# 2011 Ground Water Protection Council Annual Forum


| Groundwater Availability & Sustainability | Groundwater / Energy Sustainability | Groundwater Quality |
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## Online Proceedings:

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*Major Funding Provided by:*

GROUNDWATER RESEARCH & EDUCATION FOUNDATION

U.S. DEPARTMENT OF ENERGY

GROUNDWATER PROTECTION COUNCIL

*The GWPC is a national association of state ground water and underground injection control agencies whose mission is to promote the protection and conservation of ground water resources for all beneficial uses, recognizing ground water as a critical component of the ecosystem.*

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

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Acknowledgements: *2011 Event Partnering Organizations* ~ On behalf of the Planning Committee… *THANK YOU!*

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| Sunday, September 25 – Preconference Events | *Meeting Competing Demands with Finite GROUNDWATER Resources* |
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| GWPC Board of Directors Meeting<br>*Resolution 11-2*: Regarding USEPA Partnership with States to Address Nutrients - Mike Paque, GWPC Executive Director<br>*Resolution 11-3*: Concerning FracFocus.org – Mike Paque, GWPC Executive Director | |
| Class I UIC Roundtable Discussion/Training<br>By Subsurface Technology, Inc.<br>Session Chair: Steve King, Subsurface Technology, Inc. | Water / Energy Division Roundtable Discussion:<br>Division Chair: Leslie Savage, Railroad Commission of Texas |
| We are planning an interactive UIC roundtable discussion and training session to cover areas of interest to each and every person attending. In order to cover relevant subject matter we would like your input on areas or specific subjects you would like to cover. If you have a specific well problem or just an area you may like to get a more thorough understanding, you will be free to bring those up during the session. Some areas that will be included are listed below.<br>- History of Injection and Overview of UIC Program<br>- Permitting<br>- Petitioning<br>- History of Injection and Overview of UIC Program<br>- Siting Criteria, Geology, and Reservoir Properties<br>- New Class I Well Construction<br>- Well Repair and Workovers<br>- Operating Procedures<br>- Fluid Quality<br>- Inspections<br>- Mechanical Integrity Testing<br>- Reservoir Testing | Items to include:<br>- Abstract 2a: The Issue of Diesel in Hydraulic Fracturing Fluid: The Federal Initiative and the States Perspectives – Leslie Savage, Texas RRC<br>- Abstract 2b:Discussion of the New York Draft Supplemental Generic Environmental Impact Statement for Hydraulic Fracturing: Don Drazan, NY DEC<br>- Abstract 2c: Methane Farming through Use of Indigenous Microbes - Roland P. DeBruyn, Luca Technologies Inc.<br>- Abstract 2d: Water Efficiency of Texas Shale Plays – Jean-Philippe (JP) Nicot, Bureau of Economic Geology, The University of Texas at Austin<br>- Abstract 2e: Haynesville Shale: Significance of Early Adaptive Water Resource Management, Regional/Industry/State Cooperation and a Driver for State Water Use Reform - Gary M. Hanson, Red River Watershed Management Institute<br>- Abstract 2f: North Carolina's Study of Shale Potential Shale Gas Development – Evan Kane, North Carolina DENR<br>- Abstract 2g: Evaluation of State Surveillance and Enforcement Methods: Proposed Study – Bill Bryson, KS Geological Survey |

2011 GWPC Annual Forum Planning Committee

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| GWPC Board of Directors | Joe Lee, PA DEP |
| GWREF Board of Directors | Jamie Crawford, MS DEP |
| Water/Energy Division | Rebecca Thingelstad, Anadarko Petro. |
| Water Availability & Sustainability Division | Brandon Kernen NH DES & Sarah Pillsbury NH DES |
| Water Quality Division | Audrey Eldridge, OR DEQ |
| RBDMS Steering Committee | Stan Belieu, NE O&G |
| USEPA Region 4 | Nancy Marsh & Robert Olive, EPA R4 |
| USEPA Headquarters | Lisa McWhirter & Mike Muse, USEPA OGWDW |
| USDOE/NETL | Rob Vagnetti, USDOE/NETL |
| USDOE - Division of CCS Research | Mark Ackiewicz, USDOE Office of Fossil Energy |
| State of Georgia | Sandra Jo Robertson, GA DNR |

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| Day-1 Monday, September 26 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| *Day-One:* Opening General Session -- *Groundwater Sustainability*<br>Moderator: Jamie Crawford, Mississippi Department of Environmental Quality and GWPC Vice- President<br>Linda MacGregor, Chief Watershed Protection Branch at the Georgia Department of Natural Resources – *Welcome to Georgia!* Bio 3a<br>Jim Kennedy, Georgia State Geologist - *Groundwater Use in Georgia* Bio 3b<br>William "Brad" Carver, Environmental Attorney - *Tapping the Tennessee River: the Solution to Georgia's Water Woes* Bio 3c<br>Greg Koch, Director of Global Water Stewardship for the Coca-Cola Company – *The Coca-Cola Company Global Water Stewardship* Bio 3d<br>William "Bill" Alley, Chief, Office of Groundwater for the U.S. Geological Survey - *WaterSMART Use and Availability Assessment* Bio 3e<br>Ann Codrington, USEPA Office of Ground Water & Drinking Water - *Sustaining Water Resources* Bio 3f | | |
| Alternative Water Resources<br>Moderator: Nancy Marsh, USEPA Region 4 | Groundwater Quality<br>Posters: 5e<br>Moderator: Audrey Eldridge, Oregon DEQ | Managing Water & Energy Efficiency:<br>Uses of Groundwater for Energy<br>Posters: 6e, & 6f<br>Moderator: David Terry, Massachusetts DEP |
| Abstract 4a: Water Supply in Coastal Georgia—Meeting Water Demand Using Alternative Water Sources to the Upper Floridian Aquifer - John S. Clarke -USGS Georgia Water Science Center | Abstract 5a: National Ground Water Association's ANSI Water Well Construction Standard - Kevin McCray, CAE - National Ground Water Association | Abstract 6a: The Increasing Pressure for Groundwater Sources for Natural Gas Development in the Headwaters of the Susquehanna River Basin - Brooks G. Abeln, P.G. Susquehanna River Basin Commission |
| Abstract 4b: Brackish Groundwater in the Coastal Plain of Alabama: An Historic Resource with Implications for the Future - Marlon R. Cook - Geological Survey of Alabama | Abstract 5b: Effects of experimental passive artificial recharge of treated surface water on water quality in the *Equus* Beds aquifer, 2009-2010 - Linda Pickett Garinger, USGS, KS Water Science Center | Abstract 6b: Groundwater and Agricultural Bioenergy Feedstock Production – Noel Gollehon, Natural Resources Conservation Service, USDA |
| Abstract 4c: Implementation of Brackish Groundwater Desalination Using Wind-Generated Electricity as a Proxy for Energy Storage: A Case Study of the Energy-Water Nexus in Texas - Mary E. Clayton, University of Texas | Abstract 5c: Delaware's Economical Approach to Assessing Statewide Groundwater Quality - John T. Barndt, P.G., Delaware Department of Natural Resources | Abstract 6c: An Integrated Water Management Strategy for Power Generation; a Central Georgia Case Study - Larry Neal, AMEC, Leonard Ledbetter, & Dean Alford, Allied Energy Services |
| Abstract 4d: Zero Discharge Water Management for Horizontal Shale Gas Well Development: Results of Large Scale Testing - Paul F. Ziemkiewicz, West Virginia Water Research Institute | Abstract 5d: Tracking Water with Risk Based Data Management System (RBDMS) - Paul Jehn, GWPC | Abstract 6d: Competition for Water Use in Utility-Scale Solar Power Systems - Jordan Macknick, Strategic Energy Analysis Center at the National Renewable Energy Laboratory (NREL) |
| GWPC Annual Forum Luncheon<br>*Your GWPC: Past, Present, and Future:*<br>GWPC Founder & Past-President - David Bolin, Alabama Oil & Gas; GWPC Immediate Past-President – Joe Lee, Pennsylvania DEP; GWPC President - Stan Belieu, Nebraska O&G<br>*Special guest speaker:* Ben Grumbles, President, Clean Water America Alliance | Moderator: GWPC Executive Director- Mike Paque | |

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| Day-1 Monday, September 26 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| Groundwater Management: Planning and Protection of Drinking Water Supply<br>Poster 7e<br>Moderator: Brandon Kernen, New Hampshire DES | Protecting Groundwater from Energy Impacts<br><br>Moderator: Robert Vagnetti, USDOE | The Environmental Sustainability of Nuclear Energy<br>Poster: 9g<br>Moderator: John Veil, Veil Environmental (retired Argonne National Labs) |
| Abstract 7a: An Overview of the South Carolina Capacity Use and Water Use and Reporting Programs - Paul L. Bristol, and Alexander Butler, SCDHEC | Abstract 8a: Internal and External Mechanical Integrity as Part of Unconventional Gas Development - J. Daniel Arthur, ALL Consulting | Abstract 9a: A Holistic Approach to Environmental Stewardship: Water Use, Electric Power, and Nuclear Energy - William Skaff, Nuclear Energy Institute |
| Abstract 7b: Groundwater Use and the Need for a State-wide Groundwater Level Monitoring Network in South Carolina - Harriet H. Gilkerson, SCDHEC | Abstract 8b: A model for relating environmental variation to water permit violations at thermoelectric facilities in the Taunton River watershed - Seth Sheldon, University of Massachusetts Boston | Abstract 9b: The Fukushima Accident and Nuclear Safety in the United States - Chris Thornell, Southern Nuclear Operating Company |
| Abstract 7c: US EPA's Community-Based Water Resiliency Initiative: An Integral Part of Holistic Water Resource Planning – Karen Edwards, USEPA, Water Security Division | Abstract 8c: Water Issues Related to Coal Mining in the Appalachian Basin - Paul Ziemkiewicz, West Virginia University | Abstract 9c: Used Nuclear Fuel Management: Storage and Recycling - William Murphy, Duke Energy |
| Abstract 7d: An Analysis and Evaluation of Factors Influencing Capacity Development of Public Water Systems in Mississippi - Alan Barefield, Mississippi State University Extension | | |

Posters

Abstract 5e: Interpretation of Groundwater Quality Using Multivariate Statistical Technique in Gharesoo-Gorganrud Watershed, Caspian Sea Basin - Maryam Mazidi, Department of Irrigation and Drainage, Gorgan, Golestan, Iran. *(Full Paper Available)*

Abstract 6e: Estimating Thermoelectric Water Consumption Using Energy Budgets - Timothy H. Diehl, Tennessee Water Science Center of the U.S. Geological Survey

Abstract 6f: Integrated Water-Energy Policy Approaches With or Without a Climate Change Emphasis - Cat Shrier, Ph.D., P.G., WaterCat Consulting

Abstract 7e: Mathematical Modeling of Groundwater Resources System of Dehgolan Plain, Iran - Najme Jahani – Dept. of Irrigation and Drainage, Gorgan, Golestan, Iran (not present)

Abstract 9g: Release of Radionuclides from Operation of Nuclear Reactors and Aquifer Water Quality Assessment - Nebiyu Tiruneh, Richard Raione, Hosung Ahn, Mark McBride, Joseph Giacinto Nuclear Regulatory Commission

Abstract 13e: Interpretation of Groundwater Quality Using Multivariate Statistical Technique in Gharesoo - Gorganrud Watershed, Caspian Sea Basin, Iran - Maryam Mazidi, and Mojtaba Kordestan, U. of Iran (not present)

Abstract 17d: Will Radium Be the Major Problem Limiting Land Disposal of Waste in the Inner Coastal Plain of South Carolina? – Christopher A. Wargo, Bureau of Water, SC DOHEC

Event Exhibitors:

~ National Ground Water Association ~ U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, Water Security Division ~ YSI, Inc ~ Dow Microbial Control ~ Risk Based Data Management System ~ AMEC ~ FracFocus ~ Hach Hydromet ~

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| Day-1 Monday, September 26 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | | |
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| (cont…) Groundwater Management Planning and Protection of Drinking Water Supply<br>Moderator: Brandon Kernen, NH DES | Carbon Capture & Storage & Groundwater<br>Moderator: Kevin Frederick, WY DEQ | Water Use and Nuclear Energy<br>Moderator: Mike Hightower, Sandia National Laboratory | Hydraulic Fracturing Chemical Disclosure Initiatives<br>Moderators: Gerry Baker, IOGCC & Mike Paque, GWPC |
| Abstract 7f: Sustainable Groundwater Use for Power Generation in Georgia, Case Study - Neven Kresic & Leonard Ledbetter AMEC, Jim Kennedy, GA EPD, Dean Alford, Allied Energy Services | Abstract 10a: Modeling and Mapping the Area of Potential Impact for Class VI $CO_2$ Injection Wells - Stephen R. Kraemer, USEPA Office of R&D, Athens | Abstract 9d: Nuclear Power Generation: Water Needs and Environmental Impacts: NRC Review and Analysis - Nebiyu Tiruneh, Nuclear Regulatory Commission | Welcome, introductions, and agenda review<br>Abstract 11a: FracFocus: Overview of history, process and public outreach efforts: Mike Nickolaus, GWPC<br>Abstract 11b: E-Reference: Promoting Regulatory Transparency - Gerry Baker, IOGCC<br>Accommodating Chemical Disclosure Requirement Initiatives<br>• Texas Rule<br>• Montana Rule<br>• Pennsylvania Initiatives<br>• New York Initiatives<br>• Other state Initiatives<br>Other Disclosure Initiatives – Matt Watson, Environmental Defense Fund<br>Abstract 11c: RBDMS Hydraulic Fracturing Module: Paul Jehn, GWPC |
| Abstract 7g: Consumptive water use estimates for thermoelectric power plants in the Apalachicola-Chattahoochee-Flint basin - Jennifer C. Murphy, USGS and Timothy H. Diehl-USGS, TN Water Science Center | Abstract 10b: Examining salinity restrictions for $CO_2$ sequestration: Suggestions from basin to reservoir scales. - Madalyn S. Blondes and Margo Corum, U.S. Geological Survey | Abstract 9e: An Overview of the Nuclear Power Industry's Ground Water Protection and Underground Piping and Tanks Integrity Initiatives - Kathy Yhip, Nuclear Energy Institute | |
| Abstract 7h: Groundwater Sustainable Yield Assessment in Prioritized Aquifers of Georgia Coastal Plain Aquifer System - James Kennedy, GA EPD and Katherine H. Zitsch | Abstract 10c: Water Demand for Carbon Capture – Electricity Generation - Erik Shuster, USDOE-NETL | Abstract 9f: Palo Verde Nuclear Generating Station Water Reclamation Facility - Robert Lotts, Arizona Public Service | |
| Abstract 7i: Hydroinformatics to Assess Management Regimes: Using Directed Networks and a Groundwater Decision Support System to Span Science and Policy - John M. Sharp, & Suzanne A. Pierce - Jackson School of Geosciences | Abstract 10d: Extraction of Formation Water from $CO_2$ Storage Reservoirs - Ryan J. Klapperich, Energy & Environmental Research Center | Abstract 9g:Recycling Mine Pool Water for Electricity Generation: Limerick Generating Station – Exelon Representative | |
| Abstract 7j: Groundwater Flooding – Unforeseen Consequences of Flood Control and Water Conservation in Dayton, Ohio - Brent E. Huntsman, Terran Corporation | Abstract 10e: The USDOE Sequestration R&D Program: MVA for Groundwater Protection - John Litynski, Office of Coal Power R&D, USDOE - NETL | | |

