EPA Headquarters has developed two new tools designed to assist UIC FR programs implement FR requirements: (1) FR instrument review checklists, and (2) Geologic Sequestration Cost Estimation Tool. The session will review these tools in a workshop-style setting to provide a detailed description of how to use the tools answer questions from participants.
9:30-12:30	*Royal Salon C&D (ground floor)* *Class VI UIC and Carbon Capture & Underground Storage* Facilitator **Bob VanVoorhees**, UITC Global Status of Carbon Capture and Storage **Victor Der**, General Manager - The Americas of the Global CCS Institute abstracts:12 DOE Update – **Mark Ackiewicz**, Office of Fossil Energy, USDOE abstracts: 13 Storage Effectiveness for EOR with Respect to State Reporting – **Susan Hovorka**, Gulf Coast Carbon Center abstracts: 13 USEPA Class VI Implementation Progress and Update: GS Permit Applications and GS Guidance Documents - **Bruce Kobelski**, USEPA abstracts: 14 North Dakota's Class VI Primacy – Why, How, and What Now - **Kevin Connors** – ND Industrial Commission abstracts: 15	*Queen Anne Ballroom (mezzanine level)* *Shale Gas Development, UIC, and Ground Water Protection Issues* The Impact of the Shale Play Revolution: How State Agencies are Responding -- Facilitator **John Veil**, Veil Environmental State Water Recycle/Reuse and Well Construction Rules – **Leslie Savage**, Railroad Commission of TX abstracts: 15 Hydraulic Fracturing: State of the Art in Chemical Evaluation - **Bridget Todd**, Baker Hughes abstracts:16 Development of a Framework for Brine Disposal Wells in the Northern Appalachian Basin Based on Operational and Geologic Information - **Joel Sminchak** – Battelle abstracts:16 Induced Seismicity from Fluid Injection and Draft Best Practices – **Austin Holland**, Seismologist, Oklahoma Geological Survey, University of Oklahoma abstracts: 17 Fluid Injection Inventory for Class II UIC Wells of Oklahoma - **Kyle E. Murray**, Oklahoma Geological Survey abstracts:17 Industry and Regulatory Cooperation for Better Information - **Trudy Curtis**, PPDM Association abstracts:18
12:30-1:45	*Lunch (on your own)*	

1:45-3:45	*Class I & II UIC Issues Discussion Session* *Queen Anne Ballroom (mezzanine level)* Facilitators Bob VanVoorhees, UITC & Ben Knape, UIC Regulatory Issues Consultant • Texas Supreme Court Considers Action for Subsurface Trespass against Class I Injection Well For over 15 years, a civil case between a Class I well operator, Environmental Processing Systems (EPS), and an adjacent property owner, FPL Farming (FPL), has been moving slowly through the Texas court system as FPL seeks to overturn a jury verdict denying any recovery. This case has been watched closely by interested groups including the Texas Oil & Gas Association, the Texas Farm Bureau, the Texas Chemical Council, the Underground Injection Technology Council, and the GWPC in recognition of its potential to establish significant new case law on property rights. The case specifically involves the rights of nearby surface land owners to object to subsurface migration of injected fluids in geologic formations deep beneath their property and what evidence of damage or interference with anticipated use will be required to prevail against and injection well operator. FPL has claimed that the EPS state-permitted injection well has caused migration of injected wastewater under FPL's property constituting "underground trespass" without permission from or adequate compensation to FPL and that it has an absolute right to prevent such migration even absent any showing of damage. FPL contends that chemical constituents of the injected wastewater will contaminate the native saline ground water (>144,000, ppm TDS) in the Frio Formation under FPL's property. Such contamination, according to FPL, will impair the treatability of this ground water, thereby decreasing its value as a potential future source of usable water and decreasing the overall value of FPL's property. Rebutting these claims, EPS argues that it would be entirely unprecedented in Texas and in the country to find that a surface owner has an absolute right to prevent subsurface migration without showing any damage because the property owner has no more reasonable expectation to prevent such migration than to prevent airplanes from flying over the property. And, if damage can be shown, the proper recovery is for nuisance, similar to claims for recovery from air pollutants coming onto your property. EPS also presents arguments specific to the case to uphold the "take nothing" jury verdict, which was overturned by the appellate court. • Class I/Class II Overlap: Competition for Limited Injection Zones Class I and Class II wells have the same needs for porous and permeable injection zones adequate to accept and hold injected fluids and to protect underground sources of drinking water (USDW). It is increasingly apparent that such injection zones with their pore-space capacity for holding injected water are not in infinite supply. Growing demands for oil and gas waste disposal from hydraulic fracturing and production have resulted in a surge in the demand for Class II disposal well capacity, increasing construction of new wells and imposing new volumes – and consequently elevated pressures – on injection zones of existing wells. Among the issues operators and regulators are confronting are: - What factors or conditions are driving increased interstate transportation (e.g., from Louisiana to Texas) of oil and gas waste (produced water) for disposal in commercial Class II wells? - How should responsibility be apportioned between well operators for keeping injection-zone pressure below levels of possible hazardous waste migration from injection zones and USDW endangerment? - How should limits on injection volume and pressure be determined, coordinated, and enforced by regulatory agencies with dissimilar area of review (AOR) and other rule requirements, but with overlapping jurisdictions in the same locale? - Under state or federal law, do operators of existing permitted wells have precedence in use of a permitted injection zone over persons wanting to expand capacity or operate new injection wells in the zone? - Should operators of existing Class I hazardous waste wells be subject to EPA termination of land disposal restriction (LDR) exemptions as a consequence of increased injection zone pressures attributed mostly to Class II injection? - Should Class II well operators share in responsibility for assuring no migration of hazardous waste from injection zones when injection volumes and induced pressures in zones shared with preexisting Class I hazardous-waste wells are dominated by Class II well activities? • Reviewing No Migration Petition Process There are concerns over the process for issuing and reissuing approvals for hazardous waste injection disposal restriction (HWIDR) exemptions based on demonstrations of no migration of hazardous constituents out of the injection zone for as long as the waste remains hazardous (also called "no migration exemptions"). Currently 16 of 31 facilities with approved exemptions in EPA Region 6 are awaiting reissuance, and the historical processing time for the review of these demonstrations indicates that it could take many years to complete the reviews. It makes sense to search for ways to address the backlog and improve the process. This is not just a question of speeding up the process. Instead, we should find ways to improve this petition process. This would involve considering both the way petition demonstrations are prepared and the way they are reviewed. EPA has expressed concern over the need for better quality assurance and quality control reviews to minimize the amount of deficiencies that would need to be corrected during EPA's final review. There are also concerns over the approach to review and formal action on petitions, including how petitions should be prioritized and how much time should be allocated to the various tasks involved. There may also be a role for states to improve the petition process. • New Developments and Other Issues of Interest

Abstracts

Bio - Steve King has a BS in Petroleum Engineering from the University of Missouri-Rolla. He has been with Subsurface Technology, Inc., a Parsons Brinckerhoff company, since 1987 and is based in Houston, Texas. He spent his first 20-years with Subsurface in their technical group, specializing in injection and storage wells, before moving over to his current position as Business Development Manager.

Bio - Dan Arthur: 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. 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 was nominated by the U.S Department of Energy to serve on the U.S. Environmental Protection Agency's Advisory Committing on Hydraulic Fracturing.

Bio - David Overstreet: Mr. Overstreet is a Partner with the K&L Gates LLP, a global law firm with a world-wide energy and environmental practice. Mr. Overstreet resides in Pittsburgh, Pennsylvania and assists exploration and production, midstream and transmission clients throughout the United States with rulemaking, permitting, compliance, enforcement and litigation matters involving federal, state and local agencies. Mr. Overstreet has litigated cases in federal and state courts involving claims of groundwater contamination, nuisance and trespass. He also represents national and regional trade associations in connection with proceedings in state and federal courts and advises clients in connection with transactions involving potentially contaminated property and other distressed assets. Mr. Overstreet is an Adjunct Professor at the University of Pittsburgh, School of Law where he teaches classes in water and energy law.

Bio - Ron Bergman is the acting director of the Ground Water Protection Division at US EPA. He is the permanent chief of the Prevention Branch, which contains the UIC program at EPA. Previously, Ron was the chief of EPA's Drinking Water Protection Branch, working with the Public Water Supply Supervision program. Earlier in his career, Ron worked in the US House of Representatives and the Delaware House of Representatives on agricultural and natural resources issues.

