PRELIMINARY AGENDA *(as of Sept. 16, 2011)* *SEE FULL ABSTRACTS following this agenda…*

2011 Ground Water Protection Council Annual Forum

"Meeting Competing Demands with Finite GROUNDWATER Resources"

Groundwater Availability & Sustainability	Groundwater / Energy Sustainability *including:* Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing- 27th & 28th	Groundwater Quality

Major Funding Provided by:

GROUNDWATER RESEARCH & EDUCATION FOUNDATION

U.S. DEPARTMENT OF ENERGY

GROUNDWATER PROTECTION COUNCIL

Event Registration Information *Now Open!*
Conference Rates:
Government (Full Conference)-$445, (One day)-$235
Non-Government (Full Conference)-$595, (One day)-$350
Presenter Discount (Full Conference)-$200
Student (Full Conference)-$250, (One day)-$150

Hotel Registration Information *Now Open!*
Atlanta Marriott Marquis
265 Peachtree Center Avenue, Atlanta, GA 30303
"*Ground Water Protection Council*" Room Block
Conference Room Rate: $132: Reservations: 800 266 9432
Special Conference rate - good through Sept. 12th

For more detail visit: www.gwpc.org

Acknowledgements: *2011 Event Partnering Organizations*

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~ On behalf of the Planning Committee… *THANK YOU!*

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PRELIMINARY AGENDA *SEE FULL ABSTRACTS following this agenda…*

Sunday, September 25 – Preconference Events	*Meeting Competing Demands with Finite GROUNDWATER Resources*	
Preconference Sessions		
9:00-12:30	*Marquis 104-5* — *Session Staff: Dan Yates* GWPC Board of Directors Meeting	
1:00	Conference Registration Opens	
2:00-5:30	*Marquis 103* — *Session Staff: Ben Grunewald* Class I UIC Roundtable Discussion/Training By Subsurface Technology, Inc. Session Chair: Steve King, Subsurface Technology, Inc.	*Marquis 106-7* — *Session Staff: Mike Nickolaus* Water / Energy Division Roundtable Discussion: Division Chair: Leslie Savage, Railroad Commission of Texas
2:00-3:30	Abstract 1: 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, please let us know and we will cover those items. If you do not have a specific item you want covered we also encourage you to attend. Some areas you may have an interest are presented below. Please let us know prior to the roundtable and it will be included. Contact Ben Grunewald at ben@gwpc.org. - History of Injection and Overview of UIC Program - Permitting - Petitioning	Items to include: - The Issue of Diesel in Hydraulic Fracturing Fluid: The Federal Initiative and the States Perspectives – Leslie Savage, Texas RRC - Discussion of the New York Draft Supplemental Generic Environmental Impact Statement for Hydraulic Fracturing: Don Drazan NY DEC - Abstract 2a: Methane Farming through Use of Indigenous Microbes - Roland P. DeBruyn, Luca Technologies Inc. - Abstract 2b: Policies and Technologies of the Energy-Water Nexus - TBA
3:30-4:00	Break -- *Marquis Foyer* -- Exhibit Area Open — *Session Staff: Brenda Short*	
4:00-5:30	- History of Injection and Overview of UIC Program - Siting Criteria, Geology, and Reservoir Properties - New Class I Well Construction - Well Repair and Workovers - Operating Procedures - Fluid Quality - Inspections - Mechanical Integrity Testing - Reservoir Testing NOTE: A certificate of attendance will be issued to all for professional development hours.	- Abstract 2c: 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 - Abstract 2d: North Carolina's Study of Shale Potential Shale Gas Development – Evan Kane, North Carolina DENR - Abstract 2e: Evaluation of State Surveillance and Enforcement Methods: Proposed Study – Bill Bryson, KS Geological Survey

Day-1 Monday, September 26	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
7:00	Registration & Morning Reception (food provided) -- *Marquis Foyer*-- Exhibit Area Open		*Session Staff: Brenda Short*
8:00-10:20	*Marquis A* *Day-One:* Opening General Session -- *Groundwater Sustainability* *Session Staff: Dan Yates* Moderator: Jamie Crawford, Mississippi Department of Environmental Quality and GWPC Vice- President Linda MacGregor, Chief Watershed Protection Branch at the Georgia Department of Natural Resources Jim Kennedy, Georgia State Geologist William "Brad" Carver, Environmental Attorney Greg Koch, Director of Global Water Stewardship for the Coca-Cola Company Bill Alley, Chief, Office of Groundwater for the U.S. Geological Survey - Department of Interior's WaterSMART Initiative Ann Codrington, USEPA Office of Ground Water & Drinking Water		
10:20-10:40	Break -- *Marquis Foyer* -- Exhibit Area Open		*Session Staff: Brenda Short*
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*		*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*			
10:40-12:20	*Marquis C* *Session Staff: Steve Musick* Alternative Water Resources Moderator: Nancy Marsh, USEPA Region 4	*Marquis D* *Session Staff: Mary Musick* Groundwater Quality Moderator: Audrey Eldridge, Oregon DEQ	*Marquis A* *Session Staff: Mike Nickolaus* Managing Water & Energy Efficiency: Uses of Groundwater for Energy Posters: 6d, 6e, & 6f Moderator: David Terry, Massachusetts DEP
10:40-11:00	Abstract 4a: Water Supply in Coastal Georgia—Meeting Water Demand Using Alternative Water Sources to the Upper Floridian Aquifer - John S. Clarke -U.S. Geological Survey 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
11:00-11:20	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	Groundwater and Agricultural Bioenergy Feedstock Production – Noel Gollehon, Natural Resources Conservation Service, USDA
11:20-11:40	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, U. of Texas	Abstract 5c: Delaware's Economical Approach to Assessing Statewide Groundwater Quality - John T. Barndt, P.G., Delaware Department of Natural Resources	Abstract 6b: An Integrated Water Management Strategy for Power Generation; a Central Georgia Case Study - Larry Neal, AMEC, Leonard Ledbetter, & Dean Alford, Allied Energy Services
11:40-12:00	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	Tracking Water with Risk Based Data Management System (RBDMS) - Paul Jehn, GWPC	Abstract 6c: Competition for Water Use in Utility-Scale Solar Power Systems - Jordan Macknick, Strategic Energy Analysis Center at the National Renewable Energy Laboratory (NREL)
12:00-12:20	Discussion	Discussion	Discussion
12:20-2:00	GWPC Annual Forum Luncheon (plated lunch provided) -- *Marquis B* -- *Session Staff: Dan Yates* *Your Ground Water Protection Council: Past, Present, and Future* GWPC Executive Director- Mike Paque; GWPC Immediate Past-President – Joe Lee, Pennsylvania DEP; GWPC President - Stan Belieu, Nebraska Oil & Gas *Special guest speaker* Ben Grumbles, President, Clean Water America Alliance		

Day-1 Monday, September 26	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*		*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*			
2:00-3:20	*Marquis C* *Session Staff: Steve Musick* Groundwater Management: Planning and Protection of Drinking Water Supply Poster 7e Moderator: Brandon Kernen, New Hampshire DES	*Marquis D* *Session Staff: Paul Jehn* Protecting Groundwater from Energy Impacts Moderator: Robert Vagnetti, USDOE	*Marquis A* *Session Staff: Dan Yates* The Environmental Sustainability of Nuclear Energy Posters: 9b Moderator: John Veil, Veil Environmental
2:00-2:20	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
2:20-2:40	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	The Fukushima Accident and Nuclear Safety in the United States - Chris Thornell, Southern Nuclear Operating Company
2:40-3:00	Abstract 7c: US EPA's Community-Based Water Resiliency Initiative: An Integral Part of Holistic Water Resource Planning – Karen Edwards, USEPA, Water Security Division	Water Issues Related to Coal Mining in the Appalachian Basin - Paul Ziemkiewicz, West Virginia University	Used Nuclear Fuel Management: Storage and Recycling - William Murphy, Duke Energy
3:00-3:20	Abstract 7d: An Analysis and Evaluation of Factors Influencing Capacity Development of Public Water Systems in Mississippi - Alan Barefield, Mississippi State University Extension	Discussion	Discussion
3:20-3:40	Break -- *Marquis Foyer* -- Exhibit Area Open		*Session Staff: Brenda Short*

Posters -- *Marquis Foyer* -- *Session Staff: Ben Grunewald*

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

Abstract 6e: The Nexus of Asset Management and Energy Management in Action - Heather Himmelberger -New Mexico Environmental Finance Center

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 - Department Of Irrigation and Drainage, Gorgan, Golestan, Iran

Abstract 7i: Hydroinformatics to Assess Management Regimes: Using Directed Networks and a Groundwater Decision Support System to Span Science and Policy - Suzanne A. Pierce, Center for International Energy and Environmental Policy in the Jackson School of Geosciences

Abstract 9b: 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 13d: Interpretation of Groundwater Quality Using Multivariate Statistical Technique in Gharesoo - Gorganrud Watershed, Caspian Sea Basin, Iran - Maryam Mazidi, and Mojtaba Kordestan, U. of Iran

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

Event Scholarships Available for Environmental Organizations, Students, and Local Governments -- visit www.gwpc.org "Meeting Information"

SEE FULL ABSTRACTS following this agenda…

Day-1 Monday, September 26	*Meeting Competing Demands with Finite GROUNDWATER Resources*			
Breakouts				
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*			*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*				
3:40-5:40	*Marquis C Session Staff: Steve Musick* Groundwater Management Planning and Protection of Drinking Water Supply (cont.) Moderator: Brandon Kernen, NH DES	*Marquis D Session Staff: Ben Grunewald* Carbon Capture & Storage & Groundwater Moderator: Kevin Frederick, WY DEQ	*Marquis A Session Staff: Dan Yates* Water Use and Nuclear Energy Moderator: Mike Hightower, Sandia National Laboratory	*Marquis 302-3 Staff: Mike Nickolaus* Hydraulic Fracturing Chemical Disclosure Initiatives Moderators: Gerry Baker, IOGCC & Mike Paque, GWPC
3:40-4:00	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 (AoPI) for Class VI CO_2 Injection Wells - Stephen R. Kraemer, USEPA Office of R&D, Athens	Abstract 9c: Nuclear Power Plant Water Needs and Potential Environmental Impacts: NRC Review and Analysis - Nebiyu Tiruneh, Nuclear Regulatory Commission	- Welcome, introductions, and agenda review - FracFocus: Overview of history, process and public outreach efforts: Mike Nickolaus, GWPC - Interstate Oil & Gas Compact Commission Initiative to Assemble State Regulations - Gerry Baker, IOGCC - Accommodating Chemical Disclosure Requirement Initiatives • Texas Rule • Montana Rule • Pennsylvania Initiatives • New York Initiatives • Other Initiatives - RBDMS HF Module: Paul Jehn, GWPC
4:00-4:20	Abstract 7g: Consumptive water use estimates for thermoelectric power plants in the Apalachicola-Chattahoochee-Flint basin - Jennifer C. Murphy 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	Nuclear Industry Groundwater Protection and Underground Piping and Tanks Integrity Initiatives - Kathy Yhip, Southern California Edison	
4:20-4:40	Abstract 7h: Groundwater Sustainable Yield Assessment in Prioritized Aquifers of Georgia Coastal Plain Aquifer System - James Kennedy, GA EPD; H. Harry Cheng, Lee P. Wiseman, Mark Maimone, & Katherine H. Zitsch, CDM	Water Demand for Carbon Capture – Electricity Generation - Erik Shuster, USDOE-NETL	Radiation Protection at Duke Energy Nuclear Power Plants and the SC DHEC Groundwater and Surface Water Screening Project for Radioactive Constituents Around Nuclear Power Plants - Larry Haynes, Duke Energy (inv.)	
4:40-5:00	Abstract 7i: Hydroinformatics to Assess Management Regimes: Using Directed Networks and a Groundwater Decision Support System to Span Science and Policy - Suzanne A. Pierce, & John M. Sharp - Jackson School of Geosciences	Abstract 10c: Extraction of Formation Water from CO_2 Storage Reservoirs - Ryan J. Klapperich, Energy & Environmental Research Center	Palo Verde Nuclear Generating Station Water Reclamation Facility - Robert Lotts, Arizona Public Service	
5:00-5:20	Abstract 7j: Groundwater Flooding – Unforeseen Consequences of Flood Control and Water Conservation in Dayton, Ohio - Brent E. Huntsman, Terran Corporation	Abstract 10d: The USDOE Sequestration R&D Program: MVA for Groundwater Protection - John Litynski, Office of Coal Power R&D, USDOE - NETL	Recycling Mine Pool Water for Electricity Generation: Limerick Generating Station - Tom Vogdes, System Engineer, Exelon (invited)	
5:20-5:40	Discussion	Discussion	Discussion	
5:45-7:30	Reception -- *Marquis Foyer* -- Exhibit Area Open GWPC 2011 Annual Forum Reception			*Session Staff: Brenda Short*