Reception

GWPC 2011 Annual Forum Reception
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| Day-2 Tuesday, September 27 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| General Session -- *Water / Agriculture Nexus: Groundwater Quality and Quantity Issues Related to Agriculture*<br>Moderator: Marty Link, Nebraska Department of Environmental Quality – *Power, Water and Everything Else* (Abstract 12a)<br>Abstract 12b *United States Department of Agriculture: Resources Conservation Assessment*, Noel Gollehon, Natural Resources Conservation Service, USDA<br>Abstract 12c *Agricultural and Groundwater: An Overview of Current Issues* - Mike Wireman, USEPA Region 8<br>Abstract 12d *High Nitrate in Shallow Groundwater: Status and Implications for Our Linked Surface-Water and Groundwater Resources* - Neil M. Dubrovsky, USGS<br>Abstract 12e *"25x'25" – America's Energy Future* – Michael Bowman, National Steering Committee, "25x'25"<br>Abstract 12f *The Groundwater/Energy/Food Nexus* – Jay Lazarus, & Robert Hagevoort, Glorieta Geoscience Inc. | | |
| Groundwater & Agriculture<br>Poster: 13e<br>Moderator: Bruce Olsen, MN Dept. of Health | Class VI UIC Implementation Session<br>*(open to public)*<br>Moderator: Mike Nickolaus, GWPC | Reducing the Need of Fresh Groundwater Use for Energy Production<br>Moderator: Dave Bolin, Alabama O&G Board |
| Abstract 13a: Conjunctive Regional Management to Offset Declining Water Supplies - Dean Pennington, Yazoo Mississippi Delta Joint Water Management District and Jeff Ballweber, Pickering Firm | EPA Panel:<br>Abstract 14a: Timing for Applying for Class VI Primacy and Issuing Class VI Permits - Lisa M. McWhirter, USEPA OGWDW<br><br>Abstract 14b: Geologic Sequestration Data System - Joe Tiago, OGWDW, USEPA | Abstract 15a: Innovative Process to Upgrade Shale Gas Produced Water for Recycling verse Deep Well Injection - Tom Lewis, Lewis Environmental Services, Inc. *(Presentations not available)* |
| Abstract 13b: Keeping it on the Farm: Potential Water Quality and Quantity Impacts of On-Farm Storage Reservoirs - Mary Love Tagert, MSU, MS Water Resources Res. Institute | | Abstract 15b: Air versus Water Cooling in Engineered Geothermal Systems - Joanna McFarlane, Oak Ridge National Laboratory |
| Abstract 13c: A Farm Storage Reservoir Optimization Model for the Mississippi Delta - Jonathan Pote, Charles Wax, Robert Thornton, Chad Swindoll, Jason Sydejko, Mississippi State University | | Abstract 15c: Beneficial Reuse in the Oilfield: A Study of Water Distillation Technology and Beneficial Reuse of Waste Brine – Dave Bell, Purestream |
| Bio 13d: USEPA Office of Ground Water and Drinking Water Groundwater & Agriculture – Roy Simon, USEPA | | Abstract 15d: Environmental Costs of Managing Geological Brines Produced or Extracted During Energy Development - Christopher Harto, Argonne National Laboratory. |
| | | Abstract 15e: Deep Shale Development and Water Use, Part Three: Even Liquid-Rich Shales are Relatively Water Efficient - Matthew Mantell, Chesapeake Energy Corporation |

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| Day-2 Tuesday, September 27 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| State Regulator / USEPA Roundtable Brownbag Lunch Session *(State and EPA regulators only, please)*<br>Moderator: Andrews Tolman – Maine Drinking Water Program, Kurt Hildebrandt, USEPA Region 7, Roy Simon, USEPA HQ<br>(Abstract 16a) Discussion items…<br>• EPA Draft Stormwater Rule – Roy Simon, USEPA<br>• Class V Stormwater Funding and CWA §319 Funding<br>• Clean Water Act §106 and Drinking Water SRF Funding for Groundwater Projects<br>• Aquifer Storage and Recovery Issues<br>• UIC Funding for Class V (What is not getting done due to lack of funding?)<br>• National UIC Database – Update and Implementation – Roy Simon, USEPA | | |
| Aquifer Management for Water Quality<br>Poster: 17d<br>Moderator: Cary Betz, Texas Com. on Env. Quality | Source Water<br>Moderator: Mike Eggert, Ohio EPA | Natural Gas Development Seminar:<br>Groundwater Protection and Hydraulic Fracturing<br>Moderator: Joe Lee, PA DEP, GWPC Past-President |
| Abstract 17a: Long-Term Potable Supply in Southold New York: Managing a Limited Freshwater Aquifer in a Largely Agricultural Region - Daniel O'Rourke, CDM | Abstract 18a: Protecting Your Water Supply and Your Bottom Line: Shifting Treatment Costs from Ratepayers to Polluters - Alexander Leff, Sher Leff, LLP | *Hydraulic Fracturing Studies*<br>Renee Stone, Senior Advisor, Designated Federal Official, US Department of Energy – *Update on Secretary of Energy Advisory Board Shale Gas Production Subcommittee 90-Day Report* Abstract 19a<br>Jeanne Briskin, USEPA ORD – *Update on EPA's Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* Abstract 19b<br>Charles "Chip" Groat, Energy Institute – *Seeking Fact-Based Shale Gas Development Environmental Regulations* Abstract 19c<br>Sheila Olmstead, Resources for the Future - *Regulating Risks from Shale Gas Development: A New RFF Study* Abstract 19d |
| Abstract 17b: Exploring Sustainable Regional Groundwater Supply Alternatives to Manage Saltwater Intrusion in the Hilton Head Island Area - Robert Fitzgerald, CDM; Kristina Masterson; Mark Maimone, and Katherine Zitsch, CDM; James Kennedy, GA DNR | Abstract 18b: Minnesota's Source Water Protection Grant Program - Bruce M. Olsen, Minnesota Department of Health | |
| Abstract 17c: Simulated Influences of Upgradient Multi-Aquifer Wells on the Movement of Contaminants to Public-Supply Wells - Sandra M. Eberts, USGS | Bio 18c: National/Federal Source Water Program Update – Roy Simon, USEPA HQ | |

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| Day-2 Tuesday, September 27 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| Mining Existing Data for New Purposes<br><br>Moderators: Chris Reimer, NGWA | Nutrients & Groundwater<br><br>Moderator: Sonja Massey, Alabama DEM | (cont…) Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing<br>Moderator: Lori Wrotenbery, OCC, O&G Division |
| Abstract 20a: Update: Unregulated Drinking Water Initiative for Environmental Surveillance and Public Health - Lorraine C. Backer, P Centers for Disease Control and Prevention | Abstract 21a: Partnership to Improve Source Water Quality through Habitat Restoration at Remsen, Iowa - Chi Ho Sham, The Cadmus Group | *Regulatory Considerations for Hydraulic Fracturing and Groundwater Protection*<br>*Federal*<br>- Abstract 19e: Update on USEPA Guidance on Use of Diesel – Ann Codrington, USEPA<br>- Abstract 19f: Hydraulic Fracturing on Federal Lands: The BLM Requirements - Michael Nedd - BLM<br>*State*<br>- Abstract 19g Legislation and Rules & FracFocus.org - Leslie Savage, RRC of Texas<br>- Abstract 19h: Environmental Defense Fund Draft Regulatory Development Guide: A Model Regulatory Framework – Scott Kell, Consulting Geologist<br>- Abstract 19i:State Review of Oil and Natural Gas Environmental Regulations: The Hydraulic Fracturing Multi-Stakeholder Initiative – Lori Wrotenbery, Oklahoma Corp. Comm., O&G Division<br>*Regional/ International*<br>- Abstract 19j: Water Management and Sustainability Planning for Unconventional Resource Development J. Daniel Arthur, ALL Consulting<br>- Abstract 19k: International Perspectives Shale Gas: It's Not Just in North America Anymore – John Veil, Veil Environmental |
| Abstract 20b: - Pilot Study to Integrate Existing Karst Flow Data for Kentucky into the National Hydrography Dataset Created by the U.S. Geological Survey –David Jackson, and Robert Blair KY Div. of Water | Abstract 21b: Near-decadal Changes of Chloride, Dissolved Solids, and Nitrate Concentrations in Groundwater in the United States, 1988-2010 - Bruce D. Lindsey, USGS | |
| Abstract 20c: The National Ground Water Monitoring Network: Six States Test the Framework Design - William L. Cunningham, USGS | Abstract 21c: Occurrence of Phosphorus in Groundwater of Northwestern Mississippi - Heather L. Welch, USGS | |
| Abstract 20d: Development of a National Ground Water Monitoring Network Ground Water Data Portal for Interoperable Data Exchange and Mediation between States and Across the Nation - Jessica Lucido, USGS's Center for Integrated Data Analytics (CIDA) | Abstract 21d: National Nutrients Initiative - Jim Taft, Association of State Drinking Water Administrators | |
| Abstract 20e: Updating the Framework Document for the National Ground Water Monitoring Network-Incorporating Sound Science and Sensible Realities: David R. Wunsch, NGWA | Bio 21e: USEPA Office of Ground Water and Drinking Water Groundwater & Nutrients – Roy Simon, USEPA | |

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| Day-3 Wednesday, September 28 | *Meeting Competing Demands with Finite GROUNDWATER Resources* |
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| Joint Water Availability & Sustainability and Water Quality Divisions Session<br>Division Chairs: Audrey Eldridge, OR DEQ and Jamie Crawford, MS DEQ | continuation … Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing cont.<br>Moderator: Don Drazan, New York Departmental of Environmental Conservation |
| Welcome and Purpose—*Lightning Discussion of Each Topic (10 Minute Maximum)*<br>1. EPA National Nutrient Initiative – Jim Taft, ASDWA<br>2. EPA Proposed Stormwater Rule Update – Roy Simon, EPA<br>3. UIC Issues – Roy Simon, EPA<br>4. EPA Watershed Technical Guidance Document - Roy Simon, EPA<br>5. USDA - Farm Bill EQIP Program Update – Bruce Olsen, MDH<br>6. GWPC Aquifer Storage and Recovery Task Force Report- Cary Betz, TCEQ<br>7. Unregulated Drinking Water Initiative Update – Lorraine C. Backer, Centers for Disease Control and Prevention<br>8. Update --Subcommittee on Ground Water—Nation Ground Water Monitoring Network- Chris Reimer, NGWA<br>9. State Regulator/USEPA Roundtable Report- Andrews Tolman, ME DWP<br>10. Source Water Work Group Report - Mike Eggert, OH EPA<br>11. Revisions to the GWPC Report to the Nation – Dan Yates, GWPC<br>12. Conference Wrap Up--Summary of Issues Heard and Needed Follow-Up -- Audrey Eldridge, OR DEQ and Jamie Crawford, MS DEQ | *Technical Considerations for Hydraulic Fracturing and Groundwater*<br><br>*Eastern U.S. Shale Gas Basins*<br>- Abstract 19l Overview of Geology, Depositional Environments, Thickness, Areas of Gas Production - Joe Lee, PA DEP<br><br>*Factors Related to Hydraulic Fracturing Implementation - Safeguarding Water Resources*<br><br>- Abstract 19m Introductory Description of Hydraulic Fracturing - Matthew Mantell, Chesapeake Energy Corporation<br><br>- Abstract 19n Water Used for Hydraulic Fracturing: Amounts, Sources, Reuse, & Disposal – David Alleman, ALL Consulting<br><br>- Abstract 19o Hydraulic Fracturing and Water Resources in Ohio: How to Protect the Groundwater through Proper Well Construction and Cementing Practices - Tom Tomastik, Ohio Division of Oil and Gas Resources Management |

*Event Scholarships Sponsored by:*

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Ashlynn Stillwell – University of Texas
Sara Carmichael – Rollins School of Public Health
Seth Sheldon – University of Massachusetts

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Amy Miguel – Salt River Pima-Maricopa Indian Community
John Sawyer – City of Savannah

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| Day-3 Wednesday, September 28 | *Meeting Competing Demands with Finite GROUNDWATER Resources* | |
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| Source Water Protection Interregional Exchange Roundtable<br>Moderator: Source Water Collaborative Steering Committee | EPA Technical Workshop:<br>Class VI Geologic Sequestration Financial Responsibility Guidance<br>Moderator: Joe Tiago, USEPA HQ | Natural Gas Development Seminar:<br>Groundwater Protection and Hydraulic Fracturing cont.<br><br>Moderator: Stan Belieu, NE O&GCC, GWPC President |
| The purpose of the interregional forum is to showcase the success of the Source Water Collaborative, regional collaborative efforts, and state program successes in order to foster support for future regional collaborations.<br><br>- Welcome Comments and "About the SW Collaborative"<br>- Regional Collaborative (Salmon Falls / Delaware Basin)<br>- Roundtable (All participants share 3-4 minutes each re: programs, successes, etc)<br>- Going Forward – Collaboration on Source Water Protection<br><br>Attendance for this session only is complimentary.<br>No registration is necessary. RSVP and/or for comments or questions, please contact Dan Yates at dyates@gwpc.org or 405-516-4972 | EPA's Class VI Geologic Sequestration (GS) final rule published in December 2010 includes financial responsibility requirements to help ensure that GS project developers fulfill their obligations and protect underground sources of drinking water. To aid in the implementation of financial responsibility requirements of the rule, EPA finalized the guidance document "Underground Injection Control (UIC) Class VI Program: Financial Responsibility Guidance" in July 2011.<br><br>The purpose of this technical workshop is to (1) introduce financial responsibility requirements for geologic sequestration projects, (2) provide an overview of supplementary information available in the guidance, and (3) discuss implementation successes and challenges. This workshop is open to the general public and will also include a question and answer session with a panel of experts.<br><br>The workshop is designed to engage stakeholders—including states, industry, and non-governmental organizations—and it will be available via webcast.<br><br>Advance registration is required. The registration link is…<br>https://www2.gotomeeting.com/register/507402386 | *Factors Related to Hydraulic Fracturing Implementation - Safeguarding Water Resources (cont.)*<br><br>- Abstract 19p: Ground Water Baseline Testing for New Oil and Gas Activities – Why? What's Important? How to do? - Ed Steele, Swift Worldwide Services<br><br>- Abstract 19q: Development of "Greener" Alternatives - Greg Bradley, Dow Microbial Control<br><br>- Abstract 19r: Disposal Options for Flow Back Water Overview of Shale Gas Produced Water Recovery and Recycling Technologies Options: Implementation, Effectiveness and Economic Lessons Learned - Tom Lewis, Lewis Environmental Services, Inc. *(Presentations not available)*<br><br>- Abstract 19s: Geochemistry of Natural Gases in Quaternary through Devonian Age Strata in the Northern Appalachian Basin: Implications for Investigations of Stray Gas Migration - Fred Baldassare, ECHELON Applied Geoscience Consulting<br><br>- Abstract 19t: State Oil and Gas Agency Groundwater Investigations and Their Role in Advancing Regulatory Reforms - Scott Kell, Consulting Geologist |

Acknowledgements: *2011 Event Sponsors and Contributors*














*Thank you for caring about Groundwater!*

# ~ Event Presentation Synopses ~

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| 2a | **Discussion of the New York Draft Supplemental Generic Environmental Impact Statement for Hydraulic Fracturing:**<br>Donald J. Drazan, Chief Technical Assistance Section, N.Y.S. Dept. of Environmental Conservation Division of Mineral Resources<br>*Mr. Drazan has been with the Division for 27 years and has oversight of the data management and reporting requirements for oil, gas and mining operations. He is a member of the RBDMS Steering Committee and is a Certified Petroleum Geologist.*<br>On September 7, 2011 the Department of Environmental Conservation released its revised draft on the Supplemental Generic Environmental Impact Statement on well permit issuance for high-volume hydraulic fracturing. This has been a three year process that reflects numerous studies and the review of over 14,000 comments submitted on the 2009 draft. With the release of the revised draft New York has started a 90 day comment period to collect comments and generate revised rules and regulations. This discussion will highlight modifications to the document from the 2009 draft and explain the Department's review process and proposed final work products. |
| 2b | **Methane Farming Through Use of Indigenous Microbes**<br>Roland P. DeBruyn, Vice President-Engineering, Luca Technologies Inc.<br>*DeBruyn is a ChemE/MBA who has worked in* in situ *capacities (technical and business) throughout his career.*<br>Presentation Synopsis: Methane Farming offers the potential to stimulate natural processes to create an ongoing stream of methane production in real time. Experience in the field has shown that methane farming need not be in conflict with other users of groundwater. |
| 2c | **Water Efficiency of Texas Shale Plays: a Discussion**<br>Jean-Philippe JP Nicot, Bureau of Economic Geology, The University of Texas at Austin<br>*Dr. Nicot is a geological engineer and a research scientist at the BEG with interests in water resources and groundwater contamination risks.*<br>Computing water-use efficiency of shale gas and liquids-rich plays could rely on average estimated ultimate recovery (EUR). Using Texas as an example, we will explore current and projected water use for the Barnett, Haynesville, and Eagle Ford plays and compare it to that of other energy sources in the state (oil, coal, uranium). We will also attempt to define water efficiency; efficient relative to what? Could it be a function of the source of water and of the location? |
| 2d | **Haynesville Shale: Significance of Early Adaptive Water Resource Management, Regional/Industry/State Cooperation and a Driver of State Water Use Reform**<br>Gary M. Hanson, Director, Red River Watershed Management Institute LSU Shreveport<br>*Hydrologist in Residence, M.S. Earth Sciences, Univ. of New Hampshire. Extensive post-graduate study Univ. of Arkansas. Energy industry experience as district exploration manager/partner and Tetra Tech office manager.*<br>The nationwide shale gas plays are forcing communities to evaluate their surface water and groundwater resources. In 2008, 300 Haynesville Shale gas wells were drilled in northwest Louisiana and by mid-2011 that number had grown to over 2200 gas wells. On average, each well was hydraulically fractured with 5-6 million gallons of water. Concerns from local stakeholders were heeded by the Louisiana Depart. Of Natural Resources/Office of Conservation, a regional water resources committee and industry. Adaptive management approaches we used to move industry from groundwater to predominately alternative surface and non-potable groundwater sources. These activities helped drive water use reform in the state. |
| 2e | **North Carolina's Study of Potential Shale Gas Development**<br>Evan Kane, Groundwater Planning Supervisor, NC Department of Environment and Natural Resources<br>*Evan Kane is a former UIC Program Manager for North Carolina and has also worked in the state's Geological Survey.*<br>North Carolina is experiencing serious interest in onshore shale gas resources in the central part of the state. While development of this resource presents a potential economic benefit to the state, it also poses a challenge since the state lacks a well-developed regulatory program for oil and gas exploration. Recent legislation directs NC DENR to study the potential development of this resource and make recommendations for a regulatory framework to manage exploration and production. This presentation will provide an overview of the potential resource and the legislative requirements NC DENR is addressing in its study. |
| 2f | **Evaluation of State Surveillance and Enforcement Methods**<br>William R. "Bill" Bryson - Senior Petroleum Policy Analyst, Kansas Geological Survey, Lawrence, Kansas<br>*Bryson regulated oil and gas in Kansas both as an inspector and state division director for 36 years.*<br>The purpose of this presentation is to outline the components of a proposed assessment of the manner in which state oil and gas regulatory agencies conduct lease inspections to ensure water and environmental resources are protected from contamination. The assessment will cover both routine inspections of lease facilities and the procedures used when non-compliance events are discovered. This study will characterize surveillance methods of petroleum lease operations and the approaches used by field inspectors to afford timely resolution of non-compliance events. The assessment will identify those surveillance methods, which are conducive to developing public trust and still be cost effective. |