Bio - Bob Van Voorhees, of the Underground Injection Technology Council has worked in the environmental and energy fields since the early 1970's. His legal and consulting practices have included environmental litigation, counseling, and representation on regulatory, legislative and compliance matters in the air, water, hazardous waste, toxic substance, underground injection, and occupational safety and health areas. He has worked with clients, primarily in the petrochemical and petroleum industries, in achieving broad policy objectives in rulemaking and judicial review proceedings. He has represented clients in challenges to regulations and standards in the United States Supreme Court and in the United States Courts of Appeals and District Courts. He has also defended clients in civil and criminal enforcement actions before administrative agencies and in courts at both the federal and state levels. The Ground Water Protection Council (GWPC)—the national association of state ground water protection and underground injection control programs—presented its Award of Excellence in Ground Water Protection to him in 1996 for his outstanding contribution in the development of sound national regulations for underground injection control. His work on ground water protection and underground injection regulations has included working with operators of every current class of injection well under federal or state underground injection control (UIC) programs. Currently, he is the Manager of Underground Injection Technology Council and of the Carbon Sequestration Council. During the past four years he has facilitated multi-stakeholder discussions to develop consensus recommendations among environmental nongovernmental organizations, industry and government regulators regarding regulatory frameworks for geologic sequestration (or storage) of carbon dioxide streams and for hydraulically fractured hydrocarbon production wells. During the last decade, he represented the State of Kuwait and the Kingdom of Saudi Arabia in presenting claims before the United Nations Compensation Commission for environmental damages incurred as a result of the invasion and occupation of Kuwait and Saudi Arabia by Iraq in 1990-91. He continues his law practice as Of Counsel with Bryan Cave LLP and works as a consultant through Robert F Van Voorhees PLLC.

Bio - Stephen Lee is currently the director of the Injection and Mining Division of the Office of Conservation within the Louisiana Department of Natural Resources. Mr. Lee first worked for the Injection and Mining Division from 1997 to 2008 as a staff geologist until leaving to consult in industry. After a 5 year absence, he returned to the Injection and Mining Division to replace the retiring director, Mr. Joe Ball, who left in July of 2013. Mr. Lee has extensive experience in the petroleum, mining, and environmental fields and holds a Bachelors in Geology, a Masters in Business Administration and a Juris Doctorate.

Louisiana Water Synergy Project

Susan Fernandes, Director of Operations for the US Business Council for Sustainable Development

US BCSD launched the Louisiana Water Synergy Project in May 2012 to provide a forum where industry leaders can work with government and other stakeholders to find and implement mutually beneficial solutions to address water quality, quantity, and storm water issues in southeastern Louisiana. Currently 21 companies are participating in the project representing refining, chemicals, steel, aluminum, power, fertilizer, and service industries. Over the last 18 months this project has demonstrated how a structured collaboration forum can produce new strategies and partnerships to achieve tangible water synergy benefits for the region and the participating companies.

Susan Fernandes is Director of Operations for the US Business Council for Sustainable Development (US BCSD). She also serves as Project Manager for the Louisiana Water Synergy Project and the Houston By-Product Synergy/Water Synergy Project. Susan has more than 30 years of experience as an environmental consultant with URS and AECOM. Her work has focused on environmental risk management and EHS compliance assurance services for Fortune 500 companies, including site characterization and risk assessment, remediation, decommissioning, due diligence, permitting and compliance management, and sustainability program support. Ms Fernandes has worked closely with several oil and gas and chemical companies as a Global Client Account Manager.

Bio - Fred Baldassare has more than 25 years of experience as a geologist, and 20 years of experience investigating more than 200 reported incidents of stray gas migration. He is an experienced investigator, and researcher who has helped pioneer the application and advancement of isotope geochemistry to identify and distinguish the origin of different microbial and thermogenic gases in the Appalachian Basin. Fred was the lead author for the Pennsylvania's Oil & Gas regulations (25 PA. CODE CH. 78, §78,89) for stray gas incident response, the Marcellus Shale Coalition's technical guidance manual for stray gas investigations, and co-author of the first comprehensive manual for investigating and characterizing incidents of stray gas migration: Technical Measures For The Investigation And Mitigation Of Fugitive Methane Hazards In Areas of Coal Mining. Fred has authored and co-authored professional papers for peer reviewed journals on the application of isotope geochemistry, taught and lectured nationally, and at his alma maters, Penn State University and The University of Pittsburgh.

Bio - Paul Jehn has over 35 years experience as a geologist working in environmental assessment responsible for collecting and interpretation monitoring data, and using monitoring data to identify sources of water contamination. Paul has been the Program Manager for the Groundwater Protection Council (GWPC) Risk Based Data Management System (RBDMS) since 1998. Paul's previous experience includes Manager of the Idaho Ground Water, Drinking Water and Underground Storage Programs and Bureau Chief of Idaho Monitoring and Technical Support Section at Idaho Department of Environmental Quality, Associate Director of the University of Idaho's Water Research Institute, and Research Scientist at Argonne National Laboratory. Paul has numerous papers and presentations on groundwater protection and the RBDMS data management system. Paul has a M.S degree in geology.

Bio - Debby L. Yost serves as the chair of the Dissolved Methane Workgroup of the Drilling, Completions, Wellsites Facilities and Production Operations Committee of the Marcellus Shale Coalition. She is a Senior Advisor - Environmental in the Environmental Health and Safety and Regulatory Department for Chesapeake Energy Corporation, Oklahoma City, OK. She was the quality assurance manager for a full-service environmental consulting firm prior to joining the staff of Chesapeake. She has B.S. and M.S. degrees from Oklahoma State University.

A Summary of ASR Findings from a Comprehensive National Survey: Updated as of July 1, 2013

Dr. Fred Bloetscher, Florida Atlantic University

This presentation outlines the result of a survey of all 204 sites in the United States that have investigated the concept of aquifer storage and recovery (ASR). This survey included all known active and abandoned sites, based on conversations with regulatory personnel, consultants and literature reviews. The process involved collecting both operational and construction details and is the first comprehensive survey in many years. Descriptions of the collected data set are provided as follows:

- State;
- Date the program was initiated or first well drilled;
- Stage of development/status, categorized as study, testing, operational or abandoned;
- Number of wells drilled: the number of individual ASR wells onsite to accommodate the designed injection capacity;
- Number of abandoned wells, the number of individual ASR wells onsite no longer in service;
- Source of water, categorized as ground, surface, reclaimed of industrial water
- Use of recovered water, categorized by irrigation, potable water supplies, raw water supplies, and surface water augmentation;
- Number of storage cycles (estimated), which is indicative of age of the system;
- Injection rate per well as a measure of injection capacity (converted to millions of gallons per day (MGD));
- Withdrawal rate per well as a measure of withdrawal capacity (converted to MGD);
- Peak flow as a measure of total available capacity on the site (converted to MGD);
- Total water stored measure of total net stored water as estimated by regulators or the utilities (converted to millions of gallons);
- Depth of well casing below the surface: A measure of depth in feet of the most interior and deepest well casing that is installed at the final construction stage;
- Depth of Well below the surface: A measure of depth in feet of the deepest point of the well
- Casing material which is the final casing categorized as steel, PVC, fiberglass or stainless steel, separating stainless steel screens form stainless steel casings;
- Casing diameter which is a measure of diameter in inches of the most interior and deepest well casing that is installed at the final construction stage;
- Whether tubing and packer wells were used;
- Injection zone formation category, categorized into formation type such as limestone, sand, sandstone, basalt, and alluvial formation as the most likely options;
- Injection zone transmissivity; as the measure the ability of water to maneuver through a porous media. It is the rate of flow per unit time per unit cross-sectional area (converted to gallons per day/ft);
- Total dissolved solids of formation – basically used to separate fresh aquifers from brackish formations;
- Type of confinement (formation type) categorized into formation type such as clay, dolomite, silt, shales, sandstone, basalt, or no confinement as the most likely options;
- Number of monitoring wells if known for monitoring Class I wells; and
- Operational issues (open ended).

It should be noted that not all of this information was available for all wells, especially the aquifer parameters of the older wells (TDS, hydraulic conductivity).

Of interest is that the vast majority of sites use surface waters for injection fluids but reclaimed water use is expanding; alluvial and limestone are popular injection horizons, but most to the northwest systems are basalt; the wells are largely confined, but California wells may not be; steel is the most common casing type; and a third of the systems are no longer utilized. Only about 35% of total sites are currently active injection programs. Over 25% are not active. Clogging, recovery and water quality issues are listed as reasons for inactive status. Most of these inactive projects are unlikely to be pursued. Ongoing geophysical, recovery and regulatory issues are barriers to overcome.