Day-2 Tuesday, September 27	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
7:00	Registration & Morning Reception (food provided) *Marquis Foyer*		*Session Staff: Brenda Short*
8:00-10:00	*Room: Marquis A* — *Session Staff: Dan Yates* General Session -- *Water / Agriculture Nexus: Groundwater Quality and Quantity Issues Related to Agriculture* Moderator: Marty Link, Nebraska Department of Environmental Quality - United States Department of Agriculture: Resources Conservation Assessment, Noel Gollehon, Natural Resources Conservation Service, USDA (Abstract 12a) - Agricultural and Groundwater: An Overview of Current Issues - Mike Wireman, USEPA Region 8 (Abstract 12b) - United States Geological Survey Nitrate Study: *High Nitrate in Shallow Groundwater: Status and Implications for Our Linked Surface-Water and Groundwater Resources - Neil M. Dubrovsky, USGS* (Abstract 12c) - *25 X 25 Initiatives and Water Management – Michael Bowman, 25 X 25* - The Groundwater/Energy/Food Nexus – Jay Lazarus, & Robert Hagevoort, Glorieta Geoscience Inc. (Abstract 12d)		
10:00-10:20	Break -- *Marquis Foyer* -- Exhibit Area Open		*Session Staff: Brenda Short*
Breakouts			
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*		*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*			
10:20-12:00	*Room: Marquis C* *Session Staff: Steve Musick* Groundwater & Agriculture Poster 13d Moderator: Bruce Olsen, MN Dept. of Health	*Room: Marquis 109* *Session Staff: Mike Nickolaus* Class VI UIC Implementation Session *(open to public)* Moderator: Mike Nickolaus, GWPC	*Room: Marquis A* *Session Staff: Paul Jehn* Reducing the Need of Fresh Groundwater Use for Energy Production Moderator: Dave Bolin, Alabama O&G Board
10:20-10:40	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: Abstract 14a: Update on Class VI Primacy and Implementation - Lisa M. McWhirter, USEPA OGWDW	Abstract 15a: Innovative Process to Upgrade Shale Gas Produced Water for Recycling verse Deep Well Injection. Case Study of upgrading Produced Water to Meet Recycling Criteria to Supplement Fresh Water Drilling Needs - Tom Lewis, Lewis Env. Services, Inc.
10:40-11:00	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 14b: Geologic Sequestration Data System - Joe Tiago, OGWDW, USEPA Discussion	Abstract 15b: Air versus Water Cooling in Engineered Geothermal Systems - Joanna McFarlane, Oak Ridge National Laboratory
11:00-11:20	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 - Andrea Metil and Chris Jahn, Purestream
11:20-11:40	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.
11:40-12:00	Discussion		Deep Shale Development and Water Use, Part Three: Even Liquid-Rich Shales are Relatively Water Efficient - Matthew Mantell, Chesapeake Energy Corporation
12:00-2:00	Lunch Session -- *Marquis Foyer* -- Exhibit Area Open (box Lunch Provided)		*Session Staff: Brenda Short*

Day-2 Tuesday, September 27	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
12:15-1:45	*Room: Marquis B* State Regulator / USEPA Roundtable Brownbag Lunch Session *(State and EPA regulators only, please)* *Session Staff: Dan Yates* Moderator: Andrews Tolman – ME Drinking Water Program, Kurt Hildebrandt, USEPA Region 7, Roy Simon, USEPA HQ (Abstract 16a) Discussion items… • EPA Draft Stormwater Rule • Class V Stormwater Funding and CWA §319 Funding • Clean Water Act §106 and Drinking Water SRF Funding for Groundwater Projects • Aquifer Storage and Recovery Issues • UIC Funding for Class V (What is not getting done due to lack of funding?) • National UIC Database – Update and Implementation		
Room: Marquis 304 Groundwater Theater. *We will be playing several films throughout the event related to groundwater.* *Session Staff: Ben Grunewald* Movies to include: ***Chattahoochee: From Water War to Water Vision***			
2:00-3:20	*Marquis C* *Session Staff: Mary Musick* Aquifer Management for Water Quality Poster: 17d Moderator: Cary Betz, Texas Com. on Env. Quality	*Marquis D* *Session Staff: Dan Yates* Source Water Moderator: Mike Eggert, Ohio EPA	*Marquis A* *Session Staff: Paul Jehn* Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing Moderator: Joe Lee, PA DEP, GWPC Past-President
2:00-2:20	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* Renee Stone, Senior Advisor, - US Department of Energy - Secretary of Energy Subcommittee to Examine Hydraulic Fracturing Issues Jeanne Briskin, USEPA ORD – EPA Study Status Update Charles "Chip" Groat, Energy Institute - University of Texas Hydraulic Fracturing Study Update Sheila Olmstead, Resources for the Future - Resources for the Future Hydraulic Fracturing Study
2:20-2:40	Abstract 17b: Exploring Sustainable Regional Groundwater Supply Alternatives to Manage Saltwater Intrusion in the Hilton Head Island Area - Kristina Masterson, Robert Fitzgerald, 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	
2:40-3:00	Abstract 17c: Simulated Influences of Upgradient Multi-Aquifer Wells on the Movement of Contaminants to Public-Supply Wells - Sandra M. Eberts, USGS	National/Federal Source Water Program Update – Roy Simon, USEPA HQ	
3:00-3:20	Discussion	Discussion	
3:20-3:40	Break -- *Marquis Foyer* -- Exhibit Area Open		*Session Staff: Brenda Short*

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Day-2 Tuesday, September 27	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*		*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*			
3:40-6:00	*Marquis C* *Session Staff: Mary Musick* Mining Existing Data for New Purposes Moderators: Robert Schreiber, CDM & Chris Reimer, NGWA	*Marquis D* *Session Staff: Steve Musick* Nutrients & Groundwater Moderator: Sonja Massey, Alabama DEM	*Marquis A* *Session Staff: Paul Jehn* Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing cont. Moderator: Lori Wrotenbery, OCC, O&G Division
3:40-4:00	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* *Federal* - Update on USEPA Guidance on Use of Diesel – Ann Codrington, USEPA - Hydraulic Fracturing on Federal Lands: The BLM Requirements - Michael Nedd - BLM *State* - Legislation and Rules & FracFocus.org - Leslie Savage, RRC of Texas - Environmental Defense Fund Draft Regulatory Development Guide – Scott Kell, Consulting Geologist - State Review of Oil and Natural Gas Environmental Regulations: The Hydraulic Fracturing Multi-Stakeholder Initiative – TBA *Regional/ International* - Abstract 19a: Water Management and Sustainability Planning for Unconventional Resource Development J. Daniel Arthur, ALL Consulting - International Perspectives Shale Gas: It's Not Just in North America Anymore – John Veil, Veil Environmental
4:00-4:20	Abstract 20b: - Pilot Study to Integrate Existing Karst Flow Data for Kentucky into the National Hydrography Dataset created by the U.S. Geological Survey – Robert Blair, and David Jackson, KY Div. of Water	Abstract 21c: Near-decadal changes of Chloride, Dissolved Solids, and Nitrate concentrations in Groundwater in the United States, 1988-2010 - Bruce D. Lindsey, USGS	
4:20-4:40	Abstract 20c: The National Ground Water Monitoring Network: Six States Test the Framework Design - William L. Cunningham, USGS	Abstract 21d: Occurrence of phosphorus in groundwater and surface water of northwestern Mississippi - Heather L. Welch, USGS	
4:40-5:00	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)	National Nutrients Initiative - Jim Taft, Association of State Drinking Water Administrators	
5:00-5:20	Abstract 20e: Updating the Framework Document for the National Ground Water Monitoring Network-Incorporating Sound Science and Sensible Realities: David R. Wunsch, NGWA	USEPA Office of Ground Water and Drinking Water Groundwater & Nutrients – Roy Simon, USEPA	
5:20-6:00	Discussion	Discussion	

SEE FULL ABSTRACTS following this agenda…

Day-3 Wednesday, September 28	*Meeting Competing Demands with Finite GROUNDWATER Resources*	
7:00	Registration and Morning Reception (food provided)	
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.* Movies to include: *Chattahoochee: From Water War to Water Vision*	*Session Staff: Ben Grunewald*
8:00–10:00	*Marquis C* — *Session Staff: Mary Musick* Joint Water Availability & Sustainability and Water Quality Divisions Session *Division Chairs: Audrey Eldridge, OR DEQ and Jamie Crawford, MS DEQ*	*Marquis A* — *Session Staff: Paul Jehn* Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing cont. Moderator: Don Drazan, New York Departmental of Environmental Conservation
8:00-10:00	Abstract 22a: - Welcome and Purpose—Lighting Discussion of Each Topic (10 Minutes) - EPA National Nutrient Initiative – Jim Taft, ASDWA - EPA Proposed Stormwater Rule Update – Roy Simon, USEPA - UIC Issues - Roy Simon, USEPA - EPA Watershed Technical Guidance Document - Roy Simon, USEPA - USDA - Farm Bill EQIP Program Update – Bruce M. Olsen, MN DOH - GWPC Aquifer Storage and Recovery Task Force Report- Cary Betz, TCEQ - Unregulated Drinking Water Initiative Update – Lorraine C. Backer, Centers for Disease Control and Prevention - Update: Subcommittee on Ground Water—Nation Ground Water Monitoring Network- Chris Reimer, NGWA - State Regulator/USEPA Roundtable Report- Andrews Tolman, ME DWP - GWPC Source Water Work Group Report - Mike Eggert, OH EPA - Revisions to the GWPC Report to the Nation – Dan Yates, GWPC - 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* *Eastern U.S. Shale Gas Basins* - Overview of Geology, Depositional Environments, Thickness, Areas of Gas Production - Joe Lee, PA DEP *Factors Related to Hydraulic Fracturing Implementation - Safeguarding Water Resources* - Abstract 19 Introductory Description of Hydraulic Fracturing - - Matthew Mantell, Chesapeake Energy Corporation - Abstract 19 Water Used for Hydraulic Fracturing: Amounts, Sources, Reuse, & Disposal – David Alleman, ALL Consulting - Abstract 19 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
10:00-10:30	Break -- *Marquis Foyer* -- Exhibit Area Open *Short*	*Session Staff: Brenda*

SEE FULL ABSTRACTS following this agenda…

Exhibitor Opportunity … visit www.gwpc.org "Meeting Information"

Day-3 Wednesday, September 28	*Meeting Competing Demands with Finite GROUNDWATER Resources*		
Room: Marquis 304	Groundwater Theater. *We will be playing several films throughout the event related to groundwater.*		*Session Staff: Ben Grunewald*
Movies to include: *Chattahoochee: From Water War to Water Vision*			
10:30-1:00	*Marquis 104-5* *Session Staff: Dan Yates* Source Water Protection Interregional Exchange Roundtable Moderator: Source Water Collaborative Steering Committee	*Room: Marquis D* *Session Staff: Ben Grunewald* EPA Technical Workshop: Class VI Geologic Sequestration Financial Responsibility Guidance Moderator: Joe Tiago, USEPA HQ	*Marquis A* *Session Staff: Paul Jehn* Natural Gas Development Seminar: Groundwater Protection and Hydraulic Fracturing cont. Moderator: Stan Belieu, NE O&GCC, GWPC President
10:30-1:00	Abstract 23a: 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. - Welcome Comments and "About the SW Collaborative" - Regional Collaborative (Salmon Falls / Delaware Basin) - Roundtable (All participants share 3-4 minutes each re: programs, successes, etc) - Going Forward – Collaboration on Source Water Protection Attendance for this session only is complimentary. No registration is necessary. RSVP and/or for comments or questions, please contact Dan Yates at dyates@gwpc.org or 405-516-4972	Abstract 24a: 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. 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. The workshop is designed to engage stakeholders—including states, industry, and non-governmental organizations—and it will be available via webcast. Advance registration is required. The registration link is… https://www2.gotomeeting.com/register/507402386	*Factors Related to Hydraulic Fracturing Implementation - Safeguarding Water Resources (cont.)* - Abstract 19 Ground Water Baseline Testing for New Oil and Gas Activities – Why? What's Important? How to do? - Ed Steele, Swift Worldwide Services - Development of "Greener" Alternatives - Greg Bradley, Dow Microbial Control - Abstract 19: 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. - Abstract 19: 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 - Results of the GWPC Research on Alleged Contamination Incidents from HF - Final Report: Scott Kell, Consulting Geologist

SEE FULL ABSTRACTS following this agenda…

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1a

Class I UIC Roundtable Discussion/Training

By Subsurface Technology, Inc.

Steve King, Subsurface Technology, Inc.

Abstract 1: 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, please let us know and we will cover those items. If you do not have a specific item you want covered we also encourage you to attend. Some areas you may have an interest are presented below. Please let us know prior to the roundtable and it will be included. Contact Ben Grunewald at ben@gwpc.org.

NOTE: A certificate of attendance will be issued to all for Professional Development Hours.

- History of Injection and Overview of UIC Program
- Permitting
- Petitioning
- Siting Criteria, Geology, and Reservoir Properties
- New Class I Well Construction
- Well Repair and Workovers
- Operating Procedures
- Fluid Quality
- Inspections
- Mechanical Integrity Testing
- Reservoir Testing

2a

Methane Farming through Use of Indigenous Microbes

Roland P. DeBruyn Luca Technologies Inc.