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| 3a | **Welcome to Georgia!**<br>Linda MacGregor, P.E. - Chief, Watershed Protection, Environmental Protection Division<br>*Linda MacGregor is the Chief of the Watershed Protection Branch of the Georgia Environmental Protection Division. In this role she is responsible for environmental, public health, and public safety protection of water and watersheds. She is responsible for permitting, enforcement, technical review and assistance, and environmental outreach. Prior to joining EPD in July 2005, Ms. MacGregor had over 20 years of consulting engineering experience in master planning, engineering, and construction primarily for municipal clients. She worked for Brown and Caldwell and was President of McKenzie MacGregor Incorporated, a woman-owned engineering firm. She is a professional engineer with a degree in Environmental and Water Resources Engineering from Vanderbilt University.* |
| 3b | **Groundwater Use in Georgia**<br>James L. Kennedy, Ph.D., P.G., State Geologist, Georgia Environmental Protection Division<br>*Dr. Kennedy holds B.S. and M.S. degrees in physics and geophysical sciences from Georgia Institute of Technology and a Ph.D. in geology from Texas A&M University. He is a registered professional geologist in Georgia. His areas of expertise are groundwater hydrology and engineering geology. Dr. Kennedy has worked on salt-water intrusion into the Upper Floridan aquifer, permitting of groundwater supply wells, groundwater modeling, and the State Water Plan. Prior to joining the EPD Dr. Kennedy worked as a consultant and conducted engineering geology, groundwater supply, and environmental remediation projects in various areas of the United States and Europe.* |
| 3c | **Tapping the Tennessee River: the Solution to Georgia's Water Woes**<br>Brad Carver is the Senior Managing Director of Hall Booth Smith & Slover<br>*Brad Carver is the Senior Managing Director of HBSS Government Affairs and is a member of the Government Affairs; Energy, Regulatory and Utilities; Environmental, Mass Torts and Land Use; International; and Business Litigation practice groups. Prior to Hall Booth Smith & Slover, P.C., he worked for Miller & Martin, Alston & Bird, the Georgia Municipal Association, and Georgia Power Company. Mr. Carver also actively serves in the U.S. Army Reserves in the rank of Major as the Senior Legal Opinions Attorney for the 213th Legal Support Organization, headquartered in Decatur, Georgia.* |
| 3d | **The Coca-Cola Company Global Water Stewardship**<br>Gregory J. Koch, Managing Director, Global Water Stewardship, Environment & Water Resources, The Coca-Cola Company, Atlanta, Ga<br>*Greg joined The Coca-Cola Company in 1996. He has over 20 years of experience in the environmental and engineering fields. His educational background includes a Bachelor of Science in Mathematics from Columbus College, a Bachelor of Civil Engineering from the Georgia Institute of Technology, and a M.S. in Civil Engineering from the Georgia Institute of Technology. Currently Greg directs the global water stewardship initiative of the Company. This work addresses the assessment and mitigation of water risks facing the global, Coca-Cola business and includes setting strategic direction, development of standards and support in the areas of plant performance, water and wastewater treatment technologies, social engagement, communications, watershed protection, water policy engagement.* |
| 3e | **WaterSMART Use and Availability Assessment**<br>William M. Alley, Office of Groundwater, U.S. Geological Survey (USGS)<br>*Dr. William M. Alley is Chief of the Office of Groundwater for the USGS. Dr. Alley is active with national and international committees and served as Associate Editor for Ground Water and the Hydrogeology Journal. He has published over 80 scientific publications, including the text Regional Ground-Water Quality. Dr. Alley is a recipient of a number of awards, including the NGWA John Hem Award and the Meritorious Presidential Rank Award. He received a B.S. in Geological Engineering from the Colorado School of Mines, an M.S. in Hydrogeology from Stanford University, and a Ph.D. from the Johns Hopkins University.* |
| 3f | **Sustaining Water Resources**<br>Ann Codrington, Acting Director, Drinking Water Protection Division, Office of Ground Water and Drinking Water, Office of Water, USEPA HQ<br>*Ann Codrington is acting director of the Drinking Water Protection Division in EPA's Office of Ground Water and Drinking Water. Ann has worked in the drinking water standards and hazardous waste programs at EPA. Ann's responsibilities include managing programs to implement the Safe Drinking Water Act including the Underground Injection Control Program. Ann has degrees from Wesleyan University and Johns Hopkins University and served as a Peace Corps volunteer in Lesotho.* |
| 4a | **Water Supply in Coastal Georgia—Meeting Water Demand Using Alternative Water Sources to the Upper Floridian Aquifer**<br>John S. Clarke, Assistant Director, USGS Georgia Water Science Center<br>*Thirty-three years experience, more than 50 papers on Georgia's aquifers, twice served as president of the Georgia Ground Water Association.*<br>During 2008-2010, the U.S. Geological Survey, in cooperation with the U.S. Department of the Army, Fort Stewart, conducted detailed site investigations and groundwater modeling studies at Fort Stewart and Hunter Army Airfield to assess the water-supply potential of ponds and wells completed in the surficial aquifer system or Lower Floridan aquifer. These studies, together with hydrogeologic and water-use information obtained from private water users, provide information to help state and local officials manage and develop alternative water sources to the Upper Floridan aquifer in coastal Georgia. |

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| 4b | **Brackish Groundwater in the Coastal Plain of Alabama: An Historic Resource with Implications for the Future**<br>Marlon R. Cook - Director, Groundwater Assessment Program, Geological Survey of Alabama<br>*Marlon Cook is Director of the Groundwater Assessment Program and hydrogelogist for the Geological Survey of Alabama for 21 years.*<br>Shallow saline groundwater has had economic significance in Alabama since the Civil War. This little known resource occurs in three areas of the Alabama Coastal Plain, characterized by unique geologic and geochemical environments that resulted in an easily accessible, abundant source of alternative water supplies. Current uses include a growing aquaculture industry and commercial chemical manufacturing. Future water needs may create increasing demands for alternative water sources, including saline groundwater. |
| 4c | **Implementation of Brackish Groundwater Desalination Using Wind-Generated Electricity as a Proxy for Energy Storage: A Case Study of the Energy-Water Nexus in Texas**<br>Mary E. Clayton, NSF Research Fellow, Department of Mechanical Engineering, University of Texas at Austin<br>*Mary is in her first year of graduate study performing research on the energy-water nexus in The Webber Energy Group.*<br>Contributing Authors: Ashlynn S. Stillwell, University of Texas at Austin, and Michael E. Webber, University of Texas at Austin<br>Implementation of brackish groundwater desalination using wind-generated electricity presents opportunities to supply drinking water without direct emissions. Using capital and operating cost data for wind and desalination technologies, we conducted a thermoeconomic analysis to determine parameters and locations of economic and geographic feasibility. Geographic information systems tools were used to map areas of feasibility. Municipal water end use was analyzed in the context of existing and alternative water supplies for cities of major populations within feasibility areas. This implementation presents a feasible alternative to energy storage methods. In order to demonstrate the economic and technological advantages, off-peak water treatment was benchmarked against compressed air energy storage, pumped hydro, and batteries. |
| 4d | **Zero Discharge Water Management for Horizontal Shale Gas Well Development: Results of Large Scale Testing**<br>Dr. Paul F. Ziemkiewicz, Director, West Virginia Water Research Institute (WVWRI)<br>*Responsible for strategic direction of WVWRI, Dr. Ziemkiewicz's areas of expertise include: mine reclamation & AMD remediation; gas well development; sustainable energy resources; coal combustion byproducts & reuse; and geology, ecology and water chemistry.*<br>Contributing Author: Jennifer Hause, West Virginia Water Research Institute (WVWRI)<br>The objective of this two-phase project is to test and evaluate a mobile, on-site option for treating return frac water (RFW) to be reused as frac make-up. The testing and review of various technologies during Phase I identified a multi-media filtration system meeting current industry standards and providing additional mobility, lower capital and operation costs and an extended range of throughput ability. Phase II consisted of the design and field deployment of a mobile treatment unit (MTU) utilizing the multi-media filtration system. Designed to process up to 180 gpm, the MTU is operating in the field. Real-time monitoring of basic water characteristics is being conducted along with regular sampling of water quality parameters such as TSS, TDS, sulfates and metals. |
| 5a | **National Ground Water Association's ANSI Water Well Construction Standard**<br>Kevin McCray, CAE. NGWA<br>*Kevin McCray, CAE, is the executive director of the National Ground Water Association headquartered at Westerville, Ohio.*<br>By having an American National Standards Institute (ANSI) approved water well construction standard the National Ground Water Association (NGWA) continues to advance the protection of public health and the safety of the groundwater resource.<br>There will be at least three significant and immediate benefits of NGWA standards: (1) certified standards further strengthen NGWA's voluntary certification program, (2) certified standards enhance the safe utilization of water well systems; and (3) when a local regulatory agency's existing or proposed rules are not consistent with the reasonable application of scientific principles and real world experiences, certified standards are a feasible argument for change. |
| 5b | **Effects of experimental passive artificial recharge of treated surface water on water quality in the *Equus* Beds aquifer, 2009-2010**<br>Linda Pickett Garinger, Hydrologist, U.S. Geological Survey Kansas Water Science Center<br>*Linda has been with the USGS for two years. She holds a B.S. in Mechanical Engineering and a Ph.D. in Geology.*<br>Contributing Authors: Aaron King, USGS Kansas Water Science Center, and Andy Ziegler, USGS Kansas Water Science Center<br>Declining groundwater levels and the migration of a saltwater plume toward public supply wells prompted the City of Wichita, Kansas to investigate using artificial recharge to replenish the *Equus* Beds aquifer. In 2009, the City of Wichita installed an experimental passive gravity-fed recharge well and trench system to increase artificial recharge at Recharge Basin 1, an existing recharge basin. This presentation will describe the local effects of the passive well recharge system on the *Equus* Beds aquifer, particularly the change in recharge rate, and densities of bacterial and viral indicator organisms. |

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| 5c | **Delaware's Economical Approach to Assessing Statewide Groundwater Quality**<br>John T. Barndt, P.G., Environmental Program Manager, Delaware Department of Natural Resources and Environmental Control<br>*John Barndt is an environmental program manager and licensed Professional Geologist with the Delaware DNREC Water Supply Section and manages the state's groundwater protection, and source water protection programs.*<br>Delaware's Department of Natural Resources and Environmental Control (DNREC) and Division of Public Health (DPH) have cooperated in sharing water quality information from public water systems to assess statewide groundwater quality as part of the 305(b) watershed reporting. The respective databases on wells, aquifers, and water-quality are being integrated via common database fields. The 2010 cycle has improved over prior years with assessments of unconfined, semi-confined, confined, karst and fractured-rock aquifers. This represents a cost savings both in staff and monetary resources. This work has also improved agency responses to incidents of contamination, SDWA monitoring, and waiver programs. |
| 5d | **Tracking Water with RBDMS**<br>Paul Jehn, Technical Director, The Ground Water Protection Council<br>*Paul Jehn is GWPC's project manager for the Risk Based Data Management System (RBDMS).*<br>RBDMS Water is part of the GWPC's National Risk Based Management System. RBDMS provides programmatic and management tools to support energy and water related environmental decision making. RBDMS water accepts manual data entry and electronic monitoring data from laboratories and displays the data in a user friendly format. This program combines a GIS and data mining interface and provides trend graphs and monitoring alerts. Monitoring alerts can be preset by the user to for electronic alerts to be generated based on user defined parameters or trend results. States are using this system to track permit compliance monitoring as well as baseline monitoring for activities such as hydraulic fracturing and acid mine drainage. The RBDMS system is available to all state energy and water programs |
| 6a | **The Increasing Pressure for Groundwater Sources for Natural Gas Development in the Headwaters of the Susquehanna River Basin**<br>Brooks G. Abeln, P.G., Hydrogeologist, Susquehanna River Basin Commission<br>*Brooks Abeln has twelve years of diverse professional experience in hydrogeology. Brooks has a B.S. degree from Bloomsburg University (Geology).*<br>Contributing Author: Erin. C. Lynam, Aquatic Ecologist, Susquehanna River Basin Commission<br>Since 2008, the natural gas industry has significantly expanded its drilling efforts in relatively undeveloped regions of the Susquehanna River Basin that contain many of the basin's most pristine headwater streams (headwaters). The Susquehanna River Basin Commission (SRBC) carefully reviews proposed withdrawals for sustainability and protection of the resources of the watershed. For sustainable groundwater projects in headwater settings, SRBC ensures protection of the resources through application of passby flow conditions that can significantly limit production capacity of the source. This presentation is intended to provide guidance on SRBC's policies for approvals of groundwater withdrawals in sensitive headwater settings. |
| 6b | **Groundwater and Agricultural Bioenergy Feedstock Production**<br>Noel Gollehon, Senior Economist, Natural Resources Conservation Service, USDA<br>*Noel Gollehon helps address agriculturally related water quantity and quality issues through working lands agricultural policy.*<br>Irrigated cropland and associated water supplies, including groundwater resources, are currently being used for biofuel feedstock production. This presentation provides a national view of water and land resources used for irrigation, with an emphasis on groundwater use. The focus of the data-driven presentation is on current biofuel production (corn-based ethanol) but implications will be drawn for possible future cellulosic ethanol feedstock. Geographic- and crop-level data from the U.S. Department of Agriculture and U.S. Geological Survey are used to illustrate the consequences of ramping up biofuel feedstock production on crop water applications with implications for the utilization of groundwater resources. |
| 6c | **An Integrated Water Management Strategy for Power Generation: a Central Georgia Case Study**<br>Larry Neal, PE, Vice President, AMEC Environment & Infrastructure<br>*Georgia Tech Bachelor of Civil Engineering and Master of Environmental Engineering; Program Manager, Georgia EPD before joining AMEC in 1976.*<br>Contributing Authors: Dean Alford, PE, Allied Energy Services, and Leonard Ledbetter, PE, AMEC Environment & Infrastructure<br>Plant Washington is a proposed coal-fired power plant in Washington County, Georgia. Water is supplied from the Oconee River so long as streamflows exceed the permitted "non-depletable flow". But when river flows fall below non-depletable levels, river withdrawals cease and the plant instead uses on-site storage and switches to permitted groundwater withdrawals. Groundwater use continues until storage is refilled and river flows again exceed non-depletable requirements. In average flow years, the river alone is sufficient to supply the plant, but once every five years groundwater is needed for about four months and once every twenty years for about eight months. |