Dr. Bloetscher is an Assistant Professor at Florida Atlantic University in Boca Raton, Florida, and also the President of Public Utility Management and Planning Services, Inc., which he started in 2000. His interests focus on the planning and management water resource systems, including groundwater resource and risk projects. Prior to starting his own firm, he worked for local governments in utility management for 20 years.

Impact of EPA's Letter to FDEP on ASR in Florida

Joseph L. Haberfeld, Florida Department of Environmental Protection

In a letter dated September 27, 2013, the U.S. Environmental Protection Agency (EPA) addressed the need for public water systems (PWS) to store treated drinking water underground for later use as a source of drinking water. The letter described how the State of Florida could apply the UIC program requirements to ASR wells used by public water systems when mobilization of arsenic is a concern. Previously, the mobilization of arsenic by the storage and recovery of oxygenated water in the oxygen-poor aquifers of Florida created a situation where the State could proceed with permitting only if the facility accepted an administrative order or consent order, each of which are considered enforcement documents. As of 2012, there were 21 facilities using or planning to use ASR for potable water supply augmentation. EPA's letter recognizes the ability and authority of the UIC Program Director (in this case, the state) to use permit conditions as needed, rather than enforcement actions, to minimize the area where potential arsenic mobilization and impacts may occur over time. Florida has several methods already in place to limit the risk of arsenic mobilization upon potable wells, well owners, and the Underground Source of Drinking Water. A guiding principle of the letter is that the burden of protection not be transferred from the PWS to another user. It is anticipated that a number of potable water ASR facilities will benefit from this letter. Similar protective measures could be considered for ASR projects in use in Florida for supplementing reclaimed water distribution systems and for surface water improvement projects, as well as for aquifer recharge where the reclaimed water is not recovered but instead is injected to replenish the aquifer as part of a water reuse project.

Joseph L. Haberfeld is Aquifer Protection Program Administrator, UIC Program Director, and Professional Geologist, Florida Department of Environmental Protection (FDEP), Tallahassee, Florida. He has worked all aspects of utilizing injection wells for wastewater disposal and Aquifer Storage and Recovery in Florida, including hydrogeologic evaluation, well construction methods, groundwater monitoring, permitting, and compliance. Prior to joining FDEP, he worked for 9 years as a petroleum geologist in the Gulf Coast and Permian Basin in the areas of development, exploration and enhanced oil recovery. He was educated at the State University of New York at Fredonia (B.S. Geology, 1975) and Southern Illinois University (M.S. Geology, 1977).

EPA Overview: ASR

Holly Green, USEPA, OGWDW; Fred McManus, USEPA Region 4

Managing water supply is an issue of growing concern throughout the country and innovative water management tools, such as aquifer storage and recovery (ASR), are becoming increasingly important to sustain water availability. A particular challenge to the safe use of ASR in some parts of the country, including Florida, is that the underground formations available for drinking water storage contain minerals that can be mobilized when in contact with injected water. This can present a regulatory challenge in implementing the underground injection control (UIC) program under the Safe Drinking Water Act, and EPA has been working with the state of Florida to help address such challenges associated with their ASR efforts. EPA has worked with Florida to clarify UIC permitting options which encompass a suite of activities to minimize the mobilization of arsenic, limit the spatial extent of any potential contamination, and to protect public health in areas where arsenic contamination may occur. In this session, EPA will discuss the regulatory challenges associated with ASR and the path forward we worked with Florida to develop, which recognizes the importance of ASR to water sustainability while protecting public health.

Holly Green currently serves as the Associate Branch Chief for the Prevention Branch in the US Environmental Protection Agency's Drinking Water Protection Division, Office of Ground Water and Drinking Water. In that role she manages the national Source Water Protection Program and works closely with the Underground Injection Control Program. Previously, Holly held leadership positions in EPA's national Water Quality Standards Program, focusing on water quality criteria implementation in Clean Water Act programs and national nutrients policy. She also spent three years with the EPA Office of Inspector General. Prior to EPA, Holly served as a Peace Corps Volunteer in Honduras working with communities to build, sustain and protect rural drinking water systems. Holly received a B.A. in Environmental Planning from Binghamton University (State University of New York) and a Master of Environmental Management degree from the Yale School of Forestry and Environmental Studies.

Fred McManus received a B.S. in Geology from the University of Alabama in 1975. Since that time, he has served in various positions with the U.S. Geological Survey, private oil and gas exploration companies and the U.S. Environmental Protection Agency. He was designated as a Certified Petroleum Geologist by the American Association of Petroleum Geologists in August 1984. From January 2009 to the present, he has served as Chief of the GW/UIC Section in the Safe Drinking Water Branch, Water Protection Division, EPA, Region 4. He has primary responsibility for directly implementing the UIC Program in Kentucky and Tennessee for all classes of injection wells and Class II wells in Florida and has oversight responsibility for the UIC Program in Alabama, Florida (except Class II), Georgia, Mississippi, North Carolina and South Carolina. His Section also has state program oversight responsibility for the Region's Ground Water Protection Program.

Regulatory Implications of EPA's ASR Letter

Bob Van Voorhees, Underground Injection Technology Council

For many years Florida has been striving to use aquifer storage and recovery (ASR) in a long-term water management strategy to conserve water that would otherwise be lost. As Florida began to inject water for ASR, it became apparent that the underground formations available for drinking water storage contain minerals such as arsenic that can be mobilized when in contact with injected water. This has raised issues about the appropriate use of underground injection wells for ASR, and those issues resulted in a thorough and lengthy consideration of appropriate approaches by the Florida Department of Environmental Protection (FDEP) and U.S. Environmental Protection Agency (EPA) at both the Region 4 and headquarters levels. On September 27, 2013 EPA resolved these issues by sending a letter to FDEP describing how Florida can apply the Underground Injection Control program (UIC) requirements to ASR wells used by public water systems when mobilization of arsenic is a concern.

EPA has interpreted the UIC Class V regulations to provide authority to issue a permit for a UIC well that does not meet the prohibition of fluid movement provision in 40 CFR §144.12(a). In the past this was thought to require an enforcement action and entry of a compliance order. Now EPA has concluded that a UIC Program Director can choose to address individual situations on a case-by-case basis by requiring a permit that would prevent endangerment as described in SDWA 1421(d)(2). The UIC Director "could decide in some cases that it is appropriate for those ASR wells to remain open under permits with conditions designed to protect public health and maximize protection of the USDW" Any such permit should include, in addition to the conditions required in all permits, conditions designed to prevent human consumption of waters that exceed Maximum Contaminant Levels (MCLs). Moreover, this could be accomplished through the use of "site access controls" to ensure that the burden of public health protection is not transferred from a public water system to another user of the USDW

In addition to describing the authority available to a UIC Director, EPA recommends that the permit conditions should, among other things, be designed to ensure that injected water can only be withdrawn by the public water system that injected it, because that entity is aware of the situation, accountable, and must comply with other regulations under the SDWA.

This presentation builds on the presentations of earlier speakers regarding descriptions of the context, the problems to be addressed, and the solution provided by EPA and examines the broader implications of these regulatory interpretations and policy statements. EPA has focused on a substantial concern over resource management, has found flexibility within the Class V UIC program to address that concern, has advanced our understanding of how we can protect underground sources of drinking water (USDWs) from endangerment, and has modeled the role of EPA within the federal-state partnership designed by Congress to implement the UIC program under the Safe Drinking Water Act.

Bob Van Voorhees has worked in the environmental and energy fields since the early 1970's. His legal and consulting practices have included environmental litigation, counseling, and representation on regulatory, legislative and compliance matters in the air, water, hazardous waste, toxic substance, underground injection, and occupational safety and health areas. He has worked with clients, primarily in the petrochemical and petroleum industries, in achieving broad policy objectives in rulemaking and judicial review proceedings. He has represented clients in challenges to regulations and standards in the United States Supreme Court and in the United States Courts of Appeals and District Courts. He has also defended clients in civil and criminal enforcement actions before administrative agencies and in courts at both the federal and state levels. The Ground Water Protection Council (GWPC)—the national association of state ground water protection and underground injection control programs—presented its Award of Excellence in Ground Water Protection to him in 1996 for his outstanding contribution in the development of sound national regulations for underground injection control. His work on ground water protection and underground injection regulations has included working with operators of every current class of injection well under federal or state underground injection control (UIC) programs. Currently, he is the Manager of Underground Injection Technology Council and of the Carbon Sequestration Council. During the past four years he has facilitated multi-stakeholder discussions to develop consensus recommendations among environmental nongovernmental organizations, industry and government regulators regarding regulatory frameworks for geologic sequestration (or storage) of carbon dioxide streams and for hydraulically fractured hydrocarbon production wells. During the last decade, he represented the State of Kuwait and the Kingdom of Saudi Arabia in presenting claims before the United Nations Compensation Commission for environmental damages incurred as a result of the invasion and occupation of Kuwait and Saudi Arabia by Iraq in 1990-91. He continues his law practice as Of Counsel with Bryan Cave LLP and works as a consultant through Robert F Van Voorhees PLLC.