Modern society has become very interested in the production and use of clean energy. Although methane, the primary component of natural gas, is a carbon fuel, it has the lowest carbon intensity of any carbon fuels, and the best combustion characteristics.

In nature, underground anaerobic microbes break down complex carbon molecules in geologic deposits, as part of the carbon and hydrogen cycles. This process occurs globally, and on a large scale. It is estimated that 20% of methane stored or produced from non-hydrate deposits is biogenic in origin. If methane in hydrates is also considered, more than 50% of non-atmospheric methane known to science was made by microbes. Numerous underground environments continue to host microbial communities capable of producing methane if activated and supported. Some of these environments are in groundwater aquifers.

Laboratory testing and field testing have confirmed that commercial rates of methane production can be established if these communities are appropriately stimulated. In addition, research has shown that the appropriate stimulants are not harmful to aquifer quality or to humans.

As commercialization of in situ methane creation gathers momentum in several jurisdictions, there is now active public discussion of the process, sometimes without benefit of data. It is appropriate to review data now in hand from several years of work in the field, and to assess the impacts of deployment of this technology on groundwater. This presentation will present geochemical and gas production data from several hundred field tests. The stimulants used by one company in this field, Luca Technologies Inc., will be presented.

Biography

Roland P. DeBruyn is Vice President, Engineering of Luca Technologies Inc. in Golden, Colorado. He has been with Luca since its founding in 2003. His work focuses on transitioning technology from Luca's lab research to the field; on project design and management; and on technical support of regulatory compliance. He holds a Bachelor of Science degree in chemical engineering from the University of Calgary, and an MBA from the University of Phoenix. He has co-authored a number of technical papers in the fields of coalbed methane engineering and methane biogenesis; is co-inventor on several domestic and international patents; and has addressed meetings of the American Association of Petroleum Geologists and the Wyoming Geological Association. He is registered as a professional engineer in Alberta, Canada.

2b

Policies and Technologies of the Energy-Water Nexus

Carey King, PhD
Research Associate
Center for International Energy and Environmental Policy, The University of Texas at Austin
Kelly Twomey
Graduate Research Assistant
Department of Mechanical Engineering, The University of Texas at Austin
Ashlynn Stillwell
Graduate Research Assistant
Department of Civil, Architectural, and Environmental Engineering, The University of Texas at Austin
Mary Clayton
Undergraduate Research Assistant
Department of Mechanical Engineering, The University of Texas at Austin
Michael E. Webber
Assistant Professor
Department of Mechanical Engineering, The University of Texas at Austin

Dr. Carey King researches energy systems, how they work together, and how they impact the environment. Much of his recent work has focused on the nexus between energy and water for projecting water demand for electricity generation and alternative automobile fuels. He is actively engaged in the economics of carbon capture and sequestration integrated with enhanced oil recovery, the integration of renewable energy and storage systems in the electric grid, the interpretation of net energy analysis for economic decision-making, and the creation of tools to help the public and policymakers understand the trade-offs among different electricity generation sources.

Kelly Twomey researches the water-energy nexus including the quantification of the impacts that the mandated increase in ethanol production will have on the energy required for water treatment in the United States. Consequently, the energy intensity for water treatment may have to increase to maintain water quality standards. She has investigated a zeroth-order top-level systems analysis of the energy impacts of ethanol with and without the additional targets set out by environmental legislation.

Ashlynn Stillwell studies the relationship between energy and water largely in the context of water and wastewater treatment. Through this research, Ashlynn quantifies and analyzes the amount of energy expended in water supply and treatment, along with the amount of water used both directly and indirectly in power generation and fuel production. She uses results of the energy water nexus analysis to provide a basis for policy recommendations and sustainable resource management.

Mary Clayton is an undergraduate at The University of Texas at Austin. She studies the ability of different cooling systems on power plants to relieve water availability and resource constraints in water basins for broader water resource management goals.

Michael Webber is the Associate Director of the Center for International Energy and Environmental Policy in the Jackson School of Geosciences, Co-Director of the Clean Energy Incubator at the Austin Technology Incubator, Fellow of the Strauss Center for International Security and Law at the LBJ School of Public Affairs, and Assistant Professor of Mechanical Engineering at the University of Texas at Austin, where he trains a new generation of energy leaders through research and education.

Abstract:
This presentation provides a qualitative description of policy objectives and the technologies and policy options that help achieve the objectives that have relevance to the energy-water nexus. Within the context and constraints of each region of the world, the best technologies and policies for each region are likely to be different. And, just as energy and water are intimately coupled, so too are policies and technologies that affect the energy-water nexus. Nations have different policy objectives related to energy, water and carbon. Some of the most relevant and universal objectives for the energy-water nexus will be discussed and used as an organizing framework. These following five policy objectives are: water security, energy security, increased water quality, carbon management, and renewable energy. Thus, while some technologies leverage policy changes, some policies encourage or need technology to be effective, and we will discuss a set of policies and technologies that tend to be coupled together in the context of meeting energy and/or water policy objectives.

2c

Haynesville Shale: Significance of Early Adaptive Water Resource Management, Regional/Industry/State Cooperation and a Driver for State Water Use Reform

Gary M. Hanson

Bio

Director of the Red River Watershed Management Institute and Resident Hydrologist Louisiana State University Shreveport. B.S. Geology, La. Tech Univ.; M.S. Geosciences, Univ. of New Hampshire; Post-graduate studies Univ. of Arkansas, Environmental Dynamics Program. Extensive industry experience (petroleum and environmental). Brought regional, state and federal stakeholders together with industry to solve water related issues. Water Resources Committee of NW LA chair and Water Energy Working Group co-chair and Member Louisiana Ground Water Management Advisory Task Force. Served as expert member of Water Research Foundation Hydraulic Fracturing Workshop and Theme Lead "Water Use and Sustainability" EPA Hydraulic Fracturing Study Water Management Workshop.

ABSTRACT

The nationwide shale gas plays are forcing communities and whole regions of the U.S. to evaluate their surface water and groundwater resources. The Haynesville Shale gas boom started in early 2008 and by the end of the year about 300 gas wells had been drilled in northwest Louisiana. At the start of the boom, water from the Carrizo-Wilcox Aquifer was the main source for hydraulic fracturing (fracing). The industry's use of potable groundwater, at the time, was thought to be an appropriate source of frac water. Complaints from local water districts, a regional water committee and local citizens initiated an evaluation of frac water sourcing. These concerns, along with statements by the state regulatory agency and the formation of a local Water Energy Working Group, led to the industry's use of significant quantities of alternative surface water and non-potable groundwater. Additional policy changes at LA DNR, including adding location and quantities of drilling/frac water used per well to the Office of Conservation's Well History Form provided a way to quantify and characterize surface and groundwater use. By 2011, over 2000 gas wells had been drilled in the Haynesville with an average 5.6 million gallons per for frac water. However, from the fall of 2009 forward, about 72% of frac water has been sourced from groundwater alternatives. Although groundwater legislation had been passed prior to the Haynesville boom, minimal surface legislation was in place. Pressure to justify ownership of surface water being used by industry led to the issuance of several opinions by the Attorney General stating that the state owns all "running water" and ultimately a water use act was passed which provided for an optional cooperative endeavor agreement so surface water could be legally procured from the state. Interim results of a locally funded water quality study of 1000 domestic wells will be reviewed.

2d

EVALUATION OF STATE SURVEILLANCE AND ENFORCEMENT METHODS

William R. Bryson
Kansas Geological Survey
Lawrence, Kansas

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. Environmental organizations and various public groups frequently express concern, often distrust, over a state's ability to provide a high quality lease inspection program. This concern has resurfaced with more intensity during the discussions of the environmental effects of hydraulic fracturing. Past GWPC Underground Injection Control UIC) Peer Reviews and those conducted by STRONGER for Exploration and Production (E&P) waste have addressed inspections as a part of a comprehensive program evaluation and recommendations have been made back to states on how to improve perceived shortcomings.

Most evaluations, however, use the permit as the primary focus for the assessing effectiveness of supporting activities, i.e. inspections, facility monitoring requirements and enforcement actions. Nothing in this proposed study intents to denigrate the importance of facility permitting procedures but to demonstrate that field surveillance of such facilities is the one essential component of oil and gas regulatory programs that ensures protection of natural resources. This study intends to characterize surveillance methods of oil and gas lease operations and the approaches used by field inspectors to afford early resolution of non-compliance events. The assessment will identify those surveillance methods, which should develop public trust and still be cost effective. It will also identify inherent "program warts" that regulatory agencies face and require evaluation in terms of their impact on environmental and water resource degradation.

4a

WATER SUPPLY IN COASTAL GEORGIA—MEETING WATER DEMAND USING ALTERNATIVE WATER SOURCES TO THE UPPER FLORIDAN AQUIFER

John S. Clarke

Concern about saltwater intrusion in the area near Hilton Head Island, South Carolina, has resulted in the Georgia Environmental Protection Division (GaEPD) imposing restrictions in several coastal area counties on permitted groundwater withdrawals from the Upper Floridan aquifer (UFA), the main source of groundwater supply in coastal Georgia. Alternatively, to meet growing demands for water in the coastal Georgia area, GaEPD has encouraged use of sources of water other than the UFA. Other potential sources of water include surface-water, such as streams and ponds, and groundwater from the surficial and Brunswick aquifer systems, and the Lower Floridan aquifer (LFA).

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 the LFA. 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.

Biography

John Clarke is Assistant Director for Hydrologic Investigations and Research at the U.S. Geological Survey Georgia Water Science Center. He has 33 years experience conducting ground-water investigations, authored or co-authored more than 50 papers on the hydrogeology of Georgia's aquifers, and twice served as president of the Georgia Ground Water Association. Most recently, he has conducted investigations at U.S. Army facilities in the coastal area to assess alternative water sources including the Lower Floridan aquifer, Brunswick-surficial aquifer system, and ponds. Mr. Clarke holds a degree in Earth Science from the State University of New York at Brockport.

4b

Brackish Groundwater in the Coastal Plain of Alabama: An Historic Resource with Implications for the Future

Marlon R. Cook

Marlon Cook is the Director of the Groundwater Assessment Program at the Geological Survey of Alabama. He earned a B.S. in Geology from the University of Alabama and a M.S. degree in Hydrogeology from the University of Alabama. He worked for 8 years as an Exploration Geophysicist in oil and gas exploration and has worked with the Geological Survey of Alabama for the past 21 years as a Hydrogeologist involved in research to protect and develop the groundwater and surface-water resources of Alabama.

Most public-water supplies in south and central Alabama are produced from ground-water sources. Coastal Plain sediments generally yield good quality fresh water from relatively shallow depths or from deep, highly confined aquifers with relatively shallow water levels. However, recent drought has caused concern for future water supplies and has revealed the need for water supply planning. Assessments are currently ongoing at the Geological Survey of Alabama (GSA) to characterize all available groundwater resources. Most of the GSA water source assessments are focused on fresh-water. However, characterization of Alabama's brackish groundwater sources is a part of the comprehensive assessment process.

Alabama has four primary areas containing brackish groundwater that exhibits unique hydrogeochemical origins including dissolution of halite from an underlying salt domes in Clarke County, sea water trapped in coastal plain sediments in Lowndes County, mixing of deep mineralized groundwater with meteoric water in highly faulted areas of west-central and central Alabama, and deep brackish water developed from long distance migration and long residence times. The salt water in Clarke County served as the major source salt for the Confederacy during the Civil War, while the brackish water in central Alabama has been used for many years in the production of catfish and is now being used to develop a growing shrimp industry. Although treatment for brackish water as public water supply sources is currently uneconomic for most uses, this water may provide viable future sources of water.

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, Ashlynn S. Stillwell, Michael E. Webber

Mary Clayton is a senior in mechanical engineering at The University of Texas at Austin. Mary is an undergraduate research assistant in The Webber Energy Group. Her research focuses on the energy-water nexus in Texas. After graduating in May, Mary intends to attend graduate school to continue her education in research.

Abstract:
As existing water supplies dwindle and population grows, cities are looking for new water sources. Desalination of brackish groundwater provides one potential water source for inland cities. However, this process is energy-intensive, and therefore potentially incongruous with goals of reducing carbon emissions. Utilization of wind-generated electricity for desalination presents opportunities to supply drinking water without direct emissions.

Wind power has grown substantially in recent U.S. history and technologies continue to improve. However, the intermittency and the diurnal and seasonal variability of continental wind farms have limited the amounts sold on the grid. Desalination using reverse osmosis is a high-value process that does not require continuous operation and therefore could utilize variable wind power. Also, clean energy and carbon policies under consideration by the U.S. Congress could help make this integration more economically feasible.

West Texas is well-suited for desalination of brackish groundwater using wind power, as both resources are abundant and co-located. Utility-scale wind resource potential is found in most of the region. Additionally, brackish groundwater is found at depths less than 150 m, making west Texas a useful geographic testbed for this work, with applicability for areas with similar climates and water supply scarcity.