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| 6d | **Competition for Water Use in Utility-Scale Solar Power**<br>Jordan Macknick, Energy and Environmental Analyst, National Renewable Energy Laboratory (NREL)<br>*Jordan is an Energy and Environmental Analyst at NREL in the Strategic Energy Analysis Center*<br>Contributing Authors: Craig Turchi (NREL), Michael Wagner (NREL), Mark Lausten (SRA International)<br>Deployment of utility-scale solar systems in the southwest United States has grown tremendously due to State Renewable Portfolio Standards (RPS), dropping costs of technology, tax and financing incentives, and Federal agencies permitting utility-scale solar systems on federal land. However, this arid region is also dominated by agriculture land uses and has severe water supply constraints. Most concentrating solar power (CSP) systems utilize steam Rankine power blocks that are most cost effective utilizing water for evaporative power cycle heat rejection, or wet cooling. CSP technologies' water use may compete with existing water uses in the southwest. |
| 6e | **Estimating Thermoelectric Water Consumption Using Energy Budgets**<br>Timothy H. Diehl, Hydrologist, U.S. Geological Survey, Tennessee Water Science Center<br>*Tim Diehl's research areas are thermoelectric water use and fluvial geomorphology.*<br>The need to estimate thermoelectric water consumption typically arises in watersheds subject to water shortages. An energy budget can be used to estimate the heat transferred by evaporation from cooling water to the atmosphere, with realistic dependence on water and air temperatures.<br>The amount of heat delivered to the cooling system is first estimated from fuel consumption, electric generation, and plant characteristics. The transfer of heat from the cooling water to the atmosphere is then divided between evaporation and conduction and radiation. The resulting estimates of water consumption are thermodynamically realistic, and call into question some published consumption coefficients. |
| 6f | **Integrated Water-Energy Policy Approaches with or Without a Climate Change Emphasis**<br>Cat Shrier, Ph.D., P.G., President, Watercat Consulting LLC<br>*Cat Shrier is President of Watercat Consulting, created to facilitate communication and understanding of innovative approaches to water management and policy.*<br>The concept of the "water-energy nexus" really involves multiple "nexus points", with considerations of "water for energy," "energy for water," and combined water-energy demands at different scales (e.g. building, town, farm, watershed, regional, and global). For each "nexus point," there are different regulatory agencies and technical assistance programs, as well as utility companies and other stakeholders, which have developed and operated independently of one another and have different organizational "cultures" and priorities. At the federal level, programmatic missions, jurisdictions, and budget authorizations limit funds, time and expertise that agency personnel can dedicate to interagency activities, creating coordination challenges for implementation of integrated energy-water planning and programs. Climate change has provided an "umbrella issue" for agency personnel to communicate and coordinate energy-water activities, particularly through the Interagency Climate Change Adaptation Task Force Water Resources and Climate Change Workgroup. Shifts in congressional receptiveness to climate change programs may raise questions about ways in which agencies can continue efforts towards interagency water-energy policy and program integration without the "framing" of climate change. Other multi-agency efforts also address energy and water, such as Executive Order 13514. This paper reviews the challenges and opportunities for agencies to work collaboratively and leverage their resources to address water and energy in a more integrated manner. |
| 7a | **An Overview of the South Carolina Capacity Use and Water Use and Reporting Programs**<br>Paul L. Bristol, South Carolina Department of Health and Environmental Control<br>*Paul L. Bristol received his B.S. from the College of Science and Mathematics (Geology), University of South Carolina in 1986, and is a South Carolina Registered Professional Geologist. He has worked in various program areas with the South Carolina Department of Health and Environmental Control (SCDHEC) for 24 years.*<br>Contributing Author: Alex P. Butler<br>*Alexander Butler has a B.S. in Geology from Clemson University. He has worked with the South Carolina Department of Health and Environmental Control (SCDHEC) for nine years.*<br>South Carolina initiated a limited groundwater management strategy with passage of the Groundwater Use Act of 1969. The original Act only required groundwater withdrawers in designated Capacity Use Areas to report water use. The Act was revised in 2000 requiring mandatory registration, permitting (in designated Capacity Use Areas), and reporting of all groundwater withdrawals exceeding three million gallons per month in the state. With accurate groundwater data, DHEC can assess the viability of local and regional aquifer systems and establish the tools to evaluate and promote effective *sustainable development water management* strategies for South Carolina. |

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| 7b | **Groundwater Use and the Need for a State-wide Groundwater Level Monitoring Network in South Carolina**<br>Harriet H. Gilkerson, Hydrogeologist, Bureau of Water, South Carolina Department of Health & Environmental Control (SCDHEC)<br>*Harriet has a B.S. and M.S. (Geology) from USC, and has worked over twenty years in various SCDHEC regulatory programs.*<br>Increased pressure on South Carolina's groundwater resources due to population growth and recent drought-induced conditions highlights the need for increased accuracy and collection of data describing groundwater conditions of the South Carolina Coastal Plain. SCDHEC, in coordination with the U.S. Geological Survey, South Carolina Water Science Center (USGS) and the South Carolina Department of Natural Resources (DNR), is developing a groundwater-level monitoring network. The long-term goal of the agencies' cooperative effort is to develop and maintain a state-wide groundwater quantity monitoring network that provides scientifically defensible information for responsibly and sustainably managing South Carolina's groundwater resources. |
| 7c | **U S EPA's Community-Based Water Resiliency Initiative: An Integral Part of Holistic Water Resource Planning**<br>Karen Edwards, Environmental Protection Specialist, Environment al Protection Agency, Office of Water Ground Drinking Water, Water Security Divisions<br>*She leads several Agency initiatives, including the Division's Overarching Communications and Outreach programs.*<br>US EPA's Community-Based Water Resiliency (CBWR) initiative is a community-focused approach to water preparedness that addresses many of the goals of holistic water resource planning. CBWR communication and outreach materials can be used to educate critical community partners and promote collaboration and partnerships between water utility owners/operators and the communities they serve. CBWR assists all community stakeholders address the "what-ifs" in water availability and is an important new tool in holistic water resource planning. Sustainability combined with preparedness planning means more resilient communities. |
| 7d | **An Analysis and Evaluation of Factors Influencing Capacity Development of Public Water Systems in Mississippi**<br>Alan Barefield, Extension Professor, Agricultural Economics, Mississippi State University<br>*Director of the Public Water System Assistance Program housed within Agricultural Economics and the Mississippi State University Extension Service.*<br>Contributing Authors: Jesse Tack, Assistant Professor, Agricultural Economics, Mississippi State University<br>The Mississippi State Department of Health–Bureau of Public Water Supply has developed a mandatory survey instrument containing sections corresponding to enumerated capacity development mandates. This paper assesses the effectiveness of the Peer Review program in increasing capacity development scores and to assess a number of other factors that may have significant influence on a particular system's capacity development. A binomial dependent variable regression model that utilizes intertemporal components is constructed to determine the marginal effects of several firm-level managerial and regional socioeconomic factors in influencing the success of public water systems in increasing capacity assessment scores to acceptable levels. |
| 7e | **Mathematical Modelling of Groundwater Resources System of Dehgolan Plain, Iran**<br>Najme Jahani, Kurdistan University *najme_jahani@yahoo.com*<br>*M.S.B. Irrigation and drainage at Kurdistan University, Consulting Engineering of Ab Nemood Sholame Shargh. Department of Irrigation and Drainage, Gorgan, Golestan, Iran. ,*<br>Dehgolan Plain is considered as a agricultural pole in province of Kurdistan. Irregular growth of population in urban and rural areas, Increase the area of irrigated lands and industry development, exploration and mining and reduced rainfall in recent years, causes irregular increasing in the rate of exploitation and severe water table drawdown in plain mentioned above. Therefore, future survival of the agricultural and rural societies, severely dependent on optimal groundwater management in the plain. Mathematical modeling of groundwater resources system is the first and the most important step in sustainable and optimal management of these resources. The purpose of this study was developing mathematical model of groundwater resources system in Dehgolan plain. For this purpose, steady and unsteady numerical models of groundwater flow was developed using Visual MODFLOW software. The water table depths measured in 2001 and 2002 years were used for calibration and testing the proposed models. Also, the effect of Hydrodynamic properties of the groundwater on accuracy of the models were studied using sensitivity analysis process. The results showed that there are a good match between the models predicted and observed values. Results also showed that specific yield is the most effective parameter on accuracy of proposed models. |
| 7f | **Sustainable Groundwater Use for Power Generation in Georgia, Case Study**<br>Neven Kresic, Ph.D., PG, AMEC Environment & Infrastructure, Inc.<br>*Belgrade University Bachelor of Hydrogeologic Engineering, and Ph.D. in Geology. Dr. Kresic is Hydrogeology Practice Leader at AMEC E&I, Inc.*<br>Contributing Authors: Jim Kennedy, Ph.D., PG, Georgia EPD; Leonard Ledbetter, PE, AMEC Environment & Infrastructure, Inc.;<br>and Dean Alford, PE, Allied Energy Services<br>Plant Washington is a coal-fired power plant proposed for construction in central Georgia. An innovative approach of conjunctive use of surface water and groundwater has been proposed as part of the Plant's water supply permitting process. In close cooperation with the GA State Geologist, a regional 3D groundwater model was developed to evaluate impacts of the proposed groundwater withdrawals on the existing groundwater users, surface water, and sustainability of the groundwater resource for future beneficial uses. The model predicts that these impacts will be minimal, and after 50 years of Plant operation there will be no mining of the aquifer. |

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| 7g | **Consumptive Water Use Estimates for Thermoelectric Power Plants in the Apalachicola-Chattahoochee-Flint Basin**<br>Jennifer C. Murphy, U.S. Geological Survey Tennessee Water Science Center<br>*Jenny Murphy earned a B.A. in geology from Lawrence University in Wisconsin and a M.S. from Vanderbilt University in Tennessee.*<br>Contributing Author: Timothy H Diehl, U.S. Geological Survey Tennessee TN Water Science Center<br>Consumptive water use for thermoelectric power plants in the Apalachicola-Chattahoochee-Flint basin was estimated using energy balance models for once-through cooling and cooling towers. The acquisition of environmental input data and assumptions pertaining to site specific power plant features are discussed. Consumption was estimated under three environmental scenarios: (1) average conditions, (2) 2007 conditions, and (3) extreme weather. Consumptive water use increases when power plants switch from once-through cooling to cooling towers. Vulnerability to low streamflow conditions vary plant by plant due to environmental factors such as wind speed and air temperature, in addition to plant-specific factors. |
| 7h | **Groundwater Sustainable Yield Assessment in Prioritized Aquifers of Georgia Coastal Plain Aquifer System**<br>Katherine H. Zitsch, PE, BCEE, Vice President, CDM and James L. Kennedy, Ph.D., P.G., State Geologist, Georgia Environmental Protection Division<br>*Katherine Zitsch is a Vice President with CDM working on various water resources and water supply projects across Georgia. Dr. Kennedy is the State Geologist for Georgia, with areas of expertise in groundwater hydrology and engineering geology.*<br>Contributing Author: Dr. H. Harry Cheng, CDM; Lee P. Wiseman, CDM; Dr. Mark Maimone, CDM<br>This presentation addresses the sustainable yield assessment of prioritized aquifers in the Georgia Coastal Plain Aquifer System. Groundwater models were developed and utilized to determine ranges of aquifer sustainable yields in the Coastal Plain Aquifer System. Ranges were constrained by groundwater level drawdown and by the reduction of groundwater contributions to stream baseflow in order to maintain opportunities for surface water use. Modeling of sustainable yields of the prioritized Coastal Plain aquifers indicated that ranges of sustainable yields will be sufficient to meet projected groundwater demands through year 2050, with the exception of within the Dougherty Plain of southwestern Georgia. |
| 7i | **Hydroinformatics to Assess Management Regimes: Using Directed Networks and a Groundwater Decision Support System to Span Science and Policy**<br>John M. Sharp, Jr., Department of Geology, Jackson School of Geosciences, The University of Texas at Austin<br>*Professor Sharp's research ranges from flow in fractured rocks, the hydrology of arid zones, to effects of urbanization on groundwater.*<br>Contributing Authors: Suzanne A. Pierce, Center for International Energy and Environmental Policy, Jackson School of Geosciences, The University of Texas at Austin<br>Jenifer Wehner, Energy and Earth Resources Graduate Program, Jackson School of Geosciences, The University of Texas at Austin<br>We present the use of informatics to link outputs from a Groundwater Decision Support System (GWDSS) with topical analysis of policy. The GWDSS uses groundwater availability models and optimization to generate candidate solutions for possible groundwater management decisions. The topical map provides a visualization of planning and policy categories that come directly from network analysis state planning documents.<br>The results provide a means to see patterns in large groundwater datasets and highlight how well management plans align with policy. The approach has the capacity to span between planning contexts and groundwater science while supporting science-based dialogue about managing groundwater systems. |
| 7j | **Groundwater Flooding – Unforeseen Consequences of Flood Control and Water Conservation in Dayton, Ohio**<br>Brent E. Huntsman, CPG, Chief Hydrogeologist, Terran Corporation<br>*Mr. Huntsman has over 30 years experience in designing and implementing hydrogeologic investigations for commercial, municipal and governmental clients nationwide.*<br>Kelly C. Smith, CPG, Terran Corporation, and Daniel J. Wagel, Terran Corporation<br>Following a brief account of the major surface water features and groundwater usage in the Dayton area, the hydrologic and geologic factors contributing to groundwater flooding in the city will be discussed. Various types of groundwater flooding are reviewed. Results of two groundwater modeling techniques used to estimate areas most vulnerable to groundwater flooding as well as attempts to forecast groundwater levels immediately following river high water events will be presented. Finally, a few examples of remedial actions to lessen the impacts of groundwater flooding are provided. |

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| 8a | **Internal and External Mechanical Integrity as Part of Unconventional Gas Development**<br>J. Daniel Arthur, P.E., SPEC, President/Chief Engineer, ALL Consulting<br>*Mr. Arthur is a registered professional engineer with more than 25 years of professional experience. He earned is Petroleum Engineering Degree from the Missouri University of Science & Technology. He has throughout his career and continues to be heavily involved with well integrity issues throughout North America.*<br>Internal and external well integrity have been cornerstones of the U.S. Environmental Protection Agency's Underground Injection Control (UIC) Program since it's inception. Well integrity has also be a key aspect of oil & gas production for more than a century. Today, with the growth of unconventional resource development (especially shales) and the use of high volume hydraulic fracturing, well integrity is perhaps more critical than at any time in the history of the fossil energy business. This presentation explores well integrity issues as relates to unconventional gas and also oil development. |
| 8b | **A Model for Relating Environmental Variation to Water Permit Violations at Thermoelectric Facilities in the Taunton River Watershed**<br>Seth Sheldon, Ph.D. Candidate, UMass Boston<br>*Seth Sheldon graduated from Duke University in 2008 and is currently completing a Ph.D. in Environmental Science at UMass Boston.*<br>Contributing Author: **Anamarija Frankić**, UMass Boston<br>Water use by once-through thermoelectric facilities is highlighted within the larger context of energy-water nexus studies. The two example facilities (i.e., Cleary-Flood and Somerset) are introduced with a simple schematic and statistics about each power plant, along with an explanation of their appropriateness as case studies. NPDES water permitting for power plants is briefly explained. Permit limits are shown to have consequences ("Derate or Violate" paradigm). The successes and failures of the research methodology to model effluent effects are shown. Hindcasting and forecasting results are presented, in which past violations and likely future "operational headaches" are identified. |
| 8c | **Water Issues Related to Coal Mining in the Appalachian Basin**<br>Paul F. Ziemkiewicz, Director, West Virginia Water Research Institute<br>*Paul Ziemkiewicz is the Director of the West Virginia Water Research Institute. Major programs address mine drainage and drilling brine*.<br>Coal is mined by both surface and underground methods in Appalachia. In addition to historic issues such as acid mine drainage and attendant pollutants such as acidity, iron, aluminum and manganese. Emerging pollutants reflect alkaline discharge from large, surface mines in the central Appalachian region and deep mines in the northern part of the basin. Pollutants such as selenium and dissolved solids and aluminum have emerged which are difficult to treat to the regulatory standards proposed by the regulatory agencies. This presentation addresses the potential for innovative control strategies for these otherwise intractable pollutants. |
| 9a | **A Holistic Approach to Environmental Stewardship: Water Use, Electric Power, and Nuclear Energy**<br>William Skaff, Director, Policy Development, Nuclear Energy Institute<br>*William Skaff is Director, Policy Development, at the Nuclear Energy Institute and the author of the NEI study, Water Use, Electric Power, and Nuclear Energy: A Holistic Approach to Environmental Stewardship.*<br>Holistic environmental management requires balancing the relationships among all relevant issues and making responsible trade-offs appropriate to the unique characteristics of each ecosystem where an electricity generation facility already exists or is to be deployed. Holistic environmental management applies to Clean Water Act Section 316(b) regulations governing thermoelectric power plant cooling system intake structures. These regulations should allow the choice of cooling system and fish protection technologies according to the unique characteristics of the local ecosystem, with a site-specific assessment of potential environmental impact and cost-benefit. EPA's proposed rule, as a whole, does not do this. Among the facts: Cooling towers consume twice as much water as once-through cooling systems. Scientific study demonstrates that once-through cooling systems do not have an adverse impact on aquatic life populations. |
| 9b | **The Fukushima Accident and Nuclear Safety in the United States**<br>Chris L Thornell, Assistant to Executive Vice President and Chief Nuclear Officer, Southern Nuclear Operating Company<br>*Thornell oversees the Southern Nuclear Business Planning process, chairs the Plant Manager Council, and coordinates the Nuclear Safety Culture program.*<br>The presentation comprises a brief review of events at Fukushima and the unlikely potential for such a scenario to recur in the United States, for reasons including safety system testing and inspections; plant design, engineering, and construction; and actions undertaken by the NRC and the industry to ensure the integrity of our facilities through reviews, inspections, and proposed alterations. |