Shale Gas Development and Water Resource Management

Paul Doucette, Global Public Policy, General Electric

All the experts, pundits and commentators tell us that the "Age of Gas" is upon us. From its role in power generation to the prospects for CNG and LNG as a transportation fuel, natural gas is at the forefront of many conversations. But those conversations also detail serious environmental questions about the process of hydraulic fracturing, which is essential to the production of natural gas from shale.

Air issues, local impact, contract disputes and water quality concerns are the focus of discussions at the local level, but also among state and federal regulators and policy makers, literally around the globe.

For the United States, natural gas provides significant benefits to our economy, our national security and the environment … but, only if exploration, development and use of natural gas is done safely and sustainably.

In his discussion, Paul Doucette who is the global policy and funding leader for the GE O&G drilling and subsea businesses will talk about the shale gas revolution and the intersections between industry activity, the policy and regulatory community and the general public. From the perspective that shale gas development is safe and sustainable now, Paul will describe the role GE believes that technology can play in providing proof of that assertion and, through a spirit of collaboration and continuous improvement, make development safer and more sustainable in the future.

Paul Doucette is the Global Public Policy leader for GE's Subsea and Drilling and Surface businesses and the Global External Funding leader for the Oil & Gas business. In this position, Paul is responsible for the development and execution of growth strategies with regard to monitoring, influencing, and responding to government policy and for establishing collaborative research relationships with governments, universities and customers.

Previously to joining GE in 2007, Paul career includes roles with Cornell Companies, Inc. as Vice President of Public Affairs and Business' serving as Vice President of Ward Creative Communications from 1996-2000, Director of Public and Government Affairs with Star Enterprise from 1991-1996 and with Texaco in roles ranging from Sales to Director of Public and Government Affairs.

Paul served with the 2nd Bomb Wing, 2nd Air Force of the Strategic Air Command. He holds his Masters in Business Administration from Nicholls State University; Thibodaux, Louisiana and a Bachelor of Arts degree from Louisiana Tech University. He is a graduate of the Advanced Executive Development Program of the Kellogg School of Business at Northwestern University.

Paul is an avid long distance cyclist, logging thousands of miles each year. He enjoys spending time with his wife the 1991 National Teacher of the Year, Rae McKee and their five children and eight grandchildren.

Uranium and Uranium Progeny in Groundwater Associated with Uranium Ore Bearing Formations

Matt Hartmann, Uranium Resources, Inc.

Uranium is a naturally occurring element that is recovered commercially as an energy fuel when found in sufficient concentrations and quantities. Geoscientists have historically sampled and analyzed groundwater from existing wells for uranium and other elements as a uranium exploration method. In 1973, the Atomic Energy Commission initiated the National Uranium Resource Evaluation (NURE) program to identify uranium resources in the United States.

NURE investigators systematically sampled and analyzed groundwater across the United States to determine the presence and levels of uranium and other chemical constituents. Analysis of the NURE data revealed that naturally occurring uranium is commonly found in fresh water aquifers in uranium producing regions of the United States.

In situ uranium recovery (ISR) has been widely practiced in the United States for about 40 years.
Because ISR is conducted in aquifers, a vast amount of baseline ground water quality data is required before mining can begin which must be provided to regulatory agencies and the public.

This baseline data, from over 150 mine areas, reveals that elevated concentrations of uranium and its progeny occur in the groundwater in and around the uranium mineralization.

It is this understanding of the uranium radiochemical footprint in groundwater that USEPA uses as the basis for issuing Aquifer Exemptions for ISL uranium recovery facilities according to their rules at 40 CFR 146.4 that requires a finding that groundwater in a uranium ore zone cannot now and will not in the future serve as a source of drinking water. ISR cannot be conducted in the United States without a USEPA approved Aquifer Exemption.

Matt Hartmann is the Manager of Development Geology for Uranium Resources, Inc.; based at their corporate office in Denver, Colorado. Matt's focuses on the geology, resources, geotechnics, hydrogeology, and technical economics of mineral deposits to craft development and monetization strategies . His experience covers five continents and a variety of commodities including gold, silver, copper, uranium, potash, and diamonds. For the past decade he has specialized in the development of mining projects that utilize in situ and solution mining techniques for the recovery of uranium, copper and evaporite sequence minerals. Prior to joining URI in 2012, Matt held senior positions with Schlumberger Water Services, SRK Consulting, and Strathmore Minerals Corp. Matt is a graduate of The Ohio State University, and is a licensed professional geologist in Texas and Wyoming.

Class III UIC Regulatory Perspective: In situ Uranium Mining in Texas

David Murry P.G., Texas Commission on Environmental Quality

Commercial uranium deposits occur in Tertiary sediments underlying the coastal plain of the southern part of the Texas Gulf Coast. Surface deposits were discovered in 1954, and mining initially was done using open-pit methods. Deeper deposits have been and currently are mined using *in situ* mining techniques. Injection and production wells used for *in situ* mining are regulated under the TCEQ's Class III UIC program. This program includes a comprehensive permitting process designed to ensure that *in situ* uranium mining is protective of Underground Sources of Drinking Water (USDW). Mine operators must obtain a Class III UIC area permit, and a production area authorization for each ore body mined within the Class III permit area. As all deposits discovered to date occur in USDWs, an aquifer exemption also is necessary. The extensive permitting process includes public participation through public notice, opportunity to comment, and opportunity for a contested case hearing. Permits contain protective provisions for groundwater monitoring, containment of mining fluids, response to excursions of mining fluids, and restoration of affected groundwater to pre-mining quality.

David Murry is a Senior Geologist and Project Manager with the Underground Injection Control (UIC) Permits Section of TCEQ. David reviews permit applications for Class I and Class III UIC injection wells, and provides geologic assistance to other agency employees. He is a Texas Licensed Professional Geoscientist with 35 years of experience in minerals and petroleum exploration, industrial and hazardous waste permitting, and UIC permitting. David received his BS and MS degrees from the University of Texas at El Paso.

Louisiana Sinkhole Incident and Class III Rule Revisions

Stephen Lee, Injection and Mining Division of the Office of Conservation, Louisiana Department of Natural Resources.

Stephen Lee is currently the director of the Injection and Mining Division of the Office of Conservation within the Louisiana Department of Natural Resources. Mr. Lee first worked for the Injection and Mining Division from 1997 to 2008 as a staff geologist until leaving to consult in industry. After a 5 year absence, he returned to the Injection and Mining Division to replace the retiring director, Mr. Joe Ball, who left in July of 2013. Mr. Lee has extensive experience in the petroleum, mining, and environmental fields and holds a Bachelors in Geology, a Masters in Business Administration and a Juris Doctorate.

Class V Injection Wells: Back to the Future

Lorrie Council, P.G., Texas Commission on Environmental Quality

EPA first evaluated Class V injection wells in the mid-1980s, as part of its nationwide implementation of the Underground Injection Control (UIC) Program authorized by the federal Safe Drinking Water Act (SDWA). The presentation author assisted EPA with this initial evaluation; in this presentation, she provides a state-specific retrospective from the 2014 vantage point. Soon after the 1986 Amendments to the SDWA, EPA developed a nationwide inventory of Class V injection wells, in states with primacy for the UIC Program and in states where EPA had direct implementation authority. An assessment was also conducted of the initial nationwide inventory of Class V injection wells. These efforts culminated in the legislatively-mandated 1987 "Report to Congress Class V Injection Wells: Current Inventory, Effects on Ground Water, Technical Recommendations." EPA and the primacy states have made revisions to their UIC Class V Programs in the 27 years since this initial work.

The State of Texas Class V Program is implemented by the Texas Commission on Environmental Quality (TCEQ). Many of the same concerns outlined in the 1987 Report to Congress are relevant in Texas. The state has greatly restricted the use of motor vehicle waste disposal wells, large-capacity cesspools and septic systems, subsurface fluid distribution systems, and drywells, including specific closure requirements. Injection wells used to remediate groundwater and soil contamination comprise the majority of Class V wells in Texas. Due to increasing water supply needs and ongoing drought conditions in Texas, there is growing interest in and use of injection wells for disposal of concentrate from public drinking water treatment systems and aquifer management using recharge wells and aquifer storage and recovery techniques. As of December 2013, the inventory of Class V injection wells in Texas stands at over 41,000. TCEQ is also working to modify its database structure in an effort to address needs of the EPA database system, which should facilitate reporting and UIC data availability.