Implementation of a wind-powered desalination project requires both economic and geographic feasibility. Using capital and operating cost data for wind turbines and desalination membranes, we conducted a thermoeconomic analysis to determine the tradeoffs of transmitting the wind-generated electricity to the brackish groundwater versus transporting the water to the wind. The maximum distance between the wind turbines and brackish groundwater and the maximum depth and minimum volume of an aquifer at which desalination using wind power remains economically feasible was determined based on energy requirements for desalination as a function of total dissolved solids (TDS). We modeled the availability of resources using geographic information systems (GIS) tools to illustrate areas where implementation of a wind-powered desalination project is economically feasible, including the cities of Abilene, Lubbock, and Midland. Municipal water end use was analyzed for these cities in the context of existing and alternative water supplies.

Utilization of wind-generated electricity for desalination 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. Capitol costs of desalination and energy storage, water sales, and electricity sales were used for this comparison. The efficiency, ease of operation, and economics demonstrate wind-powered desalination as a feasible alternative.

4d

Zero Discharge Water Management for Horizontal Shale Gas Well Development: results of large scale testing

Dr. Paul F. Ziemkiewicz, Director, West Virginia Water Research Institute
Jennifer Hause, Program Coordinator, West Virginia Water Research Institute

Shale gas production depends on the creation of permeability within an otherwise nearly impermeable rock formation. Two technologies have been applied to produce natural gas – directional/horizontal drilling and massive hydraulic fracturing. Fracturing uses large volumes of water to create several, long fractures in the shale formation. Sand is pumped with the water and left to prop open the fractures, thus providing multiple, permeable flow paths for the natural gas. The use of the large volumes of water often stresses local fresh water supplies, and the water flowing back from the well after fracturing is a briny mixture, creating a water disposal problem. Through an Environmental Sciences and Technology Development Funding Opportunity, the Department of Energy's National Energy Technology Laboratory (DOE/NETL) Strategic Center for Natural Gas & Oil provided funding to a team of researchers from West Virginia University (WVU) to look at methods for managing frac water withdrawals and returns from large gas wells in the Marcellus Formation. The WVU project team has undertaken to recover and convert the briny waste into a suitable, partial replacement of the fresh water that is currently used as the fracturing fluid of choice. The objective of this two-year, two-phase project is to develop and demonstrate a process for treating return frac water (RFW) from Marcellus horizontal well development that will allow an increased recycle rate while decreasing make-up water and disposal requirements.

The testing and review of various treatment technologies during Phase I of the project allowed the West Virginia University (WVU) project team to identify two options that have potential for on-site treatment and reuse of the RFW: 1) an unique multi-media filter unit to greatly reduce suspended solids, and 2) an electro-coagulation (EC) unit to pre-treat the RFW before it enters the multi-media filtration unit. Depending upon the removal levels of solids and metals required either option provided an efficient solution for on-site treatment of RFW for reuse in the gas drilling industry. Industry standards for acceptable recycle water quality standards continue to evolve with current primary needs of high-rate filtration operations achieving solids removal well below 20 microns and a reduction in sulfates and heavy metals. Along with that, Industry requires a treatment system with minimal operation and maintenance, occupies a small footprint, and can easily be taken from site to site. The solution is to design a treatment system that currently meets the need of the industry, provides a level of environmental protection and can adapt to future water quality criteria.

Upon review of the laboratory tests results and multiple discussion sessions with Industry representatives, the project team determined that the multi-media filtration system provided additional mobility, lower capital and operation costs and an extended range of throughput ability. During multiple runs of the lab-scale multi-media filtration system treating RFW samples from three producers during various stages of the production process, the unit provided a high-rate operation achieving upwards of 76% suspended solids removal eliminating suspended solids greater than 3 microns along with reductions in sulfates and concentrations of heavy metals. All samples were tested for radioactivity and found to be at or below background values. This project, now well into Phase II, design, fabrication and field deployment of a mobile treatment unit (MTU), will take the multi-media filtration system to an active field well site for verification and validation. The MTU is an 8-foot wide by 40-foot long modified ISO shipping container customized to incorporate all components of the treatment process, necessary utilities and data acquisition instrumentation to monitor and operate in the range of 60 to 120 gpm throughput. The anticipated mobilization date is June 2011. The MTU will operate for a minimum of 2 to 4 months. Results of the operation will be made available to the DOE/NETL, Industry and general public and offer final recommendations for a cost-effective option to treat RFW lessening the burden on our water resources and offering a level of environmental protection not yet implemented throughout Industry.

The successful development of a technology for treatment and reuse of RFW will advance shale gas development through improved economics and resolution of environmental impacts. Improved economics will be achieved by reducing the amount of trucking and disposal of RFW and costs associated with these activities. By reusing the RFW for subsequent fractures, the need for fresh water will be reduced. The better you treat the RFW, the higher the blend ratio with fresh water, the less dependence and strain on local water resources, and the less impact on local infrastructure and surrounding environment. Perhaps one of the more important benefits from cleaner and less disruptive drilling operations will be the "good will" exercised by stakeholders to respect and protect the environment while providing a source of fuel for the country.

5a

National Ground Water Association's ANSI Water Well Construction Standard

Kevin McCray, CAE
National Ground Water Association

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. ANSI, founded in 1918, promotes and facilitates voluntary consensus standards and conformity assessment systems, and safeguards their integrity.

Two major factors for NGWA's selection of ANSI were: (1) ANSI standards are recognized worldwide and (2) the ANSI process is inclusive. The ANSI process demands the standard setter actively seeks comment from all parties and responds to all comments. An important aspect is that ANSI approves the process, but does not approve the actual standards. NGWA approves the standards and ANSI verifies that its process has been completed.

There will be at least three significant and immediate benefits of NGWA standards: (1) certified standards further strengthen NGWA's voluntary certification program, which is also relied upon by 17 states and one county for contractor licensing purposes; (2) certified standards enhance the utilization of water well systems as a safe and reliable source of drinking water; 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.

The NGWA starting point for the standard – but not the finishing point – was the 1997 edition of the Association's *Manual of Water Well Construction Practices,* a manual first developed in 1975 by a team of water well contractors from around the nation.

NGWA is an international not-for-profit professional society and trade association representing the ground water industry. Its members include many of the world's leading public and private sector ground water scientists, engineers, water well contractors, as well as manufacturers and suppliers of ground water related products and services.

Kevin McCray, CAE, is the executive director of the 13,000 member National Ground Water Association headquartered at Westerville, Ohio. McCray has served on a number of water-related advisory groups, including the U.S. Water Resources Export Council; Water Systems Council; U.S. EPA/AWWA Comprehensive Integrated Resource Cooperative Blue Ribbon Panel; Kellogg Foundation Ground Water Education Consortium; Great Lakes Commission Ground Water Education Roundtable; and the Ground Water Remediation Technology Analysis Center Advisory Board.

5b

Effects of experimental passive artificial recharge of treated surface water on water quality in the *Equus* Beds aquifer, 2009-2010

Linda Pickett Garinger, Aaron King, and Andy Ziegler
U.S. Geological Survey, Kansas Water Science Center, Lawrence, Kansas

The south-central Kansas *Equus* Beds aquifer currently provides the City of Wichita with about 32 percent of its water supply. Declining groundwater levels and the migration of a saltwater plume toward public supply wells prompted the city to investigate using artificial recharge to replenish the 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 (RB-1), an existing recharge basin. During April 2009 through March 2010, the U.S. Geological Survey collected water levels and water-quality samples, and maintained continuous water-quality monitors to test the recharge capacity of the experimental passive recharge system, the effect of the recharge on geochemistry of the aquifer, and the fate of bacteria and viruses present in the recharge water. During April 2009 treated surface water from the Little Arkansas River was recharged through the passive recharge well. The artificial recharge rate through the passive recharge well and trench system was about 78 percent larger than that for the original basin configuration. In May 2009, tests indicated that bacterial and viral indicators were entering the aquifer through the recharge system and recharge was discontinued. The city disconnected the recharge trench from the passive recharge well, and withdrew water at RB-1 to remove the recharged water and avoid aquifer contamination. Bacterial and viral indicators were detected in some groundwater samples from RB-1 sites before and immediately after the installation of the passive recharge well and trench system. Concentrations of bacterial and viral indicators in RB-1 wells were larger during and immediately after artificial recharge. After water withdrawal in August 2009 through the end of data collection in March 2010, detections of bacterial and viral indicators in groundwater decreased to densities similar to those before installation of the passive recharge system.

5c

Delaware's Economical Approach to Assessing Statewide Groundwater Quality

John T. Barndt, P.G.

John Barndt is an environmental program manager with the Delaware Department of Natural Resources and Environmental Control, Water Supply Section. John is responsible for managing the state's ground-water protection, source water protection, and wellhead protection programs. John has worked for DNREC since 1985 in a variety of environmental protection programs including hazardous waste and leaking underground storage tank remediation. Among current areas of interest is the state-wide characterization of major aquifers, promotion long-term source water protection by state and local agencies, and integration of groundwater discharge into surface water program assessments. John serves on several state and local boards that advise on water related issues on such matters as pesticide application, development in critical water resource areas, and extractive use.

John has served in several capacities with the national Ground Water Protection Council including as a division chair and more recently as a Board member. John has also participated in several national and regional efforts including development of ground water resource assessment guidance, Ground Water Report to the Nation, and guidance on Watershed Assessment reporting for ground water.

John received a Masters of Environmental Pollution Control, Bachelor of Science in Environmental Resource Management, and Bachelor of Science in Animal Bioscience all from Penn State University. John is a registered Professional Geologist in the State of Delaware since 1995.

The Delaware Department of Natural Resources and Environmental Control (DNREC) and the Delaware Division of Public Health (DPH) have cooperated in sharing information about public water supply systems for the purpose of assessing statewide groundwater quality. The respective databases on wells, aquifers, and water-quality data arte being integrated via common fields in the databases. The DNREC, for the past two Watershed Assessment Reports (305 (b)), has been using a combination of DNREC and DPH data to assess groundwater quality both statewide and for specific aquifer types. This is a long-term effort with the number of public water systems included in this assessment increasing yearly. The 2010 cycle was much improved over the prior years with assessments for unconfined, semi-confined, and confined aquifers in the Coastal Plain Province and for karst and fractured-rock aquifers in the Piedmont Province. Water-quality parameters include the major contaminant types that are routinely tested by the DPH for Safe Drinking Water Act compliance. The integration of the information between the two databases has allowed Delaware to utilize data normally only used for SDWA compliance monitoring for statewide 305 (b) resource assessments. This represents a cost savings both in staff and monetary resources. The work in improving the various databases by using common fields – mainly the DNREC water well permit number - allows for queries to be tailored to the resource assessment needs such as only raw well tap results or systems with no treatment. This work has also benefited both the DNREC response to incidents of contamination as well as the DPH's SDWA monitoring and waiver programs

6a

The Increasing Pressure for Groundwater Sources for Natural Gas Development in the Headwaters of the Susquehanna River Basin

Brooks G. Abeln, P.G.
Brooks G. Abeln, P.G., Hydrogeologist, Project Review, Susquehanna River Basin Commission

Abstract
As the natural gas industry expands its drilling efforts in the Susquehanna River Basin, increasing pressure is being applied on the water resources of the Basin's headwaters for development of new water supplies. Initially, the gas industry primarily targeted surface water approvals from the Susquehanna River Basin Commission (SRBC). However, nearly all surface water withdrawal approvals include passby flow conditions, which render these withdrawals "interruptible" during low flow periods.

Recently, SRBC received a steady increase in the number of applications for groundwater withdrawals that have been submitted by the gas industry. This surge in groundwater withdrawal applications is due, in part, to the common misconception (or misguided expectation) that groundwater approvals are uninterruptible. According to SRBC Regulation 18 CFR §806.23, passby flow conditions can be applied to any approval of a requested withdrawal (surface water or groundwater) that may cause a significant impact to a surface water feature or a reduction in surface water flow. Aquifer testing results are not only used to help SRBC evaluate the aquifer and the production capability of a proposed supply well, they are also used to determine the extent, if any, the withdrawal will impact sensitive surface water features. During the course of the required aquifer test, if the withdrawal from the well causes a reversal of the hydraulic gradient adjacent to a stream, or if the projected drawdown (after 120 days without recharge) shows that the withdrawal will induce flow from a surface water feature, the withdrawal approval may include conditions that require minimum passby flows. When designing an aquifer test plan for review and approval by SRBC, the proposed testing procedures must incorporate monitoring of a type and frequency that is sufficient to allow evaluation of these factors. This presentation is intended to provide guidance on SRBC's aquifer testing requirements for all groundwater withdrawal applications; specifically, for projects located in headwater settings or in the vicinity of sensitive surface water features.