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| 9c | **Used Nuclear Fuel Management: Storage and Recycling**<br>William Murphy, P.E. – Duke Energy<br>*William Murphy is the lead engineer at Duke Energy for used fuel storage at Catawba Nuclear Station.*<br>Used commercial nuclear fuel is stored safely and securely at reactor sites across the United States. Dry used fuel storage systems are deployed where used fuel pools are reaching capacity. In order to facilitate total plant decommissioning and ensure confidence in the nuclear fuel cycle, used fuel should be removed from reactor sites and placed in a centralized interim storage facility until deep geologic disposal can be established. Used fuel recycling may be pursued in the future, which could further reduce the quantity and toxicity of the waste stream. |
| 9d | **Nuclear Power Generation: Water Needs and Environmental Impacts**<br>Nebiyu D. Tiruneh, Hydrologist, U.S. Nuclear Regulatory Commission<br>*Nebiyu Tiruneh is a hydrologist/water resources engineer. He holds a Ph.D. in Civil Engineering specializing in Water Resources and Hydrology*<br>Contributing Authors: Richard Raione, Chief, Hydrologic Engineering Branch, U.S. NRC; Hosung Ahn, Hydrologist, U.S. NRC; Joseph Giacinto, Hydrologist, U.S. NRC<br>The construction and operation of nuclear power plants requires large quantities of water. The review of applications for nuclear power plants addresses water availability and impacts on, water quality. The identified water source has to be sufficient to meet the demands of a proposed plant as well as existing and potential users. The water quality component of the review addresses impacts of thermal, chemical and radiological effluents on the environmental system. This paper will provide an overview of the technical and regulatory aspects of the review performed by the staff of the U.S. Nuclear Regulatory Commission (U.S. NRC). |
| 9e | **An Overview of the Nuclear Power Industry's Ground Water Protection and Underground Piping and Tanks Integrity Initiatives**<br>Kathleen Yhip, Senior Project Manager, Radiation Safety & Environmental Protection, Nuclear Energy Institute<br>*Kathy has been in the nuclear power for 27 years and is currently responsible for coordinating the industry's implementation of the Ground Water Protection Initiative.*<br>The nuclear power industry developed and began implementing the Ground Water Protection Initiative in 2006. Subsequently in 2009, the industry implemented the Buried Piping Integrity Initiative that has since been expanded to become the Underground Piping and Tanks Integrity Initiative. Collectively, these initiatives represent a coordinated approach to improving each plant's programs and processes to bolster protection of the environment from unintended leaks that are well below regulatory limits. These initiatives are also intended to enhance public and regulatory confidence by fostering more transparent communications with external stakeholders. |
| 9f | **Palo Verde Nuclear Generating Station Water Reclamation Facility**<br>Bob Lotts, Arizona Public Service, Manager, Water Resource Planning<br>*Bob joined APS in June 1982 and has held various positions including Plant Manager of the Water Reclamation Facility at Palo Verde NGS and assumed the role as the manager of this newly formed department in March 2009.*<br>The Palo Verde Nuclear Generating Station (PVNGS), located in the Sonoran Desert 50 miles west of Phoenix, Arizona, is the largest nuclear power plant in the United States. Prior to construction a review of possible water sources was performed, the secondary effluent produced by the Wastewater Treatment Plants in metropolitan Phoenix area was determined to be the appropriate solution. A decision was made to purchase, convey and provide additional treatment in order to utilize the effluent for plant cooling. PVNGS is the only nuclear Power Plant in the world that uses reclaimed water for cooling tower operation. |
| 9g | **Release of Radionuclides from Operation of Nuclear Reactors and Aquifer Water Quality Assessment**<br>Nebiyu D. Tiruneh, Hydrologist, U.S. Nuclear Regulatory Commission<br>*Nebiyu Tiruneh is a hydrologist/water resources engineer. He holds a Ph.D. in Civil Engineering specializing in Water Resources and Hydrology*<br>Contributing Authors: Richard Raione, Chief, Hydrologic Engineering Branch, U.S. NRC; Hosung Ahn, Hydrologist, U.S. NRC; Mark McBride, Hydrologist, U.S. NRC<br>The U.S. Nuclear Regulatory Commission reviews applications for new reactors to determine compliance with applicable regulatory requirements and ensure public health and safety. The review considers accidental releases of radioactive liquid effluents into ground and surface waters and relies on adequate site characterization and identification of alternate pathways. Site characterization is based on hierarchical hazard assessment approach, monitoring, correct interpretation of data, and site-specific groundwater flow and transport models. This poster presents the current monitoring and site-specific modeling approaches and initiatives the U.S. NRC uses as part of wide array of tools in performing review of new reactors. |

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| 10a | **Modeling and Mapping the Area of Potential Impact for Class VI $CO_2$ Injection Wells**<br>Stephen R. Kraemer, Ph.D., Research Hydrologist, US Environmental Protection Agency, Office of Research and Development, Athens, Georgia<br>*Dr. Stephen Kraemer has been with the EPA for over twenty years. He has a Ph.D. in Environmental Science from Indiana University, Bloomington, and a B.S. in Engineering Science from the University of Notre Dame. His research supports the EPA Safe and Sustainable Water Resources research program, with particular emphasis on Source Water Protection and Underground Injection Control. Dr. Kraemer develops and applies computer modeling approaches for representing regional ground water flow and interactions with surface water systems. The material in this presentation was supported by Dr. Karl Bandilla of Princeton University, Dr. Mark Bakker of the Delft Technical University (The Netherlands), Dr. Jens Birkholzer and Dr. Quanlin Zhou of LBNL, Dr. Matt Tonkin team at SSPA, and Mr.Jay Rineer team at RTI International.*<br>We are developing modeling and mapping tools to assist regulators in the evaluation of the Area of Review (AoR) associated with permit applications for UIC Class VI wells ($CO_2$ injection for purpose of geologic sequestration). The applicant for a permit is required to use computational multi-phase modeling to map the maximum extent of the $CO_2$ plume and threshold pressure fronts. We are exploring the utility of semi-analytic pressure response solutions (e.g., Theis, Hantush-Jacob, Moench, Zhou) and mapping technology (e.g., GIS) to represent an approximate area of potential impact and gain insight into the AoR. |
| 10b | **Examining Salinity Restrictions for $CO_2$ Sequestration: Suggestions from Basin to Reservoir Scales**<br>Madalyn S. Blondes, Operations Research Analyst, U.S. Geological Survey<br>*Madalyn Blondes is a geochemist (Ph.D., Yale 2008) currently developing probabilistic models for the National Geologic $CO_2$ Sequestration Assessment project.*<br>Contributing Authors: Margo D. Corum, Peter D. Warwick, Sean T. Brennan, Matthew D. Merrill, U.S. Geological Survey<br>US EPA Class VI well regulations prohibit $CO_2$ injection into underground sources of drinking water (total dissolved solids < 10,000 mg/L). Many potential "saline" storage formations and known "fresh" water aquifers contain a mix of data both above and below this cut-off. Applying this regulation depends on the project scale. The USGS National $CO_2$ Sequestration Assessment now applies a salinity factor (0-1) to remove the fresh water fraction to allow assessment in broad saline regions. At the reservoir scale, spatial and statistical approaches are suggested to avoid having a few saline data points define a fresh aquifer as saline. |
| 10c | **Water Demand for Carbon Capture – Electricity Generation**<br>Erik Shuster, Engineer, Department of Energy – National Energy Technology Laboratory<br>*Erik Shuster is currently an engineer at the National Energy Technology Laboratory. He holds a Master's degree in chemical engineering from the University of Pittsburgh.*<br>Currently, fossil fueled power plants generate 71% of the United States' electricity and 67% of the World's. EIA and IEA both forecast by 2035 that fossil fuels will continue to generate over 60% for both the United States' and the World's electricity needs. Concerns with CO2 emissions may someday require fossil fueled power plants to capture and sequester CO2. This presentation shows the magnitude of the current fossil fueled fleet and examines the water demands for several prospective carbon capture technologies. Water requirements for carbon capture technologies are compared to plants without carbon capture, and the water intensive processes in the plants are identified. |
| 10d | **Extraction of Formation Water From $CO_2$ Storage Reservoirs**<br>Ryan J. Klapperich, Research Scientist, Energy & Environmental Research Center<br>*Ryan Klapperich, a Research Scientist at the EERC, has an M.S. in Geology from the University of North Dakota.*<br>Contributing Authors: Robert M. Cowan, Charles D. Gorecki, and Guoxiang Liu Energy & Environmental Research Center<br>The IEA Greenhouse Gas R&D Programme and the U.S. Department of Energy are jointly sponsoring the Energy & Environmental Research Center to perform a project focused on water extraction from $CO_2$ storage reservoirs. The project aims to assess the global potential for extraction of formation water from deep saline formations to increase $CO_2$ storage capacity and to assess the beneficial reuse of the extracted waters. These goals will be met through geologic modeling of injection scenarios, evaluations of the resulting extracted water's quantity and quality, and comparisons to global distributions of deep saline formations. |
| 10e | **The U. S. DOE Sequestration R&D Program: MVA for Groundwater Protection**<br>John Litynski, Sequestration Program Technology Manager, National Energy Technology Laboratory, Pittsburgh, PA<br>*John Litynski received his B.S. in Civil Engineering from Virginia Polytechnic Institute and State University and M.S. in Environmental Engineering and Science from Johns Hopkins University.*<br>Contributing Author: Andrea McNemar, Sequestration Division Project Manager, National Energy Technology Laboratory, Morgantown, WV<br>The Monitoring, Verification and Accounting (MVA) component of the core program is increasing the portfolio of techniques for groundwater protection, including projects on wellbore monitoring, seismic, and non-seismic methods, and intelligent monitoring systems. The Regional Carbon Sequestration Partnerships (RCSPs) and International Collaborations are demonstrating the ability to use monitoring tools to track the movement of the $CO_2$ plume, and monitor signals (chemical, pressure, seismic, resistivity, etc) that might indicate a leak from the injection formation. Lessons learned have been compiled in a Best Practices Manual. |

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| 11a | **FracFocus: Overview of History, Process and Public Outreach Efforts**<br>Mike Nickolaus, Ground Water Protection Council<br>*Mike Nickolaus is the Special Projects Director for the GWPC. A 1979 graduate of Indiana University, Mike is a Licensed Professional Geologist and member of the Society of Petroleum Engineers. Prior to joining the GWPC in 2005 Mike was the state Director of Oil and Gas for the State of Indiana.*<br>The issue of hydraulic fracturing chemical disclosure has become a critical part of the national discussion on the safety of hydraulic fracturing. As an association of state regulatory agencies, the Ground Water Protection Council recognized that there was a need for a uniform system of chemical reporting which could be adopted by state regulatory agencies to meet the public need for disclosure. FracFocus has already been adopted for use by three states (Montana, Texas, and Louisiana) and is under consideration for adoption by several more. This session will discuss the history, content and future of the FracFocus system. |
| 11b | **E-Reference: Promoting Regulatory Transparency**<br>Gerry Baker, Associate Executive Director, Interstate Oil and Gas Compact Commission<br>*Baker joined the IOGCC in 2002 after working as a reporter, crisis communications consultant and business communications director.*<br>Contributing Author: Heath Kennedy, Account Supervisor, Brothers &Co.<br>Recent assertions regarding hydraulic fracturing regulatory requirements has prompted the IOGCC to develop an easy-to-reference source of state regulations governing the HF process. The intent is to provide the ability to quickly locate specific regulatory requirements in individual states and to permit transparency among state programs. Ultimately, the vision is to provide a more extensive electronic reference system for the major elements of state oil and gas regulatory programs. North Dakota and Oklahoma were the leading supporters of this initiative, and the IOGCC is actively seeking additional input from other state programs. |
| 11c | **RBDMS Hydraulic Fracturing Module**<br>Paul Jehn, Technical Director, The Ground Water Protection Council<br>*Paul Jehn is GWPC's project manager for the Risk Based Data Management System (RBDMS).*<br>The RBDMS hydraulic fracturing module is part of the GWPC's National Risk Based Management System. RBDMS provides programmatic and management tools to support energy and water related environmental decision making. RBDMS stores and manages all data related to hydraulic fracturing including: chemicals used, water quality/quantity, well construction information, completion reports, and well history and inspection reports. Industry can electronically report to state systems. State inspectors collect data in the field via lab top computers and transmit the data electronically to the main state data system. Program managers use RBDMS to run reports and monitor state wide compliance. RBDMS hydrofrac is being pilot tested in Colorado and Pennsylvania. The RBDMS system is available to all state energy and water programs. |
| 12a | **Power, Water, and Everything Else**<br>Marty Link, Associate Director, Water Quality Div., Nebraska Dept. Environmental Quality<br>*Marty Link has worked for the Nebraska DEQ since 1988 in the Water Quality Div., doing ground and surface water quality, point and nonpoint source work.*<br>This short presentation introduces the session's speakers and the issues of energy production, ground water quality and quantity, surface water quantity and quality, endangered species, and air quality. |
| 12b | **Resources Conservation Assessment**<br>Noel Gollehon, Senior Economist, Natural Resources Conservation Service, USDA<br>*Noel Gollehon helps address agriculturally related water quantity and quality issues through working lands agricultural policy.*<br>Contributing Authors: James Benson, NRCS and Daniel Mullarkey, NRCS<br>The Soil and Water Resources Conservation Act (RCA) provides broad natural resource strategic assessment and planning authority for the USDA. The RCA calls for—<br>• A continuing *Appraisal* of the Nation's soil, water, and related resources that documents the current status and trends of soil, water, and related natural resources, and the capability of these resources to meet current and projected demands.<br>• A *National Conservation Program* to guide USDA assistance to landowners for conserving soil, water, and related resources on non-Federal land.<br>The 2011 RCA Appraisal provides an overview of the U.S. agricultural sector; of the status, condition, and trends of natural resources on non-Federal lands; and of the USDA programs for assisting landowners in natural resource conservation. Stakeholder input obtained during the development process clearly identified water resources (quality and availability) as the most pressing natural resource concerns, with soil quality, invasive species, and wildlife habitat as other high priority concerns. Looking ahead, it examines interrelated issues that have significant potential implications for U.S. agriculture and forestry: climate change, biofuels production, and the quality and availability of water. |