Lorrie Council serves as the UIC Permits Section Manager for the TCEQ. She manages professional geologists and engineers who review applications and write permits and authorizations for Class I, III, IV, and V injection wells in Texas. Ms. Council has 21 years of environmental consulting experience in groundwater protection and restoration and 12 years of Texas state government experience covering UIC permitting, waste disposal, and coastal erosion response. Ms. Council earned a B.S. in Geology from the University of Oklahoma and is a licensed professional geologist in Texas and Arizona.

Iowa Experience With Agricultural Drainage Well Inspection. Testing, Permitting, and Closure

Michael K. Anderson, P.E., Water Allocation Manager, Iowa Department of Natural Resources

The Iowa Department of Natural Resources (IDNR) has adopted rules to implement a comprehensive program to minimize the contamination potential of Agricultural Drainage Wells (ADWs). The IDNR's ADW permit program tries to bring existing ADWs into compliance with these rules and, implement a comprehensive program to minimize the contamination potential of ADWs. The rules arise out of Senate File 473, which was passed by the 1997 Iowa General Assembly. The bill required the closure of some ADWs and, for others, the removal of surface water intakes and sealing the cisterns. Iowa's water rights law was modified to specifically require a permit for the "diversion" of surface water into an aquifer, which precisely included ADWs. Agricultural drainage wells were constructed in Iowa in the early 1900s to provide outlets for surface runoff and tile drainage water from cropland areas. Because ADWs discharge water directly to groundwater aquifers, they are potential routes for movement of contaminants to aquifers. Consequently, state cost-share funds have been allocated to close approximately 400 of these wells on a priority basis. Alternative drainage outlets are developed to surface streams needed to replace these wells. The alternative drainage outlets are typically developed through formation of drainage districts, although some outlets can be developed by individual landowners. Environmental risk to drinking water supplies associated with ADWs in close proximity to earthen waste storage units has been eliminated through this program. A number of wells in Iowa (about 155) were ADW continued use permits under the Department's water allocation authority. These permits were valid for a period of ten years; most expired in 2009. For renewal of these permits, physical on-site inspections and water quality testing was required. The results from the on-going closure program and the re-inspection program are that we have reduced the number of permits to 57.

In this talk we will show a few maps of where this groundwater pollution has been found and how it is occurring, but the main focus will be on legal and regulatory issues to help reduce risks from these wells. For example, we will spend a little time expanding the discussion about lessening the nutrient loading to streams, since our State has shifted the discharge of pollutants from subsurface to surface. Also, some discussion of the legal basis and de facto power of the drainage districts, which will attempt to focus on obstacles that the ADW owners who were required to close faced.

Michael Anderson has been an engineer in the Iowa Department of Natural Resources Water Supply Engineering Section since 1984, and a Senior Engineer since 1995. He is responsible for leading the water allocation group, conducting analysis of water rights, and carrying out planning aspects of Iowa water law. He is also IDNR's water security specialist. He has a Bachelor's Degree and a Master's Degree, both in civil engineering, and both from the University of Minnesota in Minneapolis. His emphasis in his Master's Curriculum and Thesis was hydrology/hydrogeology.

Class V UIC and Septic Systems

Sonja S. Massey, Chief Groundwater Branch, Land Division, Alabama Department of Environmental Management

Sonja Massey is the Chief of the Groundwater Branch in the Land Division of ADEM. The Groundwater Branch directly administers the Underground Storage Tank Regulatory and Corrective Action programs, as well as the Underground Injection Control program for the State of Alabama. The Groundwater Branch also provides groundwater technical support where needed for other ADEM programs.

Ms. Massey is a registered Professional Engineer in Alabama. She graduated from Auburn University in 1979 with a Bachelor's Degree in Chemical Engineering and spent three years as an environmental engineer in the paper industry. Following that, she began work with the Alabama Water Improvement Commission (a predecessor agency to ADEM) in 1982, as an environmental engineer in the Industrial NPDES permitting program, where she worked for five years. In 1987 she was appointed as Chief of the ADEM Groundwater Branch of ADEM.

SAWS Brackish Groundwater Desalination Program: Production to Injection Wells

Bill Stein, P.G., LBG-Guyton Associates & Kevin Morrison, San Antonio Water System

The San Antonio Water System (SAWS) continues to diversify their water supplies. Brackish groundwater desalination is one of the options under development. SAWS will produce brackish water from the Wilcox Aquifer south of San Antonio, which will be desalinated in a reverse-osmosis (RO) treatment plant. The initial phase will produce about 10 million gallons per day (MGD) of permeate and approximately 0.9 MGD of bypass water from 12 production wells. Each production well will produce about 800 gallons per minute (gpm) and range from about 1,300 feet to 1,800 feet in depth.

SAWS has obtained Class 1 injection well permits from the Texas Commission of Environmental Quality (TCEQ) to dispose of the RO concentrate. SAWS was the first applicant to go through the TCEQ General Permit approval process, which has been created to streamline the injection well approval process for disposing of concentrate from desalinization for municipal water supplies. This new permitting process significantly reduces the TCEQ review and approval time line.

The waste generated by the RO plant from the initial phase is expected to be about 1.1 MGD of concentrate with a total dissolved solids (TDS) ranging from about 13,000 to 15,000 milligrams per liter (mg/L). SAWS will dispose of the RO concentrate in the Edwards Limestone. The first test injection well was constructed in 2012 in northern Wilson County. The total depth of the well is at about 5,000 feet. Water samples from the well indicate that the native Edwards water has about 90,000 mg/L TDS, which is well above the 10,000 mg/L TDS level for usable source of drinking water (USDW). The Wilcox Aquifer, which is the source of the brackish water, is the deepest USDW in this area at depth of about 2,000 feet. Cemented conductor, surface casing and long string help protect the shallower groundwater. Injection tubing with packer assembly is installed inside the long string tubing to inject directly into the Edwards Limestone. The TDS of the concentrate at 13,000 to 15,000 mg/L will be significantly better than the 90,000 mg/L for the native Edwards water. Initial testing of the first injection well indicates that about 400 to 500 gallons per minute will be able to be injected into that well.

***Bill Stein** has worked with LBG-Guyton Associates for 22 years following five years of working for the U.S. Geological Survey Water Resource Division in San Antonio. Bill has a Bachelor and Master of Science Degree in Geology from the University of Texas at San Antonio. Bill has been working on the SAWS Brackish Desal Program since 2005.*

Subsidence and Coastal Geomorphic Change in Central Louisiana

Jack Kindinger, U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center

It is well documented that the Mississippi River delta region of coastal Louisiana has experienced high rates of relative sea-level rise largely driven by subsidence. This differential downward elevation and sea-level change has led to widespread land loss and deterioration of ecosystem health. The precise causes of subsidence are not well understood because it results from multiple physical processes including reactivation and movement along preexisting growth fault systems, deep-basin salt migration, deltaic sediment compaction, sediment loading, glacial isostatic adjustment (GIA), anthropogenic fluid withdrawal, and surface water drainage and management. Complicating this understanding is that each of these processes function at varying spatiotemporal scales and rates and as well as depth within the subsurface. Also, these processes are not necessarily independent of one another: the effect of one may influence coastal response to another.

There has been widespread disagreement within the research community as to what magnitude each process contributes to the aggregate subsidence rate; consequently, there is a lack of agreement for a single rate of subsidence in the region. Rates of subsidence in central coastal Louisiana generally range from 6 to 20 mm/yr, but vary greatly by individual process from GIA (0.6 to 2.0 mm/yr) to fluid withdrawal (up to 23.0 mm/yr). From 2002 to 2005, subsidence rates for the most populated area of coastal Louisiana, New Orleans, averaged 6.4 mm/yr and ranged from 0 to 28.6 mm/yr.

The effect of subsidence-driven relative sea-level rise has already impacted Louisiana's wetlands and coastal shorelines. Low-lying areas are being flooded more frequently, exposing them to erosion by storm waves. These impacts are cumulative: frequent inundation and erosion of low-lying areas will cause more frequent flooding. In addition to these impacts threatening ecosystems, there will be damage to coastal infrastructure. Managing these impacts requires a comprehensive understanding of subsidence in coastal Louisiana using a full range of measurements relative to spatial and temporal scales in which each process occurs.