6b

An Integrated Water Management Strategy for Power Generation; a Central Georgia Case Study

Larry Neal[1], Leonard Ledbetter[1], Dean Alford[2]

Plant Washington is an 850 megawatt coal-fired power plant proposed for construction by Power4Georgians in Washington County, Georgia. Plant water requirements of about 13.5 MGD will be satisfied by withdrawal from the Oconee River when streamflows exceed the monthly "non-depletable flow" requirement that protects instream flows and downstream users. Whenever daily streamflow passing the intake falls short of the non-depletable flow requirement, withdrawal from the river ceases and the plant continues to operate using its on-site water storage pond for up to 12 days before converting to groundwater withdrawal. Groundwater use continues until on-site storage is refilled and river flows return to levels exceeding the non-depletable flow requirement, at which time river withdrawals resume and groundwater withdrawals cease.

Analysis of streamflow records estimates the expected frequency and duration of groundwater use. During normal streamflow years (i.e., the two-year return interval), river withdrawals and onsite storage are sufficient to the supply the plant without using groundwater. And once every five years, on average, the plant will rely on groundwater for about four months and once every twenty years for about eight months.

In addition to conjunctive use of the river and groundwater, the strategy includes onsite reuse of all process-generated wastewater. The only discharge from the plant is approximately 1.55 MGD of non-contact cooling tower blowdown going to the Oconee River after 7-to-8 cycles of reuse.

Because Plant Washington is physically located in the Ogeechee River basin and the river withdrawal is from the Oconee River, the withdrawal is defined as an interbasin transfer and the State of Georgia issued a permit consistent with interbasin transfer considerations pursuant to Georgia's 2008 Statewide Water Plan. To prevent any potential water quality impact in the Ogeechee River, all stormwater – even exceeding a 500-year storm event- will be collected on site and used as part of the integrated water management strategy.

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6c

Competition for water use in utility-scale solar power systems

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Macknick is an Energy and Environmental Analyst at the Strategic Energy Analysis Center at the National Renewable Energy Laboratory (NREL). Turchi is a Senior Engineer for the Concentrating Solar Power Program at NREL. Wagner is an Engineer for the Concentrating Solar Power Program at NREL. Lausten is a Senior Engineer with SRA International in the Concentrating Solar Power at the Department of Energy's Solar Energy Technologies Program.

Abstract:
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. In the six states considered in the Department of Interior's and Department of Energy's Programmatic Environmental Impact Statement, nearly 80% of freshwater withdrawn is for irrigated agriculture. Less than 1% of water withdrawal in this region is for thermoelectric power, but consumption from CSP plants may impact specific basins. Some CSP technologies and all photovoltaic systems do not use water for cooling, but still require water for collector washing and plant operations. Dry-cooling, which rejects the Rankine power cycle's heat to ambient air, can reduce water consumption by over 90% but entails a cost penalty that depends on location, plant design, and market factors. NREL and partners have analyzed water demand for utility-scale solar power plants as a function of technology and location. Currently, dry-cooling entails greater capital cost and lower operating performance. Hot summer afternoons, the peak energy demand period, coincides with the period of lowest efficiency for dry-cooling systems. Cost impacts of dry cooling are also highly dependent on time-of-delivery rates for energy. Water consumption for different plant designs and new technologies are discussed along with time-of-day performance and revenue impacts. In addition, water use of utility-scale solar plants is evaluated in context of existing land and water uses in the southwest.

6d

Estimating thermoelectric water consumption using energy budgets

Timothy H. Diehl

Tim Diehl has been a hydrologist in the Tennessee Water Science Center of the U.S. Geological Survey since 1989. His current main research areas are water use by thermoelectric power plants and its potential response to climate change, and erosion and sediment transport due to land disturbance. He's also studied woody debris in streams, the evolution of wetlands in aggrading alluvial systems, and the complex relations among floodplain vegetation, floods, channel configuration, and floodplain deposition. He received his Ph.D. in Civil Engineering, M.S. in Environmental Studies, and B.S. in Botany from the University of Wisconsin – Madison.

The need to estimate thermoelectric water consumption typically arises in watersheds subject to water shortages. In order to address problems of water consumption in droughts, heat waves, and climate change, the estimation method should incorporate realistic dependence of consumption on environmental conditions, in particular water and air temperatures. Detailed models of water consumption are typically used on a plant by plant basis, but their results are generally proprietary. Published coefficients relating evaporation to electric generation do not vary with environmental conditions. An energy budget method is a third approach that estimates the heat transfer from cooling water to the atmosphere, including heat transferred by evaporation. Such methods have been applied at the scale of large regional watersheds, but have fallen into disuse.

The application of an energy budget can be divided into two main steps. In the first, the amount of heat delivered to the cooling system is estimated from fuel consumption and electric generation data reported to EIA and from plant characteristics. In the second, the transfer of heat from the cooling water to the atmosphere is divided between evaporation and conduction and radiation. In cooling ponds and once-through cooling systems, heat loss from the surface water body to the atmosphere is dominated by conduction if the water is cool and by evaporation if it is warm. Wind increases the relative importance of evaporation. In cooling towers, evaporation dominates heat transfer, and the ratio of evaporation to total heat loss depends mostly on the wet-bulb temperature of the inlet air. The ratio of airflow to cooling water flow must be estimated, and it strongly influences the amount of evaporation. In natural-draft towers, this rate varies with atmospheric conditions.

6e

The Nexus of Asset Management and Energy Management in Action

Heather Himmelberger, P.E., Director, New Mexico Environmental Finance Center

Heather Himmelberger is a registered professional engineer with over 25 years of experience in the environmental arena. She has a BS in Environmental Engineering from Penn State University and an MS in Environmental Engineering from Johns Hopkins University. She has been the Director of the NM Environmental Finance Center since 1996. As Director, she has assisted state, local and tribal governments with the broad financial implications of providing environmental services and complying with regulations. Heather has been providing training and implementation assistance in Asset Management since 2005 and has served as an expert witness to EPA's Financial Advisory Board for the past 14 years.

Abstract:

Under funding from the Kansas Department of Public Health and the Environment, the New Mexico Environmental Finance Center was able to travel around the country filming water and wastewater utilities who have done Asset Management or Energy Efficiency programs or both. These entities were included in a manual that shows utilities how to do both an Asset Management Plan and an Energy Efficiency Program as one joint activity. The manual includes both text to explain how to do an integrated Asset Management/Energy Efficiency Program and video clips of utilities who have successfully completed these activities. The videos are informative, as well as inspirational and allow utilities to learn in a peer to peer mode. This talk would present the integrated Asset Management/Energy Efficiency Approach and show videos of utilities to share their success stories and challenges. For example, one of the filmed utilities saved $58,000 per year in electricity costs that they then used to replace or upgrade older infrastructure. Another utility cut energy use by 10%. Another utility is in a community in which they decided to undertake a carbon challenge and reduce the community's carbon footprint. One of the challenges faced was the lack of metering at all of the equipment.

6f

INTEGRATED WATER-ENERGY POLICY APPROACHES WITH OR WITHOUT A CLIMATE CHANGE EMPHASIS

Cat Shrier, Ph.D., P.G.

Cat Shrier is President of Watercat Consulting, facilitating communication and understanding of innovative approaches to water management and policy. Cat worked with environmental consulting firms since 1992, and water and environmental agencies and legislative offices on environmental issues since 1984. She organized the September 2009 "Water-Energy Sustainability Symposium" in Salt Lake City and authored the 2010 symposium report: "Water-Energy Sustainability Perspectives and Policy Approaches" for GWPC, USDOE, and the National Laboratories. Cat holds bachelor's degrees in Government (Dartmouth) and Geology (NCSU); MS in Environmental Science and Engineering from UNC-Chapel Hill; and a Ph.D. in Civil Engineering/Water Resources Planning from CSU.

Abstract: Uses of water and energy resources pervades every aspect of daily life and industry, and there are water quality and quantity impacts associated with changes in use of water and energy supplies that affect rivers, coasts, and aquifers. 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). Each "nexus point" also has climate change considerations due to changes in hydrology and carbon emissions, as well as opportunities for cost savings. 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. Consequently, there are challenges in the coordinated development and implementation of sustainable policies for water and energy resource management, and in for agencies to collaborate and leverage their limited resources.

Climate change has provided an "umbrella issue" for agency personnel to communicate and coordinate their respective activities related to water and energy. In particular, the Water Resources and Climate Change Workgroup, which reports to the Interagency Climate Change Adaptation Task Force, includes many federal agency personnel who are evaluating the role of their own individual agencies in addressing water-energy nexus issues. Outside of this workgroup, however, there remain federal agency personnel, particularly those involved with national and global energy security issues and associated climate change activities, who may still not see or acknowledge a connection between these activities and water resources issues. Recent shifts in congressional receptiveness to climate change programs may also raise questions about ways in which agencies can continue efforts towards interagency water-energy policy and program integration without the "framing" of climate change. There are also other multi-agency issues related to water and energy, with or without climate change considerations, such as the sustainability requirements under Executive Order 13514 and the economic and environmental impact considerations for federal water projects under the Principles and Guidelines, currently under revision. 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 and Reporting Programs

Paul L. Bristol, Alex P. Butler

Bio

Paul L. Bristol received his B.S. from the College of Science and Mathematics (Geology) from the 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.

Alexander Butler has a B.S. in Geology from Clemson University. He has worked with the South Carolina Department of Health and Environmental Control (DHEC) for nine years.

Abstract

Natural and human induced changes and degradation have significantly increased demands and pressures on water supplies in South Carolina. The vulnerability of this finite resource readily demonstrates the need to monitor, manage, and preserve the resource for current and future generations.

South Carolina initiated a limited groundwater management strategy with passage of the Groundwater Use Act of 1969. The original Act required groundwater withdrawers in designated Capacity Use Areas to report water use if withdrawals exceeded one hundred thousand gallons per day, one million gallons per month, and/or ten million gallons per year. Groundwater withdrawals outside of a designated Capacity Use Area remained unregulated and reporting was voluntary. As such, accurate water use data was limited to the designated use areas only (at the time five counties). In 2000, the Groundwater Use and Reporting Act was revised to require mandatory registration, permitting (in designated Capacity Use Areas), and reporting of all groundwater withdrawals exceeding three million gallons per month in the state.

Reported groundwater withdrawal information provides DHEC tools to better evaluate the demand on the groundwater resource across the State and communicate with users on managing their withdrawals. By evaluating groundwater usage trends along with other information such as precipitation/climatic events, population and industrial shifts, and potentiometric data, DHEC can assess the viability of local and regional aquifer systems.

As South Carolina moves forward in development and implementation of a comprehensive water management strategy, collection and analysis of accurate water use data will continue to be of utmost importance. The Department is committed to continuing acquisition of accurate and timely water use data to provide DHEC, sister State or federal agencies, and other interested parties the means to evaluate and promote effective *sustainable development water management* strategies in South Carolina.

7b

Groundwater Use and the Need for a State-wide Groundwater Level Monitoring Network in South Carolina

Harriet H. Gilkerson, Alexander P. Butler

Bio

Harriet H. Gilkerson has a B.S. and M.S. in Geology from the University of South Carolina and is a South Carolina Registered Professional Geologist. She has worked with the South Carolina Department of Health and Environmental Control (DHEC) for twenty years in various regulatory programs. She currently works in the Groundwater Management Section in the Bureau of Water (BOW).

Alexander P. Butler has a B.S. in Geology from Clemson University. He has worked for DHEC nine years in various regulatory programs. He currently works in the Capacity Use Program within the Groundwater Management Section of the BOW.

Abstract

Increased demand on South Carolina groundwater resources due to population growth and recent drought-induced conditions have emphasized the need for increased accuracy and data describing groundwater conditions of the South Carolina Coastal Plain region. The DHEC Water Use and Reporting Program currently requires reporting on the distribution and demand for surface water and groundwater resources across the State. To support groundwater use decisions, DHEC initiated the development of a groundwater-level monitoring network in the Coastal Plain of South Carolina. This was done in coordination with the U.S. Geological Survey, South Carolina Water Science Center (USGS) and the South Carolina Department of Natural Resources (DNR), both of which have existing groundwater level monitoring networks in the Coastal Plain of South Carolina.

DHEC has targeted monitoring within gaps identified in the existing USGS and DNR networks. DHEC's network includes monitoring locations screened within the major drinking water aquifers (Tertiary Sand, Floridan, Black Creek and Middendorf aquifers) in the Coastal Plain. Forty-one (41) dedicated automatic data recording devices (ADRs) have been deployed by DHEC to date, bringing the overall number of groundwater-level monitoring locations managed by the three agencies to ninety-one (91) within the South Carolina Coastal Plain. The long-term goal of the three agencies' cooperative effort is to develop and maintain a state-wide groundwater quantity monitoring network that provides scientifically defensible information for use in planning, managing and developing the South Carolina's groundwater resources in a responsible and sustainable manner for all current and future users. This presentation will provide an update on the status of the network and present preliminary data.

7c

US EPA's Community-Based Water Resiliency Initiative: An Integral Part of Holistic Water Resource Planning

Nushat Thomas, & Matthew Everett USEPA, Water Security Division

Nushat Thomas is an Environmental Protection Specialist at the Environmental Protection Agency's Water Security Division. She is the project lead on the Community-Based Water Resiliency Initiative and co-lead on Water/Wastewater Agency Response Networks (WARN). Prior to joining WSD, Ms. Thomas was employed with Mirant Services, LLC as an Environmental Analyst responsible for managing plant environmental compliance. She also served on Army active duty as an Environmental Science Officer at Fort Bragg, NC. She continues to serve in the military as Preventive Medicine Officer with the District of Columbia National Guard.