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| 12c | **Agricultural and Groundwater – An Overview of Current Issues**<br>Mike Wireman, National Groundwater Expert, US EPA Region 8<br>Since 1950 the world's population has increased from 2.5 to 6.5 billion. Water withdrawals have tripled and irrigated acreage has doubled. Approximately 70 % of annual freshwater withdrawals are now used for food production and other agricultural products. In 2000 US farmers used approximately 12 million tons of nitrogen and more than 1.2 billion pounds of pesticides. Nitrate contamination of shallow groundwater is a widespread problem in agricultural regions within the US. Withdrawals of water for agricultural use are impacting the water quality, quantity of stream flows. Rivers are drying up and fisheries are threatened. Sustainable groundwater management will require increased attention to managing supplies through integration of water quality and water quantity programs. |
| 12d | **High Nitrate in Shallow Groundwater: Status and Implications for Our Linked Surface-water and Groundwater Resources**<br>Neil M. Dubrovsky, Supervisory Hydrologist, USGS<br>*Neil Dubrovsky is Chief of the Nutrients and Trace Elements National Synthesis team of the USGS's National Water-Quality Assessment Program.*<br>A comprehensive national analysis by the United States Geological Survey shows that high nitrate has accumulated in the shallowest groundwater under areas with significant nitrogen sources. The data, collected by the National Water-Quality Assessment Program, show that nitrate contamination of groundwater used for drinking water, particularly shallow private wells in agricultural areas, is an increasing human-health concern. Nitrate in groundwater can also discharge to streams, where it contributes to widespread ecological degradation. Because of the direct connection between surface water and groundwater, the fate of the high nitrate shallow groundwater is a question of concern for all water resource managers. |
| 12e | **"25x'25" – America's Energy Future**<br>Michael Bowman, National Steering Committee, "25x'25"<br>*Michael Bowman is a rural advocate, raised on his family farm in eastern Colorado and founding board member of "25x'25"*<br>The nation's pursuit of the 25x'25 clean energy goal would create an estimated 1.4 million new jobs by 2015, according to a newly-released University of Tennessee study. Some 2.9 million jobs would be created by 2020, and 4.7 million by 2025, all from economic activity generated by the production of clean, renewable energy. The report underscores the need to strengthen and protect federal programs and funding that allow the evolving renewable energy sector to produce a triple bottom line: economic recovery, energy security and a cleaner environment. |
| 12f | **The Groundwater Energy Food Nexus**<br>Jay Lazarus, Pres./Sr. Geohydrologist, Glorieta Geoscience, Inc.<br>*Mr. Lazarus has been developing groundwater resources for agricultural, municipal, mining and industrial water users for more than 35 years.*<br>Contributing Author: Robert Hagevoort, PhD, Dairy Extension Specialist, Endowed Dairy Chair, New Mexico State University<br>The inescapable nexus between groundwater production, energy production and food production must be balanced and sustainable. Food and energy security are directly related to water security. Fresh water supplies for irrigation are critical for food security and sustaining our agricultural communities. As demand for food increases, groundwater is often produced at rates that exceed a basin's safe yield. Increased demand for biofuels has resulted in increased competition for groundwater for food production and groundwater to grow fuel crops. Increased irrigation efficiencies and implementation of water conservation measures in both urban and agricultural settings lessens competition for limited aquifers. |
| 13a | **Conjunctive Regional Management to Offset Declining Water Supplies**<br>Dean Pennington, Ph.d, Executive Director, Yazoo Mississippi Joint Water Management District<br>*Dean has been Yazoo Mississippi Delta Joint Water Management District's Executive Director since its creation in 1990.*<br>Contributing Author: Jeff Ballweber, Pickering Firm, Inc.<br>Northwest Mississippi's Delta is experiencing water supply problems from; a) declining water levels in the major aquifer used for irrigation and b) poor in-stream base flows. Conjunctive management and development of ground and surface water can provide sustainable water supply for the region's long-term economic and environmental needs. Institutional coordination for conservation and conjunctive development of ground and surface water is perhaps the greatest challenge and opportunity for water managers throughout Mississippi. This presentation discusses how private, local, state and federal institutions can use research, regulation, projects, incentives, and education in a coordinated, proactive fashion to address regional water resource problems. |

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| 13b | **Keeping it on the Farm: Potential Water Quality and Quantity Benefits of On-Farm Storage Reservoirs**<br>Mary Love Tagert, Ph.D., Assistant Research Professor, Mississippi State University<br>*Dr. Tagert has appointments with the MS Water Resources Research Institute and Agricultural and Biological Engineering Department at Mississippi State University.*<br>Contributing Authors: Joel Paz, Ph.D., Assistant Professor, Department of Agricultural and Biological Engineering, Mississippi State University;<br>Jonathan Pote, Ph.D., Professor and Head, Department of Agricultural and Biological Engineering, Mississippi State University;<br>Charles Wax, Ph.D., Professor, Department of Geosciences, Mississippi State University<br>This presentation will outline two projects, one which is proposed and one which was recently awarded and initiated. The first project proposes to look at optimization of on-site water storage systems for nutrient reduction to determine if on-site water storage systems can be optimized and used as an effective management practice to both conserve water and reduce nutrient concentrations without adversely affecting in-stream flows. The recently awarded project, which is just beginning, will investigate the downstream water quality and quantity impacts of water storage systems in Porter Bayou Watershed to determine the watershed-scale impacts of on-farm water storage systems. |
| 13c | **A Farm Storage Reservoir Optimization Model for the Mississippi Delta**<br>Jonathan Pote, Professor and Head Agricultural and Biological Engineering Department, Mississippi State University<br>*Jonathan Pote is a professor in the Agricultural and Biological Engineering Department at Mississippi State University, where he also serves as the Department Head. He has served at various times as the Director of the Water Resources Research Institute, President of the National Institutes for Water Resources, President of the Universities' Council on Water Resources, and Chair of the Board on Natural Resources.*<br>Contributing Authors: Charles Wax, Professor and State Climatologist; Robert Thornton, Graduate Student;<br>Chad Swindoll and Jason Sydejko, Students, Geosciences Department, Mississippi State University<br>This research developed a model for optimizing the size of on-site water retention structures to capture rainfall to use in place of groundwater for irrigation in agricultural fields in the Mississippi Delta region. The model uses long-term weather records (50 years of daily data) to estimate daily values of these climatological inputs. The percentage of required irrigation demand that is met by rain stored in the ditch is calculated weekly for the entire growing season. This study uses comparable techniques to predict the impact of adoption of on-farm surface water storage for irrigation on groundwater volume in the aquifer. |
| 13d | **USEPA Office of Ground Water and Drinking Water: Groundwater & Agriculture**<br>Roy Simon, USEPA<br>*Roy currently assists in managing the Source Water Protection and Underground Injection Control Programs as the Associate Branch Chief for the Prevention Branch with the Environmental Protection Agency. In addition, he has been in the forefront of working with urban communities to renew them as part of EPA's Urban Waters Initiative and worked on implementing the Federal stimulus package. He entered federal service as a Presidential Management Intern in 1978. Roy received a Master of Public Management degree from Carnegie-Mellon University's Heinz School of Public Policy and a received a B.S. in government studies from Penn State University.* |
| 14a | **Timing for Applying for Class VI Primacy and Issuing Class VI Permits**<br>Lisa M. McWhirter, Office of Ground Water and Drinking Water, US Environmental Protection Agency<br>*Ms. McWhirter holds a BA in Environmental Science from the University of Virginia, MS in Engineering Management from George Washington University, and a JD from Pace Law School. She joined EPA in 2009, where she primarily works on Class VI Primacy and Implementation.*<br>The Safe Drinking Water Act (SDWA) §§1422 and 1425 authorize EPA to approve State UIC Programs (grant primary enforcement responsibility (primacy)) for states that develop UIC programs meeting the minimum federal UIC Program requirements found in SDWA §1421(b) and 40 CFR Parts 144-146 and 148.<br>Under SDWA §1422 and 40 CFR §145.21(h), states have 270 days following publication of the GS Rule in the *Federal Register* to submit a primacy application for Class VI wells and receive EPA approval. If a state does not receive EPA's approval of its Class VI program by day 270 (September 6, 2011), then EPA will implement the UIC Class VI program on the state's behalf, beginning on September 7, 2011 (day 271).<br>During this 270-day application period, states with SDWA §1422 primacy may consider using existing authorities (e.g., Class I or Class V experimental) to issue permits for GS of carbon dioxide. EPA suggests using Class I permits, if allowed, because the GS Rule limits the use of the Class V experimental technology wells. EPA encourages states to issue permits that include the Class VI requirements to facilitate issuing a Class VI permit with minimal additional effort on the part of the owner or operator or the UIC Program Director.<br>For those states without existing SDWA § 1422 primacy programs, all Class VI permit applications must be directed to the appropriate EPA Region. EPA Regions will issue permits using existing authorities and well classifications (e.g., Class I or Class V experimental), as appropriate. Regions are also encouraged to include Class VI conditions in these permits.<br>Once states receive SDWA §1422 primacy for Class VI, these states with approved Class VI programs may begin issuing state Class VI permits and any previously EPA-issued Class VI permits will be transferred to the state. |

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| 14b | **Geologic Sequestration Data System**<br>Joe Tiago - US Environmental Protection Agency<br>*Joe Tiago, MS, MPH, Environmental Scientist US Environmental Protection Agency HQ Office of Ground Water and Drinking Water Drinking Water Protection Division (4606M) 1200 Pennsylvania Avenue, NW Washington, DC 20460*<br>EPA published new regulations for geologic sequestration of carbon dioxide on December 10, 2010, The Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide Geologic Sequestration (GS) Wells (Class VI Rule), codified under 40 CFR 146.81 et seq.<br>EPA recently hosted Joint Requirement Planning (JRP) meetings to support the development of a data system for GS activities that is required under the Class VI Rule. The goal of the JRP meetings was to identify the needs of Class VI GS data system users and the necessary components of the data system, based on the requirements of the Class VI Rule and to integrate this information into the development of the data system.<br>During this session, EPA will present the outcome of the JRP meetings and get additional input from participants in the process of designing a data system to meet the Class VI Rule requirements. |
| 15a | **Innovative Process to Upgrade Shale Gas Produced Water for Recycling verse Deep Well Injection.**<br>Tom Lewis, President & CEO, Lewis Environmental Services, Inc.<br>*Mr. Lewis is a graduate of Carnegie-Mellon University with a B.S. in Chemical Engineering. He is a leader in using activated carbon for nontraditional applications and has successfully treated over 500,000,000 gallons of waste water. Mr. Lewis has patented several recycling processing utilizing activated carbon.*<br>Mr. Lewis' presentation will summarize a field demonstration of the ENVIRO-SHALE Process (ESP); an innovative shale gas waste water recycling technology at a deep well injection facility. The case study will highlight the successful ESP trial which upgraded produced water and eliminated its disposal. The ESP effluent met water reuse criteria and was recycled back to an active drill site to supplement fresh water drilling requirements. The presentation will highlight the equipment package and operational results achieved in processing produced water for recycle. The field demonstration lasted 14 days. Economic advantages of recycling produced water will be highlighted. |
| 15b | **Ways to Minimize Water Usage in Engineered Geothermal Systems**<br>Joanna McFarlane, Research Chemist, Oak Ridge National Laboratory<br>*Dr. McFarlane, PhD U.Toronto 1990, studies fluids used for heat transfer and energy production and environmental chemistry.*<br>Contributing Authors:Kevin J. Qualls, A. Lou Qualls, Adrian S. Sabau, Hebi Yin, Lawrence M. Anovitz, and Andrew K. Kercher, Oak Ridge National Laboratory; Steven A. Wright, Sandia National Laboratory<br>To address problems such as greenhouse gas emissions and energy security, the US is considering renewable resources, such as geothermal energy. Hydrothermal systems produce about 3000 MWe domestically; however, electricity may also come from engineered geothermal systems (EGS) with siting issues such as low-permeability rock, limited water, and deep wells. Water use can be reduced with a power cycle that works efficiently with air cooling, using refrigerant mixtures. Heat extraction from the subsurface represents another aspect of geothermal water use because complex fluid-rock interactions affect heat transport and lifetime performance. These factors all contribute to the viability of EGS. |
| 15c | **Beneficial Reuse in the Oilfield: A Study of Water Distillation Technology and Beneficial Reuse of Waste Brine**<br>David A. Bell, Purestream<br>*David A. Bell, PhD, has over 30 years of management and engineering experience. An expert in computation fluid dynamics, Dr. Bell has managed projects from biomedical blood monitoring to electrical transients in transmission lines, as well as thin film deposition techniques for optical storage media. A founder of Thermal Management Technologies (TMT), he is an innovator of Purestream Technology's unique AVARA vapor recompression system and a member of the board of trustees of the Utah State University's Research Foundation. Dr. Bell is a registered professional engineer in several western states.*<br>Contributing Author: Andrea Metil, Purestream<br>Purestream's AVARA System reclaims produced and flow-back water at the well head through a unique, thermally efficient vapor recompression process. The resulting output stream is distilled water that can be put to beneficial use for field operations — non-detectable levels of TDS and TSS. Additionally, this technology can provide solutions to field source air emissions by capturing vent or flared gas to utilize as a fuel for the heat and energy required to operate. This integrated unit is thermally efficient (more BBL / BTU) and compact, via trailer mount or single container, providing greater field penetration and a reduction in water trucking and disposal costs. Discussion will also include research on beneficial reuse for brine concentrate, including solar salt ponds and cement production. |

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| 15d | **Environmental Costs of Managing Geological Brines Produced or Extracted During Energy Development**<br>Christopher Harto, Energy and Environmental Analyst, Argonne National Laboratory<br>*Chris's research at Argonne focuses on the environmental impacts of energy development and associated policy implications.*<br>A number of energy development activities may result in the production or extraction of geological brines with varying concentrations of dissolved salts and minerals. Recent life cycle assessment work at Argonne has begun to quantify the environmental costs (energy, greenhouse gas emissions, net water consumption) of different practices for managing these brines including a range of treatment, reuse, and disposal options. The purpose of this effort is to identify the most environmentally preferable management practices for brines with different characteristics. It will also help to quantify the environmental tradeoffs between brine disposal and a range of beneficial reuse options. |
| 15e | **Deep Shale Natural Gas Water Use, Part Three: Even Liquid-Rich Shales are Relatively Water Efficient**<br>Matthew E. Mantell, P.E. Senior Environmental Engineer – Engineering Technology Group; Chesapeake Energy Corporation<br>*Matt is responsible for produced water management, water treatment and reclamation, environmental issues with hydraulic fracturing, and chemical disclosure initiatives.*<br>This presentation is the 3rd version of "Deep Shale Natural Gas: Abundant, Affordable, and Surprisingly Water Efficient" originally developed for the 2009 GWPC Water/Energy Symposium. This presentation will discuss the water efficiency of deep shale natural gas compared to other energy resources using the most up to date operational data for shale gas development. New information presented this year will include the water efficiency of emerging liquid (oil and condensate) rich shale plays compared to conventional oil and other energy resources. Current successes and challenges related to produced water reuse and recycling will also be discussed. |
| 16a | **State Regulator / USEPA Roundtable Brownbag Lunch Session**<br>1. EPA Draft Stormwater Rule<br>What is the status of the proposed EPA Draft Stormwater Rule (Sept. 2011 initial draft released for comment)? If the rule hasn't been released, please discuss conceptual background on the following.) What are the proposed requirements related to directing stormwater to the shallow subsurface (groundwater)? How does the proposed rule address water quality for non-class v infiltration to groundwater. Will there be revisions to the June 13, 2008, clarification memo on stormwater infiltration practices/technologies having the potential to be regulated as "Class V" wells?<br>2. Class V stormwater funding and CWA §319 Funding<br>Do states have the ability to permit stormwater discharges under the Class V program under the existing and new proposed stormwater rule? Is there funding available under CWA §319 for the Stormwater Class V program?<br>General §319—States are having problems with reporting requirements such as in-kind match demonstration, cost allocation plans for direct and indirect costs, gathering and reporting information to demonstrate project effectiveness, and differences between EPA regional program implementation.<br>3. Clean Water Act §106 and Drinking Water SRF funding for groundwater projects<br>States—how do you get Clean Water Act §106 funding for groundwater projects? Can EPA help to emphasize the importance of this funding to the regions and states? Can or should there be dedicated funding under CWA §106 for groundwater rather than just a mention in guidance to and from the regions? How are states taking advantage of DWSRF set-aside for groundwater assessment and protection?<br>4. Aquifer Storage and Recovery Issues<br>Where are we on resolving the Aquifer Storage and Recovery issues with point-of-compliance/ endangerment? States need flexibility on permitting ASR projects, and EPA cooperation and support for the development of technical assistance on ASR and how to deal with the endangerment issue.<br>5. UIC Issues<br>Funding for Class V - What is the current thinking at EPA on the allocation formula? What is not being done due to a lack of funding?<br>Current and planned activities of the UIC Technical Workgroup<br>UIC National Data Base - Update and Implementation |
| 17a | **Long-Term Potable Supply in Southold, New York: Managing a Limited Freshwater Aquifer in a Largely Agricultural Region**<br>Daniel O'Rourke, P.G., CDM<br>*A project hydrogeologist located in CDM's Edison, New Jersey office, he has M.S. degrees in Geosciences/Hydrogeology and Environmental Engineering.*<br>Contributing Authors: Mary Anne Taylor, P.E. (CDM), Matthew Gamache, P.E. (CDM)<br>Southold has extensive agricultural land use and is underlain by a thin freshwater aquifer that limits individual well capacity. Approximately 5,000 households currently use private wells as potable supply, but due to elevated levels of nitrogen and pesticides, the demand for a community supply is expanding. Based on average supply well capacity and water use patterns, the need for 23 additional wells is projected by 2030. Alternatively, the development and implementation of an aggressive conservation program, along with the addition of only three wells, can more efficiently manage Southold's water demand without significant impacts to water resources or infrastructure requirements. |