Jack L. Kindinger, Supervisory Research Geologist, U.S. Geological Survey St. Petersburg Coastal and Marine Science Center, St. Petersburg, FL has worked for 35 years as a geoscientist with the USGS, working nationally and internationally on understanding the geologic history and evolution of marine and coastal depositional environments including subsidence studies to determine and quantify processes contributing to land loss such as erosion of barriers islands and shorelines along the Gulf of Mexico and Atlantic coasts; and Coastal Pollution Studies, a multidisciplinary study of the distribution and quality of lake bottom sediments in Lake Pontchartrain Basin, LA. Jack has also served as the Science Center Director for 8 years.

Why Standards: Planning a Framework and Attaining Balance within a Maturing Unconventional Oil and Gas Industry

Caryl Alfaro, President, Earth Resource Systems, LLC

What balance can be reached allowing for the economic viability for these shale oil and gas operations that include hydraulic fracturing while ensuring environmentally safe operations? What constitutes a standard? Who are some of the better known standard development organizations (SDOs)? How do they inter-relate?
How will standards that are not counterproductive to the cost efficiency of these manufacturing operations be completed? How will we address public environmental concerns in these standards? How will they shape important practices within the industry without unnecessary regulations? How will we plan for the potential environmental risks and hazards from these operations when accidents do happen? What have we learned from these operations in the United States to prevent or minimize potential environmental issues in other parts of the world?

Domestically, unconventional shale oil and gas plays are now focused on manufacturing and production as the major exploration phase has been mostly completed. Cost drives the industry. Internationally, shale oil and gas operators and service providers are cashing in on knowledge transfer as the exploration phase starts in some countries.

Many of these operators use sophisticated tools and computer systems during the hydraulic fracturing process and throughout the life cycle. The export of certain records and fields (especially environmental data elements) for standardized reporting during these operations may streamline government processing and oversight. If planned properly, the right types of data gathered, reported and archived would be helpful for spatial, environmental and engineering analysis and knowledge.

As unconventional production surges and increases the United States energy independence, public discussions and protests still persist. Recent landmark decisions regarding community rights versus state control reopens the conversation on how to achieve a balance between the operators, regulators and public at large. An important turning point is here now—consensus standards may help lead the way to achieve a balance amongst the various stakeholders.

Caryl Alfaro is the President and primary environmental consultant at Earth Resources Systems LLC. She holds a PG license in Georgia and is a CPG and PMP. She has a B.S. in Geology and MPPM, Master's in Public and Private Management. Currently, she works for a healthcare IT company looking at data analytics, software and product development, and cloud-based implementations. She spent her early years in oil and gas exploration for a geophysical company based in Houston Texas. With the oil bust in the 80s, she went into environmental and worked for various engineering consulting firms: PELA, Ogden, URS, Shaw. In Florida with CH2M Hill she worked on the City of Tampa ASR project and Injection Well projects. She has lots of field experience with drilling crews and sampling programs under NAVY CLEAN, RCRA and UST Programs. In all, she has spent around 15 years engaged in environmental site assessments, remediations, compliance, and environmental litigation support.

The Global Status of CCS: 2013

Victor Der, General Manager – The Americas Global CCS Institute

The Global CCS Institute accelerates carbon capture and storage, a vital technology to tackle climate change and provide energy security. The Institute advocates for CCS as a crucial component in a portfolio of technologies required to reduce greenhouse gas emissions. It drives the adoption of CCS as quickly and cost effectively as possible by sharing expertise, building capacity and providing advice and support to overcome challenges. Its diverse international membership of 373 comprises governments, global corporations, small companies, research bodies and non-governmental organizations committed to CCS as an integral part of a low carbon future.

This talk will present the *Global Status of CCS: 2013* report, based on the Institute's annual global survey. It will provide an overview of carbon capture and storage (CCS) from various aspects including policy, legal and regulatory, market, CCS technologies and large-scale demonstration projects, insights and recommendations for actions to accelerate the deployment of CCS technology.

Victor Der joined the Global CCS Institute in May 2011, and is General Manager for The Americas. Prior to joining the Institute, Victor worked at the U.S. Department of Energy (DOE) for over 37 years, retiring as the Assistant Secretary (acting) for Fossil Energy. Victor has led the Office of Fossil Energy in the areas of Clean Coal, Carbon Capture and Storage (CCS), Oil and Gas R&D, and the Strategic Petroleum Reserve. He had served in various prior capacities at DOE, including the Principal Deputy for Fossil Energy and Deputy Assistant Secretary for Clean Coal and CCS. Victor is also the former Chair of the Carbon Sequestration Leadership Forum (CSLF) Policy Group, and had also served as the Chair of the CSLF Technical Group. As the Assistant Secretary (acting), Victor managed a multi-billion dollar portfolio of Clean Coal Technology and CCS Demonstration projects in addition to a multi-million dollar research portfolio on CCS, power generation, and enhanced oil and gas recovery research. Victor's prior experience includes research and management in advanced nuclear energy, geologic storage of high-level nuclear waste, and superconductivity for magnetic fusion energy. Victor's prior work includes NASA's Apollo 15 moon mission project and the National Oceanic and Atmospheric Administration program on modeling the upper atmospheric density. Victor holds a Bachelor of Science, Master of Science and Ph.D. in Mechanical Engineering from the University of Maryland, and serves on the Advisory Board of the University of Maryland's Energy Research Center and on the Board of Carbon Management Canada Research Institutes, Inc.

Update on DOE's CCS Activities

Mark Ackiewicz, US Department of Energy

The EIA projects that fossil fuels, including coal, will remain a vital component of the nation's energy mix in the future. The clean and efficient use of coal is a key part of President Obama's all-of-the-above energy strategy.

A major challenge however is that coal is a major source of carbon dioxide (CO_2) emissions. Therefore it is critical that technologies be developed and deployed to reduce these emissions. The U.S. Department of Energy (DOE) is investing in a strategy that consists of demonstration projects of first generation technologies and development of advanced second generation technologies.

DOE is currently supporting eight commercial-scale demonstration projects of first generation technologies that will capture, utilize, and store CO_2 from power plants and industrial sources. These projects will help industry understand and overcome start-up issues, address component integration, and gain early commercial experience to overcome technical and financial risks in future plants. These eight demonstration projects are investing in pre-, post, and oxycombustion technologies for conventional pulverized coal power plants, advanced coal plants such as integrated gasification combined cycle (IGCC), and industrial sources.

The eight demonstration projects, along with the Regional Carbon Sequestration Partnership (RCSP) projects are also investing in CO_2 storage activities to address key infrastructure development issues and provide experience on site characterization, construction, operations, monitoring, mitigation, closure, and long-term stewardship.

These efforts are coupled with research and development (R&D) activities on development of more cost-effective capture technologies, monitoring, verification, and accounting technologies to ensure permanent storage; and advanced energy systems to improve plant efficiency.

This presentation will provide an update on the status of the DOE's demonstration and RCSP projects, and an overview of its CCS R&D efforts.

Mark Ackiewicz is the Director for the Division of Carbon Capture and Storage (CCS) Research at the U.S. Department of Energy. He is responsible for planning, management, and administration of the division's $170+ million R&D portfolio related to post- and pre-combustion carbon capture, utilization, and storage. He previously served as Program Manager for the Carbon Capture and Fuels Programs, where he was responsible for program management of research and development activities. Prior to joining DOE, he worked in industry as an energy consultant and as a research and process engineer. Mr. Ackiewicz has a B.S. in Chemical Engineering from Johns Hopkins University, and a Master's in Engineering Management from George Washington University.

Reporting Storage Effectiveness for CO_2 EOR

Susan Hovorka, Bureau of Economic Geology, Jackson School of Geoscience, University of Texas

Protocols and regulations for geologic storage recognize the importance of site-specific design for monitoring. One of the major differences among sites is history, both geologic history and past use. A site that has trapped hydrocarbons and from which hydrocarbons have been produced (referred to as a brownsite) and a site that does not have this history (referred to as a greensite) have fundamental differences. In a situation which requires reporting or confirmation of effectiveness of storage, for example for tax credits or to comply with voluntary GHG regulations, or to provide assurance of no risk to USDW, assessment of these fundamental differences is needed.

Greensites, where injection is planned into unused saline aquifers, are characterized and modeled to predict response to injection. However at the start of injection, significant uncertainty in how the site will respond to pressure increase and fluid substitution remains. The trapping mechanism and the modeled pressure elevation and extent of CO_2 need to be demonstrated. A monitoring program validates the accuracy of the predictions and informs adjustment of the injection program.