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, also referred to as Integrated Water Resource Management. This planning approach addresses the management of natural resources, including water, to help communities maximize social and economic welfare without compromising sustainability.

Wise management of water resources includes preparing for potential water service interruptions. Water is a vital public health and economic resource; yet critical service providers and businesses in many communities have not factored the Water Sector into emergency preparedness planning and are ill-prepared to handle potential consequences of a water service interruption. Potential threats to the availability of water include climate change impacts, e.g., droughts and flooding; and both natural and man-made disasters. Water scarcity and growing populations are also putting pressure on water supplies. According to the US Government Accountability Office 36 states could face water shortages by 2013.

CBWR strengthens communities by (1) encouraging integration of the Water Sector in preparedness planning and (2) raising awareness of interdependencies with other sectors. The CBWR electronic tool gives communities almost 350 free resources to develop and implement resiliency plans and includes a self-assessment tool that provides tailored recommendations on which tools and resources will best assist the user in water planning and preparedness.

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. Other resources in the toolbox cover such topics as: emergency water supply planning, sustainable infrastructure planning, and preparing for climate change.

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

Alan Barefield, Mississippi State University

Alan Barefield is an Extension Professor of Agricultural Economics with the Mississippi State University Extension Service. His efforts focus on the topics of economic and community development particular emphasis on regional economic analysis, infrastructure development, firm economics, strategic planning and leadership development.

Barefield directs the MSU Extension Service Public Water System Assistance Program. This effort involves the maintenance of water system board management training curricula for municipalities and water associations, coordinating the Peer Review program for capacity development, managing and evaluating several training contracts and providing support for the Mississippi WARN effort.

The Safe Drinking Water Act Amendments of 1996 (SDWA) mandated the implementation of capacity development strategies to avoid the withholding of Drinking Water State Revolving Fund monies. In particular, section 1420 defined the two capacity enhancement foci as (1) ensuring that new community and non-transient water systems demonstrate sufficient financial, managerial and technical capacity to achieve authorization and (2) developing an implementation strategy to assist currently operating water systems with acquiring and maintaining these same capacity components.

As the state's primacy agency, the Mississippi State Department of Health–Bureau of Public Water Supply (MSDH-BPWS) has developed a mandatory survey instrument that contains three sections corresponding to the enumerated capacity development mandates. MSDH-BPWS regional engineers administer this survey to all community and non-transient water systems in the state. MSDH-BPWS also utilizes a portion of Drinking Water State Revolving Fund monies to fund capacity development programs, such as the Peer Review program. The Mississippi State University Extension Service implements this program that utilizes a team of certified waterworks operators from high performing systems to make site visits to poorer performing systems and providing advice and technical assistance in improving capacity development scores.

The purpose of this paper is to assess 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. A unique methodology concerns the pairs of systems conforming to specific factors that are developed by statistical methods to allow meaningful evaluation of the assistance program.

7e

Mathematical modelling of groundwater resources system of Dehgolan plain, Iran

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ABSTRACT

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

Neven Kresic[1], Jim Kennedy[2], Leonard Ledbetter[1], Dean Alford[3]

Plant Washington is a coal-fired power plant proposed for construction in Washington County, central Georgia. An innovative approach of conjunctive use of surface water and groundwater has been proposed as part of the water supply permitting process for the plant. Surface water from the Oconee River will be the primary water supply source, whereas during drought conditions, when the river flow decreases below Georgia Environmental Protection Division (EPD)-designated levels, Plant Washington will rely on groundwater. Based on detailed hydrologic and meteorological analyses of the historic river flows and the occurrence of droughts, it is anticipated that Plant Washington will rely on groundwater, on average, once every five years for a period of four months.

A regional three-dimensional, transient groundwater flow model has been developed to evaluate impacts of the proposed groundwater withdrawals on the existing groundwater users, surface water features (streams, ponds, and wetlands), and sustainability of the groundwater resource for projected future beneficial uses including during extreme droughts. In order to minimize potential adverse impacts of the proposed 16 Plant Washington wells, their locations and design parameters including pumping rates and depths of individual well screen intervals within the aquifer were optimized with the model. By locating wells away from the river and its major tributaries, and withdrawing only from the bottom of the Cretaceous aquifer, the model predicts that Plant Washington groundwater withdrawals in the western portion of the county will not result in water losses from the Oconee River. Although the groundwater withdrawals would temporarily lower groundwater levels in the Cretaceous aquifer near the extraction wells, the transient modeling indicated that water levels would recover to baseline conditions soon after groundwater withdrawals ceased. The model predicts that the impacts on surface water bodies located near the plant may not even be measurable, as they will be protected from groundwater withdrawals by confining clay layers. Finally, the model predicts that, after 50 years of growth in the county and 50 years of operation of Plant Washington, the groundwater potentiometric surface in the Cretaceous Aquifer will remain at least 45 feet above the top of the lower confining clay layer, thus retaining the aquifer's full saturated thickness with no mining of the aquifer. Likely because of very close cooperation between major stakeholders and EPD during all phases of the groundwater model development and its subsequent use for evaluating numerous groundwater withdrawal scenarios, third parties did not challenge the permit issued by EPD.

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Jim Kennedy is the State Geologist of Georgia. He holds B.S. and M.S. degrees in physics and geophysical sciences from Georgia Tech and a Ph.D. in geology from Texas A&M, and is a registered professional geologist. His areas of expertise are groundwater hydrology and engineering geology. 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.

Leonard Ledbetter is Executive Vice President and Senior Corporate Consultant for AMEC. He earned a Bachelor of Civil Engineering and Master of Sanitary Engineering from Georgia Tech and is a registered professional engineer. Before joining AMEC in 1990, Mr. Ledbetter served for 25 years with the State of Georgia where he was Commissioner of the Department of Natural Resources and Director of Environmental Protection.

Dean Alford is President and CEO of Allied Energy Services with responsibility for major energy projects across the United States. He earned a Bachelor of Electrical Engineering from Georgia Tech and is a registered professional engineer. Prior to joining Allied, he was President and CEO of A&C Enercom, a nationwide utility consulting firm he founded in 1977.

7g

Consumptive water use estimates for thermoelectric power plants in the Apalachicola-Chattahoochee-Flint basin

Murphy, Jennifer C. and Diehl, Timothy H., USGS TN Water Science Center

Jenny Murphy is a hydrologist with the U.S. Geologic Survey at the Tennessee Water Science Center in Nashville, TN. She earned a Bachelor degree in geology from Lawrence University in Appleton, WI and a Master of Science in Earth and Environmental Sciences from Vanderbilt University in Nashville, TN.

Tim Diehl has been a hydrologist in the Tennessee Water Science Center of the U.S. Geological Survey since 1989. His current main research areas are water use by thermoelectric power plants and its potential response to climate change, and erosion and sediment transport due to land disturbance. He's also studied woody debris in streams, the evolution of wetlands in aggrading alluvial systems, and the complex relations among floodplain vegetation, floods, channel configuration, and floodplain deposition. He received his Ph.D. in Civil Engineering, M.S. in Environmental Studies, and B.S. in Botany from the University of Wisconsin – Madison.

Historically, water allocation disputes have been common in the arid west and southwest United States, but as demand for freshwater increases nationwide similar disputes have begun to occur in the humid southeast. The conflicting water demands of public water suppliers, agricultural irrigation, ecological productivity and electric power utilities in the Apalachicola-Chattahoochee-Flint basin (ACF) is a prime example of such water conflicts likely to play out in other southeastern watersheds in the future. An accurate accounting of consumptive water use by freshwater users within a basin is needed to appropriately allocate water and to prepare for periods of extended drought. Until now, estimates of consumptive water use by thermoelectric power plants have been poorly defined. By synthesizing published thermodynamic models for evaporation, energy balance models of thermoelectric water consumption for once-through cooling and cooling towers have been developed. Consumptive water use for six thermoelectric power plants (one nuclear and six coal-fired) in the ACF was estimated. The acquisition of environmental input data and assumptions pertaining to site specific power plant features are discussed. Consumption was estimated under three scenarios: (1) annual average environmental conditions for maximum electric generation versus actual generation, (2) 2007 environmental conditions, and (3) extreme weather scenarios (e.g. maximum air temperature combined with minimum streamflow on record). 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 such as water intake depth and electric generation capacity.

7h

Groundwater Sustainable Yield Assessment in Prioritized Aquifers of Georgia Coastal Plain Aquifer System

Dr. James Kennedy[1], Dr. H. Harry Cheng[2], Lee P. Wiseman[2], Dr. Mark Maimone[3] and Katherine H. Zitsch[4]

Abstract: Georgia is one of the fastest growing states in the nation, and population growth and economic prosperity in the state are tied to the state's water resources. The growth in population and economic activities in Georgia is placing increasing demands on the state's water resources. Water demands are increasing across all sectors, including public supply, industrial, energy, and agricultural uses. In Georgia, groundwater is a critical component of the state's water resources. Approximately 41 percent of population in the state uses groundwater as drinking water (Alley, *et. al*., 1999). About 87% of the groundwater use in Georgia in 2005 was provided from hydrogeologically complex Coastal Plain Aquifer System. The Georgia Environmental Protection Division prioritized the Upper Floridan, Claiborne, Clayton, and Cretaceous Coastal Plain aquifers for modeling of ranges of sustainable yield. To assist the State of Georgia in evaluating the state-wide groundwater resources, CDM developed and applied sophisticated, three-dimensional numerical groundwater models to assess the sustainable yields in the prioritized aquifers in the Georgia Coastal Plain Aquifer. Three-dimensional groundwater models provided a comprehensive level of estimates of the ranges of sustainable yield of the prioritized aquifers within Georgia. The sustainable yield estimates are being used by Georgia Regional Water Planning Councils in their water supply planning efforts.

This paper presents the development and application of three-dimensional groundwater models for the sustainable yield assessment of the prioritized aquifers in the Coastal Plain Aquifer System of Georgia. The criteria and procedures used for the aquifer sustainable yield assessment are also discussed in the paper. The modeling results of the sustainable yield assessment of the prioritized Coastal Plain aquifers are presented in the paper. Quantitative sustainable yield metrics were established for the modeling of ranges of sustainable yield. For instance, to maintain opportunities for surface water use, simulations of the ranges of sustainable yield were constrained by a metric that limited the reduction of groundwater discharge to surface waters to a percentage of groundwater contributions to stream baseflow. The modeling results indicated that increasing withdrawals from one prioritized aquifer would increase recharge from other aquifers, and the sustainable yields with simultaneous withdrawals from all of the prioritized aquifers were less than the total of the sustainable yields with individual aquifer withdrawals. The modeling results also demonstrated that the quantity of water coming from different sources (aquifer storage, recharge from other aquifers, recharge from surface waters, and recharge from rainfall) to pumping wells changed over time until a new equilibrium condition was reached. Modeling of sustainable yields of the prioritized Coastal Plain aquifers indicated that except for the Upper Floridan aquifer in the Dougherty Plain of southwestern Georgia, ranges of sustainable yield will be sufficient to meet projected groundwater demands through year 2050. The largest projected groundwater demand from Georgia Coastal Plain aquifers is for agricultural use and the smallest projected demand is for energy use. The methodology and results presented in this paper demonstrate that the development and application of scientifically based groundwater modeling tools are essential to the groundwater sustainable yield assessment.

Authors Bio: **Dr. Jim Kennedy** is the State Geologist of Georgia. He 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. His areas of expertise are groundwater hydrology and engineering geology. 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.

Dr. H. Harry Cheng has over 20 years of research and consulting experience in regional water supply planning and management; groundwater flow/solute transport/optimization modeling, integrated surface water/groundwater modeling; geotechnical engineering; hydrogeology; contamination assessments and remediation; and solid waste disposal design. Dr. Cheng holds a Ph.D. in Civil Engineering from University of Waterloo, Canada, a M.S. in Civil Engineering from Southwest Jiaotong University, China, and a professional engineering license in State of Florida.

Lee P. Wiseman has over 20 years of experience applying various analytical and numerical models to simulate groundwater flow, mass transport, and water quality. His areas of expertise include hydrogeology, groundwater modeling, aquifer storage and recovery evaluation and design, water supply planning and design, and groundwater remediation. Mr. Wiseman holds a M.S. in Environmental Engineering and a B.S. in Microbiology from the University of Central Florida

Dr. Mark Maimone is a senior water resource management specialist at CDM with experience in groundwater and surface water studies, source water protection and storm water studies, water quality studies, wetlands remediation, and mathematical modeling of ground and surface water. He has a PhD. in Water Resource Planning from the University of Groningen, a M.S. in Environmental/Regional Planning and a B.S. in Civil Engineering from the University of Technology, Delft, Netherlands. Dr. Maimone has over 20 years experience in groundwater and surface water management, water quality studies, and mathematical modeling of ground and surface water. He holds professional engineering licenses in New York State and in the European Economic Community.