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| 17b | **Exploring Sustainable Regional Groundwater Supply Alternatives to Manage Saltwater Intrusion in the Hilton Head Island Area**<br>Robert Fitzgerald, P.E., Associate, CDM<br>*Mr. Robert Fitzgerald is a senior groundwater modeler and CDM's Cambridge MA Water Resources Group Leader.*<br>Contributing Author: Kristina Masterson, CDM; Dr. James Kennedy, State Geologist of Georgia, Dr. Mark Maimone, CDM, and Katherine Zitsch, CDM<br>As part of the Coastal Georgia Sound Science Initiative (CSSI), a groundwater flow and saltwater transport model was developed for the Georgia Environmental Protection Division to study saltwater migration in the Upper Floridan aquifer beneath Hilton Head Island, and to evaluate options for managing saltwater intrusion and maintaining a sustainable water supply. Historically, groundwater withdrawals in the area of Savannah, Georgia and the Hilton Head Island vicinity have contributed to saltwater intrusion beneath Hilton Head Island. Model simulation results have been presented to an interstate committee tasked with examining management options. |
| 17c | **Simulated Influences of Upgradient Multi-Aquifer Wells on the Movement of Contaminants to Public-Supply Wells**<br>Sandra M. Eberts, Hydrologist, U.S. Geological Survey, Ohio<br>*USGS hydrologist since 1985. Currently team leader for the NAWQA Transport of Anthropogenic and Natural Contaminants to Supply Wells study.*<br>Contributing Author: Rick Johnson, Oregon Health and Science University; Leon Kauffman, U.S. Geological Survey, New Jersey;<br>Brian Clark, U.S. Geological Survey, Arkansas; Matthew Landon, U.S. Geological Survey, California<br>Simulations demonstrate that a single multi-aquifer well located upgradient of a confined-aquifer public-supply well can contribute nearly 10 percent of the water (and associated contaminants) produced by the public-supply well. When irrigation pumping from the confined aquifer is included in the simulations, downward flow of water between aquifers increases by at least 35 percent because of an increase in the downward hydraulic gradient between aquifers. These simulations show that water can move downward and out the bottom half of a multi-aquifer well even as water is being pumped from the well if the downward gradient between aquifers is sufficiently large. |
| 17d | **Will Radium Be the Major Problem Limiting Land Disposal of Waste in the Inner Coastal Plain Of South Carolina**<br>Christopher A. Wargo – Geologist, SC Department of Health and Environmental Control (SCDHEC)<br>*Christopher Wargo has a B.Sc. in Geology from Kent State University and a M.Sc. in Geology from the University of South Carolina.*<br>David J. Ebinger, Peter A. Stone, Jeffrey M. Schrag, et al. (SCDHEC)<br>Human activities at or near the land surface that appreciably alter water chemistry in the shallowest aquifer can lead to the release of natural radium into aquifer water, and these radium concentrations are often in excess of the health-based drinking water limit. These triggered radium problems should be considered in planning and permitting activities that will affect the groundwater chemistry. |
| 18a | **Protecting Your Water Supply and Your Bottom Line: Shifting Treatment Costs from Ratepayers to Polluters**<br>Alexander Leff, Managing Partner, Sher Leff, LLP<br>*Dedicated exclusively to representing water suppliers in contamination cases, Sher Leff has obtained over $400 million for clients since 2003.*<br>Water suppliers are facing enormous financial challenges in complying with environmental regulations. Where will the money come from? Some landmark legal cases have held that manufacturers of products – rather than the local end users of their products – are responsible for reimbursing water suppliers for the costs of responding to contamination caused by their products. These cases have resulted in hundreds of millions of dollars being paid to water suppliers. This presentation examines these innovative legal theories, the landmark cases, and the legal and political responsibilities of water suppliers threatened by man-made contamination. |
| 18b | **Minnesota's Source Water Protection Grant Program**<br>Bruce Olsen, Minnesota Department of Health<br>*Bruce Olsen supervises the Source Water Protection at the Minnesota Department of Health and has been working on it Water since 1989. He has a bachelors and masters degree in geology from the University of Minnesota. Prior to joining the Minnesota Department of Health, he was staff geologist with the Minnesota Geological Survey.*<br>The Minnesota Department of Health has established a grant program to help public water suppliers implement source water protection actions. Three types of grants are used to address the specific needs of community and noncommunity public water supply systems. There is a $10,000 grant cap and over $1,000,000 has been awarded through 176 grants since the initial grant offering in April 2010. A wide variety of source water protection needs are being addressed but challenges remain to maximize the full potential of yet grant program. |

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| 18c | National/Federal Source Water Program Update<br>Roy Simon, USEPA<br>*Roy currently assists in managing the Source Water Protection and Underground Injection Control Programs as the Associate Branch Chief for the Prevention Branch with the Environmental Protection Agency. In addition, he has been in the forefront of working with urban communities to renew them as part of EPA's Urban Waters Initiative and worked on implementing the Federal stimulus package. He entered federal service as a Presidential Management Intern in 1978. Roy received a Master of Public Management degree from Carnegie-Mellon University's Heinz School of Public Policy and a received a B.S. in government studies from Penn State University.* |
| 19a | Update on the Secretary of Energy Advisory Board Shale Gas Production Subcommittee 90-Day Report<br>Renee Stone, Senior Advisor, Designated Federal Official, U.S. Department of Energy<br>*Renee Stone is a Senior Advisor to the Secretary of Energy and the Designated Federal Official for the Shale Gas Subcommittee.*<br>In March 2011, President Obama directed Energy Secretary Steven Chu to form a subcommittee of the Secretary of Energy's Advisory Board to conduct a review of shale gas production and make recommendations to improve its safety and environmental performance. A group of highly respected experts with experience in industry, environmental groups and state regulatory agencies were selected by Secretary Steven Chu to conduct the review. The Subcommittee produced a report on August 18, 2011, that contains a number of recommendations regarding public disclosure, best practices, air and water quality, research and development needs, and community land use issues. |
| 19b | Update on EPA's Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources<br>Jeanne Briskin, Leader, Hydraulic Fracturing Research Task Force, Office of Research and Development, U.S. Environmental Protection<br>*Jeanne Briskin is the leader of the Task Force on Hydraulic Fracturing Research in the Office of Science Policy, Office of Research and Development of the U.S. Environmental Protection Agency (EPA) in Washington, DC*<br>In response to public concern and a request from Congress, EPA has developed a plan to study the potential impacts of hydraulic fracturing on drinking water resources. This presentation will provide background information regarding the study plan and its development, as well as an overview of the research to be conducted. The study plan was developed with considerable stakeholder input, included peer review by EPA's Science Advisory Board. The research will be conducted under strict quality assurance guidelines. The research will include data analysis, case studies, scenario evaluations, laboratory studies, and toxicological assessments. |
| 19c | Seeking Fact-Based Shale Gas Development Environmental Regulation<br>Chip Groat, Associate Director, University of Texas at Austin Energy Institute<br>*Chip Groat is also Professor, Jackson School of Geosciences and LBJ School of Public Affairs at UT Austin. He is a former director of the USGS.*<br>This initiative is focused on, but not limited to, fracing issues and includes information gathering on environmental damage claims and analysis, and development of recommendations regarding ways to ensure that policies, regulations, and public opinions reflect actual conditions and impacts. Seismicity and air quality impacts are also being addressed. The goal is to promote policies and regulations that are grounded in scientific understanding and to achieve effective communication of fact-based assessments of environmental impacts. |
| 19d | Regulating Risks from Shale Gas Development: A New RFF Study<br>Sheila M. Olmstead, Fellow, Resources for the Future<br>*Sheila Olmstead is an environmental economist at Resources for the Future. Her research focuses primarily on water resources.*<br>Contributing Author: Alan J. Krupnick, Resources for the Future<br>A new RFF project will assess the risks associated with shale gas development and recommend economically sound policies to reduce those risks. The project has five key components: (1) A survey of experts to identify the most salient risks; (2) a public survey in several key shale gas states to understand public risk perceptions; (3) analysis of data to understand what drives the risks identified through the two surveys, and how they can be reduced; (4) an assessment of current state and federal regulation; and (5) recommendations for economically sound regulatory and non-regulatory approaches to mitigating shale gas development risks. |

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| 19e | **Update on the US EPA Guidance on the Use of Diesel Fuels**<br>Ann Codrington, US EPA<br>*Ann Codrington, US EPA, Acting Director, Drinking Water Protection Division, Office of Ground Water Drinking Water*<br>Natural gas plays a key role in our nation's clean energy future and EPA recognizes the role hydraulic fracturing plays to the success of that effort. While the Agency's primary responsibilities are to ensure the protection of human health and the environment, the Agency is firmly committed to working with industry, and our state and federal partners to ensure that EPA's efforts compliment, rather than conflict with our nation's goals for a clean energy.<br>This presentation will provide an update on the Agency's efforts to issue guidance on the use of diesel fuels in hydraulic fracturing activities. The purpose of the guidance is to clarify how existing Underground Injection Control (UIC) regulations under the authority of the Safe Drinking Water Act (SDWA) apply to permitting for underground injection fluids or propping agents containing diesel fuels used in hydraulic operations related to oil and gas production. The overriding goal of the guidance is to better ensure the protection of underground sources of drinking water and EPA is committed to working with state oil & gas programs to make UIC program implementation a success. |
| 19f | **Hydraulic Fracturing on Federal Lands: The BLM Requirements**<br>Michael Nedd, Assistant Director, Bureau of Land Management<br>*Provides leadership for developing renewable energy, fluid and solid minerals resources on public lands.*<br>Contributing Authors: Mike Nedd, Assistant Director; Steven Wells, Fluid Minerals Division Chief; Mike Worden, Petroleum Engineer<br>The BLM manages approximately 700 million acres of subsurface mineral estate in the Lower 48 states and Alaska. During the last 10 to 15 years exploration activities on BLM managed lands have focused largely on natural gas. The BLM estimates that over 90% of this activity has included hydraulic fracturing operations. The BLM will discuss its current responsibilities for ensuring energy development on public lands is done in a safe and environmentally sustainable manner. |
| 19h | **A Model Regulatory Framework**<br>Scott Kell, Professional Geologist<br>*Scott Kell is a professional geologist with thirty years of oil and gas regulatory experience with Ohio Department of Natural Resources. Scott served the GWPC Board of Directors for ten years, including two years as President.*<br>The draft "Model Regulatory Framework" (MRF) for hydraulically fractured hydrocarbon production wells was initiated as a joint project between Southwestern Energy and the Environmental Defense Fund. The MRF incorporates standards based upon "best-in-kind" state regulations and effective industry practices to provide a blueprint for state governments as they implement new regulations or update existing standards for hydraulically fractured wells. The MRF provides a working structure and proposes standards that address the substantive components of an effective regulatory scheme that can be customized by states to address state-specific geologic and resource development practices. |
| 19j | **Water Management and Sustainability Planning for Unconventional Resource Development**<br>J. Daniel Arthur, P.E., SPEC, President/Chief Engineer, ALL Consulting<br>*Mr. Arthur is a registered professional engineer with more than 25 years of professional experience. He earned is Petroleum Engineering Degree from the Missouri University of Science & Technology. He has throughout his career and continues to be heavily involved with well integrity issues throughout North America.*<br>Critical to the development of unconventional resources is water. As such, water management planning is instrumental in the successful development of these resources. Furthermore, planning and managing water on a lifecycle basis with an eye toward sustainability is crucial. This paper explores water management and sustainability planning for unconventional resource development and leverages research funded by the U.S. Department of Energy's National Energy Technology Laboratory. |
| 19k | **Shale Gas: It's Not Just in North America Anymore**<br>John A. Veil, President, Veil Environmental, LLC<br>*John Veil started a new consulting practice specializing in water issues affecting the energy industries upon his retirement from Argonne National Laboratory in January 2011.*<br>Tens of thousands of wells are being drilled each year in several large gas shale formations in the United States and Canada. Shale gas development is also beginning in other countries and will likely increase rapidly. An April 2011 report released by DOE's Energy Information Administration highlights many of the other shale gas plays in other parts of the world that have potential for economic production of natural gas. This presentation will talk about the progress of shale gas formation outside of North America. Some countries, like France, have passed legislation banning hydraulic fracturing, which in turns renders shale gas development non-economically viable. Other countries, like Poland and Australia, are moving forward with production. |

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| 19l | **Overview of Geology, Depositional Environments, Thickness, Areas of Gas Production**<br>Joe Lee, PA DEP<br>*Joe Lee is manager of the Source Water and Ground Water Protection Programs for the Pennsylvania Department of Environmental Protection and is a licensed professional geologist. Prior to working in the Safe Drinking Water Program, Mr. Lee worked for the Bureau of Mining and Reclamation evaluating impacts of coal mining on surface and ground water systems. Mr. Lee is presently serving as Past President of the Ground Water Protection Council.*<br>Conventional hydrocarbon resources have been exploited in Pennsylvania for over 150 years. But, the advancement of technology and re-assessment of the available reserves in unconventional gas plays has re-opened the basin for re-development. The unconventional gas shales being developed or being explored are Devonian and Ordovician shales. The geology of the Paleozoic basins is highly varied within the diverse geology of Pennsylvania. The geology of Pennsylvania has determined the depositional environments and structural history that directly relate to the occurrence of both the hydrocarbon deposits and available ground water in the state. Development of the shale gas has been challenged by the complex geology and the difficulties in protecting underground sources of drinking water. |
| 19m | **Introductory Description of Hydraulic Fracturing**<br>Matthew E. Mantell, P.E., Senior Environmental Engineer – Engineering Technology Group<br>*Matt is responsible for produced water management, water treatment and reclamation, environmental issues with hydraulic fracturing, and chemical disclosure initiatives.*<br>Hydraulic fracturing is the process of creating fissures, or fractures, in underground formations to allow natural gas and oil to flow. In oil and gas shale formations, water, sand and other additives are pumped under high pressure into the formation to create fractures. The newly created fractures are "propped" open by the sand, which allows the natural gas and oil to flow into the wellbore and be collected at the surface. The result is a highly sophisticated process that optimizes the network of fractures and keeps them safely contained within the boundaries of the shale formation. |
| 19n | **Water Used for Hydraulic Fracturing: Amounts, Sources, Reuse, & Disposal**<br>David Alleman, Senior Environmental Manager, ALL Consulting<br>*David is an ecologist with extensive experience in shale gas environmental issues, especially water issues related to hydraulic fracturing.*<br>Contributing Authors: J. Daniel Arthur, and Preston Wilson – ALL Consulting<br>At the core of shale gas development are two key technologies: horizontal drilling and hydraulic fracturing. Because of the large water volumes used, the rapid development of shale gas across the country has resulted in a substantial discussion of water issues related to hydraulic fracturing. This presentation will discuss the water volumes required for hydraulic fracturing and will explore the considerations and challenges involved with different water sourcing options and different ways of managing produced water, such as re-use and disposal through underground injection. |
| 19o | **Hydraulic Fracturing and Water Resources in Ohio: How to Protect the Groundwater through Proper Well Construction and Cementing Practices**<br>Tom Tomastik, Geologist, Ohio Division of Oil and Gas Resources Management<br>*Tom has been employed by the Ohio DNR, DOGRM since 1988. He is responsible for all of the Class II and III UIC wells and has conducted highly complex groundwater conflict investigations.*<br>Historically, most oil and gas wells in Ohio need to be hydraulically-fractured to make them economically viable. The first well in Ohio was successfully fractured in 1951. Tens of thousands of oil and gas wells have been fractured in Ohio since that time.<br>Ohio has conducted over 1000 alleged oil and gas groundwater investigations since 1983 and there are no cases of hydraulic fracturing causing groundwater contamination. Actual contamination cases were caused by surface spills or leakage, bad cement jobs, poor or improper well construction, casing integrity issues, or improperly plugged and abandoned wells. Most of these types of contamination have been eliminated by regulatory reforms. Actual groundwater contamination cases related to oil and gas activities have dramatically dropped in Ohio due the passage of more stringent regulations. |