In contrast, brownsites are well known at the start of CO_2 injection. The trapping mechanism has been tested by retention of buoyant fluids. The production history has extensively tested the reservoir volumetrics and response to pressure change. Specific areas of uncertainty may be identified, such as the response to elevated pressure, especially in terms of performance of wells, however the uncertainties that dominate the early years of greensite monitoring are already greatly reduced.

Recognition of different risk and uncertainty profiles is needed to reach equally strong assurance of effective storage in sites with different histories.

Susan D. Hovorka is a Senior Research Scientist at the Bureau of Economic Geology, Jackson School of Geosciences, at The University of Texas at Austin. She has a BA in geology from Earlham College and an MA and PhD from the University of Texas. Hovorka is the principle investigator of the Gulf Coast Carbon Center, an industry/academic partnership working on approaches to geologic sequestration of CO_2 with a focus on field testing. She has participated in seven field test designs, six of which have been implemented in both EOR and saline contexts.

Geologic Sequestration Program Implementation Progress: Class VI Permitting and Guidance

Bruce J. Kobelski, OGWDW, USEPA

The United States Environmental Protection Agency (EPA) has been involved with the development of protective regulations, in the Underground Injection Control (UIC) program, for the purpose of long term storage of carbon dioxide captured from emission sources for nearly fourteen years.
After developing a technical position on the injection of carbon dioxide (CO_2), the Office of Water decided to focus on assessing the potential risks to drinking water aquifers from such injection. In 2007, OW initiated the rulemaking process, and in late 2010 promulgated a final rule establishing a new class of injection well, Class VI, with criteria and standards addressing the deep saline injection of CO_2.

Implementation of the new Class VI program began immediately in early 2011, with the preparation of the first of twelve technical guidance documents to provide more clarity to the regulations, and a pathway forward by establishing steps for the permitting process. Two of the latest technical guidance documents are the Well Plugging and Post Injection Site Care and Site Closure document released in 2013, and the Class II to VI Transition draft guidance which is now open for comment until March 2014.

EPA is also reviewing the first permit applications for Class VI wells in the U.S. The permitting process for Class VI has become an iterative learning exercise for both the applicants and the EPA permit reviewers. EPA has also received the first state primacy application from North Dakota seeking primary enforcement authority for new Class VI wells.
New climate rules and EPA's proposed plans for addressing greenhouse gas emissions are being coordinated through the EPA Offices and in close collaboration with other federal agencies, states, stakeholders and industry.

***Bruce Kobelski**, Geologist at the Office of Ground Water and Drinking Water, USEPA has been with EPA's Underground Injection Control (UIC) program in Washington, DC since 1986. He serves as the Team Co-Leader for the Geologic Sequestration Team in the Drinking Water Protection Division. Previously, he was Chief of OGWDW's Hazardous Waste Injection Section and the UIC Regulatory Development Section from 1989 to 1995. Technical reports he co-authored include the 2001 Report to Congress on Class I Hazardous Wells, the 2004 Study on Coalbed Methane Hydraulic Fracturing, and several papers assessing research needs for GS. Past experience included work as an exploration and production geologist in the oil and gas industry sector, and in the U.S. Department of Interior's former offshore oil and gas agency; the Minerals Management Service. He received his M.S. in Geology from Pennsylvania State University and his B.A. in Geology, from Rutgers University.*

North Dakota's Class VI Primacy - Why, How, and What Now

Kevin C. Connors, North Dakota Industrial Commission, Department of Mineral Resources, Oil and Gas Division

North Dakota considers carbon dioxide a valuable commodity with industrial or commercial uses, including enhanced recovery of oil, gas, and other minerals. The utilization of the pore space in geologic formations, as storage space, allows for carbon dioxide to be readily available for such industrial or commercial applications while simultaneously reducing atmospheric emissions of anthropogenic carbon dioxide. Management of the pore space as a natural resource requires cooperative use of surface and subsurface property interests and the collaboration of property owners. Given the regulatory complexities of carbon dioxide storage including environmental protection, ownership and management of the pore space, maximization of storage capacity and long term liability, geologically stored carbon dioxide should be treated under resource management frameworks as opposed to waste disposal frameworks.

The current regulatory arena in North Dakota has convoluted the development of carbon dioxide storage projects. In addition to the federal authorities granted to the USEPA, North Dakota has enacted State laws and regulations governing carbon dioxide storage. Until primacy enforcement authority is handed over to North Dakota both federal and state laws and regulations apply to any potential carbon dioxide storage project. This issue of dual regulation has created an overly burdensome set of federal and state requirements along with two separate regulatory jurisdictions. The combined regulations are creating a major deterrent for any potential projects coming to fruition. This issue of dual regulation will be remedied upon USEPA approval of the North Dakota Class VI primacy application. Once Class VI primacy is obtained by the State of North Dakota a complete and comprehensive regulatory framework will be in place allowing for the State's lignite and energy generating industries the regulatory certainty necessary to pursue future carbon dioxide storage projects.

Mr. Kevin Connors has been the Carbon Capture and Storage (CCS) Supervisor of NDIC's Oil & Gas Division since July 2011. Kevin began with the State of North Dakota as a field inspector in the Williston District office before transferring to the Bismarck office for CCS. Prior to coming to work for the State Government, Kevin worked as a wellsite geologist in the Williston Basin Bakken play. He earned his B.S. degree in Geology from the University of Montana.

State of Texas Water Recycle/Reuse and Well Construction Rules

Leslie Savage, Chief Geologist, Oil and Gas Division, Railroad Commission of Texas

In response to concerns about water use in hydraulic fracturing, the Railroad Commission of Texas (the Commission) adopted rules to encourage recycling and reduce the use of fresh water. Effective April 15, 2013, the Commission amended its rules to encourage recycling of hydraulic fracturing flowback fluids, produced water, and other oilfield fluids. The amendments authorize non-commercial recycling under specified conditions if operators are recycling fluids on their own leases or transferring those fluids to another operator's lease for recycling. The amendments also clarify the application requirements and permit standards for commercial recycling operations for both solids and liquids and more accurately reflect the range of recycling practices currently used in the industry. The amendments establish a tiered approach for the reuse of treated fluid, including both authorized reuse of treated fluids in oil and gas operations and provisions for reusing the fluid for other non-oilfield related uses. The new rules are designed to encourage Texas operators to continue water conservation efforts during hydraulic fracturing operations.

On May 24, 2013, the Commission adopted amendments to §3.13, relating to Casing, Cementing, Drilling, Well Control, and Completion Requirements. The Commission's requirements for drilling, casing and cementing oil and gas wells in Texas have been proven effective over time; however, the new requirements codify many best management practices that are being implemented by most operators; more clearly outline the requirements for all wells; consolidate the requirements for well control and blow-out preventers; and update the requirements for drilling, casing, cementing, and fracture stimulation. The amended rules became effective for wells that are spud on or after January 1, 2014.

Leslie L. Savage is the Chief Geologist of the Oil and Gas Division of the Railroad Commission of Texas. She coordinates rulemaking, analyses state and federal proposed legislation, and the Division's programs with other state and federal agencies. She has been with the Commission since 1983 during which she has been responsible for oversight of the Commission's UIC, surface waste management, hazardous oil and gas waste, and waste minimization/pollution prevention programs. She also has been responsible for technical review of oil field contamination cases involving hydrocarbons, PCBs, asbestos, and metals. Ms Savage is on the Board of Directors of the Ground Water Protection Council and is a member of STRONGER, Inc. Ms. Savage holds a B.S. in Geology from the University of Texas.

Hydraulic Fracturing: State of the Art in Chemical Evaluation

Bridget Todd, Baker Hughes

Global focus on chemical disclosures and heightened attention to chemical use are increasing the oil and gas industry's desire to assess chemicals for potential health and environmental hazards and propose viable, alternative technologies. With the rapid emergence of unconventional reservoir development a number of questions have entered the arena of public debate associated with chemical disclosure and chemical evaluation.

Beginning with the North Sea OSPAR (OECD) schema with over 13 years of proven ecotox guidelines to current worldwide oil field specific evaluation our industry has a long history of chemical improvement and management with focus upon reducing the potential environmental, human health and physical hazard potential. A current system in its fifth year of operation, applies a standardized oil and gas industry-specific chemical evaluation process based in-part upon the United Nations 'Global Harmonized System of Classification and Labeling of Chemicals' (GHS). The process evaluates chemicals at an ingredient level for environmental and human health endpoints, and at a products level for physical hazards that may impact worker safety. The system allows for a thorough evaluation supporting quantitative scoring of a product, and if needed mapping a clear path for chemical improvement, with consideration for a products performance. Additional considerations include a list based screenings and OSPAR review and flexibility to include region or operator specific components of concern. This presentation will address chemical evaluation processes history and current state of play with an emphasis upon hydraulic fracturing applications and demonstrate how chemical evaluation tools can be used as a process for improvement for product development in the oil and gas industry.