Katherine H. Zitsch is a Senior Project Manager in CDM's Atlanta, Georgia Office. Katherine holds a Master of Science Degree in Environmental Systems Engineering from Clemson University and a Bachelor of Science Degree in Civil Engineering from Clemson University. Since joining CDM in 1996, she has been involved in water supply planning projects throughout the Southeastern United States.

7i

Hydroinformatics to Assess Management Regimes: Using Directed Networks and a Groundwater Decision Support System to Span Science and Policy

Suzanne A. Pierce, John M. Sharp, Jr., Jenifer Wehner

Author Bios:

Suzanne A. Pierce is a Research Assistant Professor with the Center for International Energy and Environmental Policy in the Jackson School of Geosciences and Assistant Director of the Digital Media Collaboratory of The University of Texas at Austin. A trained hydrogeologist, Dr. Pierce adopts a scholar-practitioner approach to build decision support systems that link participatory modeling with simulation, optimization, and multi-stakeholder concerns. Current projects include development of hydroinformatics for sustainable aquifer yield in Central Texas and South Australia, along with a Fulbright Nexus project for an energy-water case in the Atacama Desert of Chile.

John M. Sharp, Jr. is the Dave P. Carlton Professor of Geology at The University of Texas at Austin. He received a B.S. in Geology with distinction from the University of Minnesota, an M.S. from Midwestern State University, and a PhD from the University of Illinois. Dr. Sharp is a former President of the Geological Society of America and past Chair of the U.S. Chapter of the International Association of Hydrogeologists. His research interests have broad implications for groundwater management and range from flow in fractured rocks, the hydrology of arid zones, to the effects of urbanization.

Jenifer Wehner is an informatics specialist with a graduate degree from the Energy and Earth Resources program at The University of Texas at Austin. Ms. Wehner developed directed network analyses for time series datasets from state water plans in Texas. Her work resulted in an innovative set of topical maps and time burst analyses to highlight interconnections between planning objectives and recommended actions at the state level. Bringing skill sets in technical writing, informatics, and systems dynamics modeling, Ms. Wehner focuses her research on energy and water related problems.

Abstract:

The field of Integrated Water Resource Management (IWRM) engages groups to explore collaborative decision making with the use of simulation-optimization models and decision support systems. Of particular interest is the implementation of IWRM approaches to groundwater systems. Groundwater, which makes up 98% of total available freshwater on Earth, is notably absent in formal education curricula and public communication about water resource availability. The result is a public that is unacquainted with one of society's most precious resources.

Melding informatics with collaborative modeling, poses opportunities to educate an informed citizenry with the capacity to visually explore complex scientific topics and participate in substantive dialogue. This work presents results of topical analysis using management and policy texts as compared with modeled outputs from a Groundwater Decision Support System (GWDSS).

A conceptual meta-model, or schema, has been developed to overlay policy objectives with feasible sets of groundwater response. The resultant network presents an interface with the capacity to span knowledge domains between planning contexts and scientific computation.

The topical map is used to construct a visualization that can be used to overlay simulation-optimization outputs from groundwater availability models on top of planning and policy categories. Informatics visualizations provide a socio-technical interface to catalyze science-based dialogue about managing groundwater systems.

7j

Groundwater Flooding – Unforeseen Consequences of Flood Control and Water Conservation in Dayton, Ohio

Brent E. Huntsman, CPG, Kelly C. Smith, CPG and Daniel J. Wagel

Brent Huntsman is the Chief Hydrogeologist, Kelly Smith is a Senior Hydrogeologist and Dan Wagel is a Senior Scientist at Terran Corporation, an environmental consulting and services firm in Beavercreek, Ohio.

Situated along the Great Miami River and the tributaries of the Mad River, Stillwater River and Wolf Creek, the City of Dayton has tremendous groundwater resources available through the Great Miami River buried valley aquifer system. Protected by a comprehensive network of flood control structures since the 1920s, many industries, utilities, businesses and governmental agencies have built facilities in the protected portion of the floodplain. Larger entities typically utilize the abundant groundwater supplies for potable water, non-contact cooling, manufacturing purposes and more recently heating and air conditioning.

During the mid-1970s, groundwater levels in the Great Miami River aquifer rose in elevation, primarily due to declines in commercial and industrial groundwater pumpage. A rising water table results in decreasing available aquifer storage capacity. The aquifer's ability to accommodate infiltrating surface water from flood events along the Great Miami River is diminished significantly. This in turn has led to more frequent and severe substructure flooding in some areas of Dayton.

The hydrologic and geologic factors contributing to the causes of groundwater flooding in the Dayton area will be discussed. Results of groundwater modeling to estimate those 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.

8a

Internal and External Mechanical Integrity as Part of Unconventional Gas Development

J. Daniel Arthur, P.E., SPEC (ALL Consulting) and Greg Casey, P.E. (ALL Consulting)

Abstract: Assuring the protection of fresh groundwater or potentially usable groundwater is a primary concern for every state and a core aspect of the U.S. Environmental Protection Agency's (EPA's) Underground Injection Control (UIC) Program. It is also of critical concern to every oil & gas developer. In recent years, as unconventional resource development has and continues to grow at an unprecedented rate and as public concern over development risen, the issue of mechanical integrity for the unconventional resources industry has become critical. This paper explores selected key aspects of well drilling and completion as well as testing methods that have direct applicability to well integrity for understanding and evaluating integrity for oil & gas producing wells. Example issues and discussion items will include casing and cementing, pressure testing, temperature and noise logging, isotopic analysis, and other methods and considerations. The paper will also summarize some of the issues that can complicate the process of assessing the potential impacts of producing wells to a demonstration of groundwater protection. Furthermore, insights to evaluating and framing potential and alleged problems (groundwater contamination) and reference to the work GWPC has done with regard to Mechanical Integrity training will also be presented.

8b

A model for relating environmental variation to water permit violations at thermoelectric facilities in the Taunton River watershed

Seth Sheldon and Anamarija Frankic

Bio

Seth Sheldon completed his B.S. in Earth and Ocean Sciences at Duke University in May of 2008, and he is now a Doctoral Candidate at the University of Massachusetts Boston in the Environmental, Earth, and Ocean Sciences Department.

Abstract

An original model is presented which relates the rate of National Pollutant Discharge Elimination System (NPDES) water use permit violations and reduced capacity events (i.e., “dial-back”) at once-through cooled thermoelectric power plants to electricity demand and ambient environmental conditions using historical data. 31 percent of U.S. generation capacity is composed of thermoelectric facilities that use once-through (i.e., “open-loop”) cooling. Open-loop systems have substantial water demands, which put energy facilities and downstream ecosystems at risk during extreme climate events (e.g. heat waves, droughts). During such events, power plant managers must decide to either dial back their electricity generation or violate their water permits by using too much water or by discharging it at too high a temperature. Dial back events are a human health hazard. Permit violations are costly for energy companies and detrimental for the biota of receiving waters.

Two thermoelectric facilities in Massachusetts were chosen as representative case studies. A multi-decadal database of daily field measurements of environmental variables (e.g. stream flow, air temperature, ambient water temperature), electricity demand, water withdrawal rates, and industrial wastewater discharge temperatures was compiled from state records. Preliminary results of a multiple linear regression analysis suggest that air temperature and electricity demand are the key predictors of permit violations and dial-back events, and that expected violation and dial-back rates may increase with time. The model results are used in conjunction with regional climate change estimates and future energy demand scenarios to estimate future violation and dial-back rates at each of the two facilities. A follow-up study will introduce regulatory mechanisms as feedbacks into the model, with the goal of reducing dial-back events and violations.

9a

Water Use, Electric Power, and Nuclear Energy: A Holistic Approach to Environmental Stewardship

William Skaff, Nuclear Energy Institute

Bio

William Skaff is Manager of 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*. He holds a B.A. from Rutgers University and a Ph.D. from the University of California at Berkeley.

Abstract

Large-scale usable water production and large-scale electricity generation are interdependent. To manage this interdependence responsibly, a range of issues, themselves interrelated, should be taken into account. Within the energy sector, these issues include the potential environmental impacts of thermoelectric power plant cooling systems, the environmental footprint of various energy sources, and their reliability and economics when generating electricity.

A holistic approach to environmental stewardship will require 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. Local ecosystem considerations include water quantity and quality, aquatic life, wildlife, land use (habitat), and air quality (emissions). These issues, in turn, impact the broader environmental issues of sustainable development, climate change mitigation, and drought alleviation. All clean energy sources—nuclear energy and renewables—will be required for sustainable development, that is, to ensure economic progress and environmental preservation. Clean energy sources must be deployed in an environmentally responsible manner, taking into account their environmental benefits and potential impacts, their economics, and their differing electricity generation attributes.

Among the characteristics important to this analysis: Thermoelectric power plant once-through cooling systems consume 1% of water withdrawn. Both once-through and cooling-tower systems can use reclaimed water, such as municipal waste water and mine pool water. Nuclear energy has the lowest potential life-cycle impact on wildlife, along with wind power. Nuclear energy requires on average one-third of one percent of the land required by wind power to produce the same amount of electricity. Nuclear energy and most renewables do not produce greenhouse gases during operations and, by mitigating climate change, mitigate the water constraints that climate change causes. Recent U.S. EIA data shows that nuclear energy is among the lowest cost electricity generation options.

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 ecosystem, with a site-specific assessment of potential environmental impact and cost-benefit.

Among the facts: Cooling towers consume twice as much water as once-through cooling systems and produce particulate matter and salt drift air emissions. Scientific study demonstrates that once-through cooling systems do not have an adverse impact on aquatic life populations. The implementation of EPA’s 316(b) Phase I (new plants) and Phase II (existing plants) regulations will, according to NETL, increase the electric power sector’s water consumption by 29 percent by 2030.

9b

Release of Radionuclides from Operation of Nuclear Reactors and Aquifer Water Quality Assessment

Nebiyu Tiruneh, Richard Raione, Hosung Ahn, Mark McBride, Joseph Giacinto

Authors Bio

Richard Raione is Chief of the Hydrologic Engineering Branch in the Office of New Reactors at the U.S. Nuclear Regulatory Commission. Nebiyu Tiruneh, Hosung Ahn, Mark McBride and Joseph Giacinto are hydrologists in the Hydrologic Engineering Branch.

Abstract

The U.S. Nuclear Regulatory Commission (U.S. NRC) conducts reviews of applications for new reactors to determine compliance with applicable regulatory requirements and ensure public health and safety. The review considers, among other things, postulated scenarios of accidental releases of radioactive liquid effluents into ground and surface waters. The review process relies on site characterization to determine the possible pathways for accidental releases. Site characterization is also important in understanding the migration of radionuclides from operational releases, spills and leaks. Site characterization relies heavily on the interpretation of data collected during the pre-application period. The analysis of pathways and transport of radionuclides follows a hierarchical approach that starts with the most conservative and simple scenarios, then gradually applies realistic relaxation to arrive at a plausible but conservative scenario that meets the regulatory requirements.

Monitoring data play a significant role in the overall analysis and their significance becomes even clearer when it is coupled with site-specific groundwater flow and transport models. The models benefit from routine updating based on data collected from the monitoring wells and through operational lessons learned over the years. Assessment of aquifer water quality is addressed through quantitative and qualitative analyses which are aimed at understanding the various alternate pathways, conceptual site models, and dose related regulatory requirements which are governed by effluent concentration limits at a location of potable water source selected apriori. Interactions between ground and surface waters is also addressed as appropriate to determine the appropriate mechanism for the accelerated transport or attenuation of liquid radioactive effluents.

This paper addresses 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. The regulatory requirements and industry initiatives will be discussed within the framework of the review process.

9c

Nuclear Power Generation: Water Needs and Environmental Impacts

Nebiyu Tiruneh, Richard Raione, Hosung Ahn, Mark McBride, Joseph Giacinto

Authors Bio

Richard Raione is Chief of the Hydrologic Engineering Branch in the Office of New Reactors at the U.S. Nuclear Regulatory Commission. Nebiyu Tiruneh, Hosung Ahn, Mark McBride and Joseph Giacinto are hydrologists in the Hydrologic Engineering Branch.

Abstract

The construction and operation of nuclear power plants requires a substantial amount of water. The review of applications for nuclear power plants incorporates a thorough examination of water availability, water quality and associated impacts. The investigation to determine availability of water takes into consideration reactor design specific factors and hydrometeorological parameters to ensure that the quantity of water in the hydrologic system will 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. In the event that the impacts of plant operation on the ambient water is significant, the reviewer recommends changing the proposed plant system design or operational processes to maintain acceptable water quality pursuant to applicable regulations .

The review is conducted under two major categories; safety and environmental. In both cases the hydrological, hydrogeological, and geochemical processes that govern water quantity and quality are analyzed carefully. The results are evaluated to determine compliance with applicable Codes of Federal Regulations (CFRs) and the National Environmental Policy Act (NEPA). 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) with a specific emphasis on the environmental and safety related hydrologic analyses that address the areas of water availability and quality.