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| 19p | **Ground Water Baseline Testing for New Oil and Gas Activities - Why? What's Important? How to Do?**<br>Ed Steele - Environmental Advisor - Swift Worldwide Services<br>*Ed Steele is currently an environmental consultant and his 38 year career has spanned the energy and chemical industries, consulting, and regulatory agencies. Ed's educational background is in geology, geotechnical engineering, and business administration.*<br>The Oil and Gas industry has lagged other extractive industries in understanding the importance of baseline ground water quality testing. That situation is changing being driven both by regulatory requirements and a realization that such sampling is essential for liability protection. Such landowner engagement also presents an opportunity to build relationships with the local community.<br>At present, only a few states have requirements around how far water well testing should occur from the planned well bore while the only current industry guidance around such is contained within an American Petroleum Institute publication. The planned analyses for any samples should be reflective of those indicator constituents most likely to be of concern. In especial, chloride would be the best indicator of any upward leakage of fluids from a well bore as it is highly soluble and generally reflective of deep target formation conditions.<br>It is recommended that any sampling performed be done by competent personnel and that analyses are run by accredited laboratories that provide sufficient QA/QC backup that will stand the test of scientific and legal scrutiny. The collection of such information presents an opportunity for this data to be collated within a database such as RBDMS which could provide excellent prospects for research efforts and further our understanding of ground water chemistry. |
| 19q | **Sustainable Chemistries in Oil and Gas Water Treatment**<br>Gregory J. Bradley, Associate Director, Dow Microbial Control<br>*Global Regulatory Sciences, Advocacy, and Product Sustainability Leader for Dow Microbial Control, including the Gas and Oil Market*<br>There are continuing efforts across the Gas and Oil industry for further improvements in production techniques that mitigate environmental contamination and risk. Industry stakeholders are developing new technologies and solutions that further protect the environment and assure the public that industry practices in Gas and Oil exploration and production are well managed. As increased activity occurs with unconventional practices, such as with Hydraulic Fracturing, sustainable solutions with Gas/Oil field chemicals are improving not only shale gas production, but also water care management of Frac Fluids, Produced Water and Protection of Ground Water. |
| 19r | **Disposal Options for Flow Back Water**<br>Tom Lewis, President & CEO, Lewis Environmental Services, Inc.<br>*Mr. Lewis is a graduate of Carnegie-Mellon University with a B.S. in Chemical Engineering. He is a leader in using activated carbon for nontraditional applications and has successfully treated over 500,000,000 gallons of waste water. Mr. Lewis has demonstrated expertise in processing and recycling flow back and produced water from shale gas operations.*<br>Mr. Lewis will present an overview of current flow back and produced water recovery and recycling technologies. Shale gas waste water is a matrix of organic and inorganic contaminants which makes recycling difficult. The discussion will review available treatment technologies, implementation, effectiveness and economic lessons learned from increased frac water recycling. Zero discharge options to meet Pennsylvania's 2011 discharge limits will be discussed along with an overview of recycled water quality trends observed in the Marcellus Shale play. |
| 19s | **Geochemistry of Natural Gases in Quaternary through Devonian Age Strata in the Northern Appalachian Basin: Implications for Investigations of Stray Gas Migration**<br>Fred Baldassare, Sr. Geoscientist, Echelon Applied Geoscience Consulting<br>*Fred Baldassare owns Echelon Applied Geoscience Consulting and has more than 18 years of experience investigating incidents of stray gas migration. Fred has helped to pioneer the application and advancement of isotope geochemistry to identify the origin of stray gases, and has co-authored several professional publications on the subject.*<br>Contributing Authors: Christopher D. Laughrey, Weatherford Laboratories; Mark McCaffrey, Ph.D., Weatherford Laboratories; and John A. Harper, Ph.D., Pennsylvania Geological Survey<br>The origin of natural gases in shallow aquifer systems in the northern Appalachian basin is not well defined or understood. For our study, more than 2,000 gas samples were analyzed and evaluated for molecular and isotope geochemistry to determine gas origin, mixing, and thermal maturity. Gas samples were collected throughout the stratigraphic section from Quaternary to Middle Devonian deposits in northeastern Pennsylvania.<br>Evaluation of our geochemical database reveals microbial, mixed microbial/thermogenic and thermogenic gases occur in some shallow aquifer systems that pre-date drilling activity in the Marcellus Formation, and a complex thermal history with isotope reversals ($\delta^{13}C1>\delta^{13}C2>\delta^{13}C3$) throughout the stratigraphic section. |

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| 19t | **State Oil and Gas Agency Groundwater Investigations and Their Role in Advancing Regulatory Reforms**<br>Scott Kell, Professional Geologist<br>*Scott Kell is a professional geologist with thirty years of oil and gas regulatory experience with Ohio Department of Natural Resources. Scott served the GWPC Board of Directors for ten years, including two years as President.*<br>The findings and determinations of state agency groundwater investigations have been important drivers of regulatory reform in Ohio and Texas. By identifying activities and patterns of failure resulting in groundwater contamination, Ohio and Texas have strategically enhanced regulatory standards and applied resources to reduce risk associated with state-specific compliance issues. During the past decade, the national debate on natural gas E&P has focused nearly exclusively on a single, brief, yet essential activity, hydraulic fracturing. In spite of significant E&P activity, Ohio and Texas investigation teams have not identified hydraulic fracturing as the cause of a single groundwater contamination incident during the study period. |
| 20a | **Update: Unregulated Drinking Water Initiative for Environmental Surveillance and Public Health**<br>Lorraine C. Backer, PhD, MPH, Team Lead and Senior Scientist, National Center for Environmental Health, Centers for Disease Control and Prevention<br>*Research includes assessing public health impacts from contaminants in drinking and recreational waters, including marine and freshwater harmful algal blooms. Responsible for the Harmful Algal Blooms and Clean Water for Health programs.*<br>Over 13 percent of the U.S. population relies on drinking water sources not protected by the Federal Safe Drinking Water Act, primarily private wells. Numerous studies have documented the occurrence of unsafe levels of chemicals and bacteria in private wells. In marked contrast to public water supplies, the U.S. does not have a comprehensive public health program focused on ensuring the safety of private well systems through surveillance, intervention, education, and evaluation. The Unregulated Drinking Water Initiative (UDWI) addresses this deficiency, in part, by empowering private well owners to ensure the quality and safety of the water their wells produce. During the first year, UDWI activities included funding pilot projects in seven states. The goals were to identify issues associated with identifying, describing, and accessing datasets characterizing private wells. The states inventoried 57 datasets, and provided information on a number of dataset characteristics, including ownership; purpose of data collection; geographic and temporal boundaries; data format and content; data accessibility; data fields and percent of data fields populated. Other activities of the UDWI included creating a white paper to identify public health issues associated with private drinking water wells and developing partnerships. |
| 20b | **Pilot Study to Integrate Existing Karst Flow Data for Kentucky into the National Hydrography Dataset Created by the U.S. Geological Survey**<br>David Jackson, KY Division of Water<br>*David A. Jackson is a Registered Professional Geologist in the state of Kentucky with over 20 years of experience. He is the Supervisor of the Groundwater Section in the Watershed Management Branch, Kentucky Division of Water. He holds a BS in Geology from the University of Kentucky and a MS in Geology from Eastern Kentucky University, with an emphasis in karst hydrogeology.*<br>The U.S. Geological Survey's (USGS) National Hydrography Dataset (NHD) is a map layer of surface streams in the United States for use with geographic information systems (GIS). The NHD digital product was designed to also allow incorporation of various groundwater data. The Kentucky Geological Survey (KGS) and Kentucky Division of Water (KDOW) have compiled and digitized karst flow data for more than half of the karst regions in Kentucky. These data, obtained from many investigators, have been published by KGS in the Kentucky Karst Atlas map series and are available as data files for use with GIS. The USGS and KDOW have funded a pilot study, conducted by KDOW, to integrate existing karst data into the NHD. The pilot study area, located in the southwestern Mississippian Plateau Region of Kentucky, is the West Fork Red River watershed. This area was chosen because known karst flow data have been compiled and digitized and it provides good representation of a wide array of karst features present in Kentucky. Karst flow data are being added using the NHD Geo Edit toolset, which was developed by the USGS. Karst features are classified using *Feature Types (FType)* and *Categories* as defined within the NHD. Subsurface flow routes are added using the *FType* 'Underground Conduit'. *Category* is then used to convey whether the subsurface flow route is inferred from dye tracing or based on cave surveys. |
| 20c | **The National Ground Water Monitoring Network: Six States Test the Framework Design**<br>William L. Cunningham, U.S. Geological Survey, Reston, Virginia<br>*Cunningham is the Assistant Chief of the Office of Groundwater and co-chair of the ACWI Subcommittee on Ground Water.*<br>Contributing Authors: Daryll A. Pope, U.S. Geological Survey, West Trenton, New Jersey; Robert P. Schreiber, P.E., D.WRE, CDM, Cambridge, Massachusetts; Christine Reimer, National Ground Water Association, Westerville, Ohio<br>Five volunteer pilot projects completed a one-year effort to evaluate the concepts and feasibility of a National Ground Water Monitoring Network (NGWMN) under the guidance of the Advisory Committee on Water Information (ACWI) Subcommittee on Ground Water (SOGW). Pilots included Montana, Minnesota, Texas, New Jersey, and Illinois/Indiana. Pilots evaluated the distribution of existing wells within principal/major aquifers, well measurement and/or sampling frequency, field practices, database elements, and data management procedures. A NGWMN Internet data portal is a key element to the success of a NGWMN. The overall message from the pilot reports is that a collaborative NGWMN is feasible. |

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| 20d | **Development of a National Ground Water Monitoring Network Ground Water Data Portal for Interoperable Data Exchange and Mediation between States and Across the Nation**<br>Jessica M. Lucido, IT Specialist, U.S. Geological Survey Center for Integrated Data Analytics<br>*B.S. in Mechanical Engineering from the University of Illinois, M.S. in Environmental Engineering from the University of Wisconsin - Madison*<br>Contributing Authors: Nathaniel L. Booth, U.S. Geological Survey Center for Integrated Data Analytics; I-Lin Kuo, U.S. Geological Survey Center for Integrated Data Analytics;<br>Contributing Author: William L. Cunningham, U.S. Geological Survey Office of Groundwater<br>The NGWMN Data Portal is the means by which policy makers, academics and the public are able to access groundwater data through one seamless web-based application from disparate data sources. Data systems exist at many organizational and geographic levels and differing vocabulary and data structures have prevented data sharing and reuse. The data portal facilitates the retrieval of and access to groundwater data on an as-needed basis from multiple, dispersed data repositories by leveraging open standards, allowing the data to continue to be housed and managed by the data provider while being accessible for the purposes of the monitoring network. |
| 20e | **Updating the Framework Document for the National Ground Water Monitoring Network-Incorporating Sound Science and Sensible Realities**<br>David R. Wunsch, Director of Science & Technology, National Ground Water Association<br>*David R. Wunsch is the NGWA's Director of Science & Technology and member of the ACWI Subcommittee on Ground Water.*<br>Contributing Author: Michael Wireman, Hydrogeologist, EPA Region 8<br>The Subcommittee on Ground Water (SOGW) produced a framework document for the implementation of a national ground water monitoring network in 2009. In 2010, voluntary pilot projects involving 6 states and the USGS tested the concept and feasibility of the framework recommendations, while simultaneously evaluating data gaps, and costs to fully implement the network. The pilot projects provided valuable feedback for revisions and improvements in the framework document. Examples of issues and ambiguities in the original framework document will be presented, along with the SOGW's strategy and approaches to rectify the problems for an improved network design. |
| 21a | **Partnership to Improve Source Water Quality through Habitat Restoration at Remsen, Iowa**<br>Chi Ho Sham, Ph.D., Vice President/Senior Scientist, The Cadmus Group, Inc.<br>*Chi Ho has worked on drinking water and water quality issues, including source water protection, for the past two decades.*<br>Contributing Authors: Rebecca Ohrtman, Iowa Department of Natural Resources; Dan Cook, Iowa Department of Natural Resources;<br>and Steve Pick, Remsen Municipal Utility.<br>Remsen relies on shallow alluvium wells for its water supply. These wells had shown nitrate contamination since 2005. With assistance from the Iowa Department of Natural Resources, areas of concerns were investigated using groundwater models and sampling in 2008 and 2009. A plot of land where over application of manure had been practiced was identified as a major source of nitrate. Through a partnership effort, loan and grant were used to acquire the priority land where Pheasants Forever prepared seedbed for conversion to prairie grasses. Additional groundwater samplings have shown the prairie habitat is effective in lowering the nitrate concentration. |
| 21b | **Near-Decadal Changes of Chloride, Dissolved Solids, and Nitrate Concentrations in Groundwater in the United States, 1988-2010**<br>Bruce D. Lindsey, Hydrologist, U.S. Geological Survey<br>*Bruce Lindsey is the coordinator of Groundwater Quality Trends studies for the U.S. Geological Survey, National Water-Quality Assessment (NAWQA) Program.*<br>Contributing Authors: Michael G. Rupert; U.S. Geological Survey<br>This presentation summarizes decadal changes in groundwater quality in well networks sampled across the nation from 1988 to 2010. Statistical analysis of changes in concentrations of chloride, dissolved solids, and nitrate were conducted for 56 networks and most comparisons revealed no significant changes. However, for those networks with changes, increasing concentrations outnumbered decreasing concentrations by a large margin. Concentrations of chloride, dissolved solids, and nitrate increased in 45 percent, 44 percent and 28 percent of the networks respectively. Decreases were identified in 4 percent of the networks for chloride, 2 percent for dissolved solids, and 7 percent for nitrate. |

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| 21c | **Occurrence of Phosphorus in Surface Water and Groundwater of Northwestern Mississippi**<br>Heather L. Welch, Hydrologist, US Geological Survey, Mississippi Water Science Center<br>*I've been with the USGS for 12 years and focus primarily on water-quality investigations in the MRVA aquifer and the Mississippi Embayment principal aquifer.*<br>Contributing Authors: Claire E. Rose, Physical Scientist, U.S. Geological Survey, Jackson, MS; and<br>Richard H. Coupe, Supervisory Hydrologist, U.S. Geological Survey, Jackson, MS<br>Watersheds in northwestern Mississippi, an area referred to locally as the Delta, have been identified as contributing some of the highest phosphorus yields in the Mississippi River basin; however, application of phosphorus fertilizers in the Delta is low when compared to other portions of the basin. Two studies conducted in 1998 and 2010 by the US Geological Survey indicate that the median dissolved phosphorus concentration in groundwater from the Mississippi River Valley alluvial (MRVA) aquifer is 0.54 mg/L. These elevated concentrations could be a possible source of phosphorus to streams during baseflow conditions and through irrigation return flow during the growing season. |
| 21d | **National Nutrients Initiative**<br>Jim Taft, Executive Director - Association of State Drinking Water Administrators<br>*Mr. Taft oversees the activities of the Association, which involve supporting the drinking water programs in the states, territories, and the Navajo Nation. He has a B.S. in Biology and an M.S. in Environmental Engineering.*<br>This presentation will begin with a brief overview of the national nutrients challenge. It will then involve a review of recent efforts -- at the national, state, and local levels -- to address nitrogen and phosphorus pollution; with a particular focus on impacts on sources of drinking water. These efforts include collaborative initiatives among a variety of stakeholders to assess the extent of the problem and to leverage the activities and priorities of various agencies and organizations that have an interest in addressing this challenge. |
| 21e | **USEPA Office of Ground Water and Drinking Water: Groundwater & Nutrients**<br>Roy Simon, USEPA<br>*Roy currently assists in managing the Source Water Protection and Underground Injection Control Programs as the Associate Branch Chief for the Prevention Branch with the Environmental Protection Agency. In addition, he has been in the forefront of working with urban communities to renew them as part of EPA's Urban Waters Initiative and worked on implementing the Federal stimulus package. He entered federal service as a Presidential Management Intern in 1978. Roy received a Master of Public Management degree from Carnegie-Mellon University's Heinz School of Public Policy and a received a B.S. in government studies from Penn State University.* |

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