Bridget Todd is the Manager for Environmental Conformity for Pressure Pumping within Baker Hughes with a focus on chemical disclosure, product review and refinement, and greenhouse gas emissions. Prior to her position with Baker Hughes, Bridget was an environmental consultant working with energy companies throughout the U.S. Bridget is a member of Society of Petroleum Engineers and received a Bachelor of Science in Geology from Sam Houston State University.

Development of a Framework for Brine Disposal Wells in the Northern Appalachian Basin Based on Operational and Geologic Information

Joel Sminchak, John Miller, and Priya Ravi-Ganesh

Operational and geologic information were used to evaluate Class II UIC brine disposal wells in the Northern Appalachian Basin. For the purposes of the research, the study area was defined as eastern Kentucky, Ohio, Pennsylvania, and West Virginia. This area has seen increased demand for brine injection due to shale gas activity. Data was collected on well construction specifications, geological conditions of injection zones, subsurface hydrologic conditions, geophysical well logs, and operational data from brine injection wells for the Northern Appalachian Basin. The wells are completed in a variety of different rock formations related to their subsurface distribution. Well construction records indicate that approximately 18% of the wells are open-hole completions and that most wells are fractured and acidized before injection. Geological data on the injection zones showed that rock formations used for injection can be correlated across the Appalachian Basin. Maps of these formations were completed to depict the regional distribution of the injection intervals. In addition, 690 well log images from the injection wells were analyzed to better define reservoir properties and create injection simulations. Available operational data were analyzed for injectivity index, a function of injection rate and pressure. The injection performance data were correlated to geological conditions to better define brine disposal potential in the various geologic formations in the region. This project is supported by the Research Partnership to Secure Energy for America unconventional onshore program project #11122-73.

Joel Sminchak, John Miller, and Priya Ravi-Ganesh work in the Energy Systems Department at Battelle Memorial Research Institute. They have been active in research on hydrogeologic, engineering, regulatory, and risk issues associated with the deep-well injection of CO_2 to reduce greenhouse gas emissions and for enhanced oil recovery.

Induced Seismicity from Fluid Injection and Draft Best Practices

Austin Holland, Oklahoma Geological Survey

Induced seismicity from fluid injection has become a greater concern over the past few years with a significant number of new possible cases and growing public and political concern. These observations and a number of potential cases of induced seismicity in Oklahoma have caused the Oklahoma Geological Survey to develop a draft set of best practices regarding fluid injection induced seismicity. These best practices are generally designed to be quite broad and allow those implementing the best practices to define these generic terms for a given level of risk. The best practices are based off of observations from previous well-documented cases of induced seismicity and the physics behind induced seismicity. The causes of induced seismicity are generally well known and include either the diffusion of pore pressure or altering the stresses within the subsurface. These stress changes or pore pressure changes interact with naturally occurring stressed faults or fractures to trigger earthquakes. We will look at the proposed best practices in regards to relative risk and observations from published literature. Well-known risk factors for injection-induced seismicity include proximity to known faults, especially those already critically stressed, existing state of stress and pore pressure within the reservoir, and high injection pressures or volumes.

Austin Holland is a research seismologist with the Oklahoma Geological Survey (OGS). He has been with the OGS since January of 2010. Since arriving at the OGS Austin has worked on issues of triggered or induced seismicity. He has given several invited talks on induced seismicity at national meetings and continues to assess potential cases of induced seismicity throughout Oklahoma. He is currently finishing his Ph.D .at the University of Arizona where his focus was primarily on measuring deformation of the Earth using high precision GPS and earthquake seismology. He received his Masters of Science in Geophysics from the University of Texas at El Paso, and his Bachelors of Science in Geology from the University of Idaho. He worked at the Department of Energy's Idaho National Laboratory for 12 years in the seismic monitoring program.

Fluid Injection Inventory for Class II UIC Wells of Oklahoma

Kyle E. Murray, Oklahoma Geological Survey

Water and other fluids have been injected into oil and gas reservoirs for decades to allow for secondary recovery or enhanced oil recovery (EOR) of petroleum. Water co-produced with oil and gas also has long been disposed of via saltwater disposal (SWD) wells. Recent research suggests a link between these two types of Class II underground injection control (UIC) wells and seismicity in several regions of the United States. In some parts of the mid-continent, such as Oklahoma, there is limited published information regarding volumes of fluids injected, formation or injection pressures and the variability of those parameters in space and time. As a result of this data gap it is difficult to separate induced from natural seismicity or to manage seismic risk associated with UICs. The objectives of this research were to create and summarize Class II UIC well data for Oklahoma from 2000 to present. Well completion data from various sources were compiled to determine the zone into which fluids were injected for the more than 11,000 UIC wells in the state. The most complete dataset compiled thus far is for the year 2011 which indicates that the Desmoinesian, Missourian, and Atokan-Morrowan zones receive the greatest volumes of water for EOR. Saltwater is disposed predominantly into the Arbuckle Group, Multiple-Undifferentiated, and Devonian to Middle Ordovician zones. Spatial and temporal trends in fluid injection volumes are related to development of water-saturated emerging plays such as the Mississippian or to cycles of dewatering projects and secondary recovery activity.

Dr. Kyle E. Murray serves as Hydrogeologist for the Oklahoma Geological Survey (OGS) and as an adjunct faculty member in the School of Geology and Geophysics at the University of Oklahoma (OU). His emphases at OGS and OU are on the interplay between water and conventional, unconventional, and renewable energy resources. His research is designed to provide practical scientific perspectives on water issues and to influence responsible management and sustainable practices.

Industry and Regulatory Cooperation for Better Information

Trudy Curtis, CEO PPDM Association

Good data helps us make good decisions. It's a universal truth, but applying the principle is difficult to do universally. My good data may be unimportant to you. Worse, data that is well suited to my needs may be detrimental to your needs. Deciding what makes data good, and how we should make sure that everyone can have access to the data they need means that all of the stakeholders need to have input into how data should be created, collected, managed and used over time.

Data is the engine that keeps the oil and gas industry running smoothly. From the moment we start planning a well to the point where the necessary funds and approvals to create and operate the well, and finally to disposing of it, we generate vast amounts of data. Lots of that data is sent to regulators, who use it to ensure that legislation and regulations are being followed, that reserves are being efficiently managed, and that royalty revenue is received.

The diverse needs of operators, regulators, service companies and vendors have resulted in an often bewildering array of dialects and processes. The GWPC, through the RBDMS group, has cooperated with the PPDM Association, a not for profit data management society, to harmonize and improve some key processes that have previously hampered industry's ability to work collectively. This presentation will focus on some of these initiatives.

Trudy Curtis is the Chief Executive Officer of the Professional Petroleum Data Management (PPDM) Association based in Calgary, Alberta, Canada. She has over thirty four years of experience in the industry and is known around the world for her advocacy of data management as a professional discipline and data as a critical corporate asset.

After receiving a BSc. from the University of Calgary in 1978, Curtis went to work in the Oil and Gas industry, and ultimately the PPDM Association. As chief architect of the PPDM data model, trainer, speaker and leader, she has led the way to the creation and industry adoption of standards, best practices and the professionalism of data management in the petroleum industry. In addition to her role as CEO of the PPDM Association, Curtis is co-chair of the Standards Leadership Council.

About the Foundation - The Ground Water Research & Education Foundation (GWREF) is a not-for-profit 501(c) 3 corporation dedicated to promoting research and education related to the protection of ground water. The foundation is comprised of a board made up of volunteers from government, institutes of higher education, and the public appointed through the Ground Water Protection Council.

Our Mission - To promote and conduct research, education, and outreach, in the areas of development and application of technical systems, pollution prevention efforts related to ground water protection, underground injection technology, and watershed conservation and protection.

The Foundation's Goals

- Support the Ground Water Protection Council in the fulfillment of its mission to improve government's role in the protection and conservation of ground water.
- Identify and facilitate research aimed at increasing our understanding of the science and policy of ground water protection and conservation.
- Develop education and outreach initiatives which increase the level of understanding of ground water resources in order to empower citizens to assume ground water protection roles.
- Provide tools and resources for ground water protection and conservation practitioners to better fulfill their goals.

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