10a

Modeling and Mapping the Area of Potential Impact (AoPI) for Class VI CO_2 Injection Wells

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USEPA Office of Research and Development
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Dr. Stephen Kraemer has been with the USEPA 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 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.

Abstract

The Underground Injection Control (UIC) regulatory program of the US Environmental Protection Agency (EPA) is now in place for Class VI CO_2 injection wells for the purpose of geologic sequestration (GS Rule). The goal of the program is to protect drinking water resources while moving forward with high volume CO_2 injection. Area of review (AoR) evaluations and corrective action are long-standing permit requirements of the UIC Program of the EPA. The AoR refers to the delineated region surrounding the CO_2 injection well(s) wherein the potential exists for underground sources of drinking water (USDWs) to be endangered by the leakage of CO_2 injectate and/or formation fluids. Owners or operators of injection wells are required to identify any potential fluid movement (separate-phase CO_2 or displaced brine) through fractures/faults and artificial penetrations (e.g., abandoned wellbores) within the AoR, assess the integrity of any artificial penetrations, and perform corrective action where necessary to prevent fluid movement into a USDW. The GS Rule AoR is a regulatory concept that balances science and policy. There is complex physical science, computational technology, and sophisticated and expert model building supporting the definition of a zone of potentially endangering influence and its mapping as a projected area on the land surface. We are building simpler area of potential impact (AoPI) tools based on semi-analytic solutions for regulators to evaluate the more complex area of review (AoR) based on reservoir simulators. The AoPI encompasses: (1) the maximum extent of the separate-phase CO_2 plume at stabilization; and (2) the maximum extent of the threshold pressure that would drive brackish water or brine into the USDW given the presence of an unplugged well through the primary and secondary seals and traps.

10b

Examining salinity restrictions for CO_2 sequestration: Suggestions from basin to reservoir scales.

Madalyn S. Blondes, Margo D. Corum, Peter D. Warwick, Sean T. Brennan, Matthew D. Merrill

Madalyn S. Blondes is an Operations Research Analyst at the U.S. Geological Survey for the National Geologic CO_2 Sequestration Assessment project. Her work includes developing probabilistic models for the geologic assessment results and analyzing water quality data. She obtained a B.A. in Geology from Pomona College in 2003, an M.Phil. and Ph.D. from the Yale University Department of Geology & Geophysics in 2008, and did postdoctoral research at the University of Maryland through 2010. Before coming to the USGS CO_2 team, her research focused on geo/thermochronology, lithospheric evolution, basalt geochemistry, and multivariate statistical techniques for large geochemical datasets.

The U.S. Environmental Protection Agency regulations from the Underground Injection Control Program (UIC) for Class VI wells prohibits CO_2 injection into underground sources of drinking water (USDW), defined as water with a total dissolved solids (TDS) concentration less than 10,000 mg/L. Depending on the scale of the project, from basin-wide assessments to local pilot tests, it may be necessary to take different approaches in applying these regulations. As directed by the Energy Independence Security Act of 2007, the U.S. Geological Survey (USGS) is currently conducting a national assessment of potential subsurface CO_2 storage volume in sedimentary basins. At this large scale, available water quality data indicate that some formations contain a mix of mostly saline and some fresh water. The USGS now uses a salinity factor range (0 – 1) to account for the fresh water fraction and accordingly reduce the total amount of the storage resource.

At smaller reservoir-level scales, defining whether an aquifer is “fresh” or “saline” can be problematic. If one analysis has a TDS concentration greater than 10,000 mg/L, might an entire aquifer be construed as saline? Descriptive statistics are one way to resolve this issue; for example consider the Mesaverde Formation in the Southwestern Wyoming Province, an aquifer with fresh water near the surface and saline water at depth. Whereas the mean TDS concentration of 789 analyses is “saline” (13,240 mg/L), the median concentration is “fresh” (9,482 mg/L). As an alternative to a statistical model, we can also define saline versus fresh regions spatially through a brine flow model. To determine the radial distance from a region with saline data points that could be considered saline at the time-scales relevant to long-term CO_2 storage, we model length scales of saline water flux using 1-D Darcy flow for a range of applicable reservoir properties and time-scales.

10c

Extraction of Formation Water from CO_2 Storage Reservoirs

Ryan J. Klapperich, Robert M. Cowan, Charles D. Gorecki, Guoxiang Liu, Nicholas S. Kalenze, Lisa S. Botnen

Author Bios

Ryan J. Klapperich is a Research Scientist with the Energy & Environmental Research Center (EERC) and is the task leader for the U.S. Department of Energy Regional Carbon Sequestration Partnership's Water Work Group, which is focused on issues and opportunities associated with the nexus of water and carbon capture and storage. He has a Master's of Geology from the University of North Dakota. Other EERC contributing authors are Robert M. Cowan, Ph.D., Research Engineer; Charles D. Gorecki, Senior Research Manager; Guoxiang Lu, Ph.D., Research Engineer; Nicholas S. Kalenze, Research Engineer; and Lisa S. Botnen, Research Scientist.

Abstract

The energy–water nexus is deeply intertwined, especially when considering the potential impacts of capturing, compressing, transporting, and injecting carbon dioxide (CO_2) from large point sources such as power plants. Carbon capture and storage (CCS) has the potential to greatly reduce anthropogenic CO_2 emissions to the atmosphere. However, this process also has the potential to increase water consumption at power plants by 50%–100% depending on the type of fuel. Furthermore, deep saline formations (DSFs), which represent the largest potential global resource for the geological storage of CO_2, are poorly understood. There are only a few CCS projects injecting CO_2 into DSFs, and uncertainties remain relating to the capacity and injectivity of these DSFs. Of particular concern are the potential issues related to management of formation pressure and displacement of formation brines. One potential solution to these concerns is the concept of extracting of saline waters from storage formations. This practice holds several potential benefits including improvement of reservoir storage volume, enhanced management of storage reservoir pressure, and/or the generation of new sources of water that may be treated for a variety of surface uses.

The potential rates of water extraction from DSFs with respect to CO_2 storage are also not well understood. Extraction rates will depend on site-specific factors such as geological structure, permeability and heterogeneity, and project design features (i.e., the desired CO_2 injection rate or well spacing). Currently, the Energy & Environmental Research Center is performing a project for the IEA Greenhouse Gas R&D Program and the U.S. Department of Energy focused on water extraction from CO_2 storage reservoirs. The primary goals of this project are to assess the global potential for extraction of formation waters from DSFs to increase CO_2 storage potential and to assess the potential for surface reuse of these extracted waters.

10d

The U. S. DOE Sequestration R&D Program: MVA for Groundwater Protection

John Litynski
Andrea McNemar
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Authors' Bios

Andrea McNemar is a Sequestration Division Project Manager with the Department of Energy National Energy Technology Laboratory (NETL). She received her B.S. and M.S. in Civil and Environmental Engineering from West Virginia University.
John Litynski is the NETL Sequestration Program's Technology Manager. He 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.
Larry Myer is an engineer with Leonardo Technologies, Inc. He received his B.S. in Applied Mechanics from Pennsylvania State University and his M.S. and PhD in Civil Engineering from the University of California, Berkeley.

Abstract

The DOE/NETL Carbon Sequestration Program advances safe, cost effective, permanent geologic storage of CO_2. Protection of groundwater resources is essential in achieving this objective. The DOE program is working to create tools to facilitate selection of geologic reservoirs appropriate for storage; predict, and monitor the behavior of CO_2 in the subsurface; and verify the permanence of the storage – all of which contribute to protection of groundwater. The DOE has also worked with the EPA in development of Class VI UIC and the CAA MRR Subpart RR and UU regulations specific to the injection of CO_2 for long term storage. Monitoring measurements are key in confirming that projects perform as expected —that ecosystems, local populations, and natural resources, including groundwater, are protected. Because of the diversity in geologic environments potentially applicable for geologic storage, each site will require a tailored monitoring program. The DOE/NETL research program therefore is focused on providing a portfolio of monitoring techniques, adapting and testing an already existing large technology base, and developing new and improved approaches. Validation and demonstration of monitoring approaches is a major part of geologic storage field testing carried out as part of the DOE/NETL Regional Carbon Sequestration Partnerships (RCSPs) and International Collaborations. These projects 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 on Monitoring, Verification and Accounting (MVA) for geologic storage. With completion of the RCSP Validation Phase, focused primarily on small volume injections, the RCSP Development Phase, involving large volume CO_2 injections, is now underway.

11a

Evolution of Chemical Disclosure Requirements Initiatives

Monday September 26, 2011

2:00-6:00pm

AGENDA

- Welcome, introductions, and agenda Review
- Accommodating Chemical Disclosure Requirement Initiatives
    - Texas Rule
    - Montana Rule
    - Louisiana Rule
    - Pennsylvania Initiatives
    - Wyoming Initiatives
    - Arkansas Initiatives
    - New York Initiatives
    - DOE Subcommittee Recommendations
    - Other
- FracFocus overview
- E-reference and its relationship to FracFocus
- RBDMS HF module and RBDMS water integration, the data portal concept

12a

Resources Conservation Assessment

Noel Gollehon, Senior Economist, Natural Resources Conservation Service, USDA

Noel Gollehon helps address agriculturally related water quantity and quality issues through working lands agricultural policy.

James Benson, NRCS and Daniel Mullarkey, NRCS

The Soil and Water Resources Conservation Act (RCA) provides broad natural resource strategic assessment and planning authority for the USDA. The RCA calls for—

- 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.
- A *National Conservation Program* to guide USDA assistance to landowners for conserving soil, water, and related resources on non-Federal land.

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.

To find out more about RCA and other natural resource assessment activities in the Natural Resources Conservation Service, visit the NRCS home page (http://www.nrcs.usda.gov/wps/portal/nrcs/home), click on the link for 'Technical Resources' in the left-hand box, then follow links in the 'Highlights' box on the right-hand side of the Technical Resources page to—

—Resources Conservation Act, for background information, activities, and publications related to RCA;
—National Resources Inventory, for data on land use, soil erosion, and other natural resource issues; and
—Conservation Effects Assessment Project, for information on efforts to quantify the environmental effects of conservation practices.

12b

Agricultural and Groundwater – An Overview of Current Issues

Mike Wireman, National Groundwater Expert, US EPA Region 8

Since 1950 the world's population has increased from 2.5 to 6.5 billion. To accommodate the required increase in food production, 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. Annual global withdrawals of groundwater have increased from 100-150 km^3 (81.1 – 121.6 million acre-feet) in 1950 to 950 -1000 km^3 (770.1 to 810.7 million acre-feet) in 2000. Most of this increase has been related to agricultural water demand. In the United States the use of groundwater for irrigation has increased from 23% in 1950 to 42% in 2000. Globally, irrigated area supplied partially or wholly by groundwater has increased from approximately 30 million hectares (74.1 million acres) to approximately 100 million hectares (247 million acres). Approximately 83% of the world's groundwater irrigated area is concentrated in the United States, China, India, Iran, Pakistan and Bangladesh.

Anthropogenic chemicals are widely used in agriculture to increase crop yields and. prevent crop damage by pests. Chemicals of concern in groundwater include fertilizers (primarily nitrate) and pesticides (insecticides, herbicides, fungicides, nermaticides, rodenticides, etc). In 2000 US farmers used approximately 12 million tons of nitrogen and applied more than 1.2 billion pounds of pesticides (active ingredient). There are more than 20,000 pesticide products registered for use in the US. Protecting groundwaters from contamination by agricultural chemicals has proven to be difficult. Nitrate contamination of shallow groundwater is a widespread problem in agricultural regions within the US; in fact nitrate is the most widespread groundwater contaminant in the country. Pesticides are synthetic organic chemicals and are attenuated to some degree by degradation and sorption to soil. However some commonly used pesticides are highly toxic and known carcinogens. Fertilizer use is not regulated at the state or federal level. However the US EPA, pursuant to the SDWA has established a maximum contaminant level of 10 mg/l for public drinking water supplies. A suite of best management practices (BMPs) have been developed to prevent or minimize leaching of fertilizers to the underlying water table and to streams. The effectiveness of these BMPs, with respect to the design and application / maintenance is not clear.

Globally, increased food production has resulted in significant nutritional and other socio-economic benefits to many people. Land and water productivity have increased steadily since 1950, water and irrigation management have enhanced economic growth in many developing countries and increased international trade in food products have improved national food security. However there are also significant environmental impacts associated with the increased use of water for agriculture. Withdrawals of water for agricultural use are impacting the water quality, quantity and timing of stream flows, wetlands / springs and downstream / downgradient water users. Pollution (especially nutrient and sediment loading) is increasing. Rivers are drying up and fisheries are threatened by a largely unplanned use of water for agriculture. In addition, changes in precipitation patterns resulting from climate change will, increase the value of groundwater as a strategic reserve. In addition ground water use for energy production will increase significantly if nuclear power plants come on line in the next few decades. Competition for the use of limited groundwater resources in arid parts of the country will force difficult decisions in the future regarding the "best" or "highest" use. Sustainable groundwater management will require increased attention to managing supplies through integration of water quality and water quantity programs, more sophisticated approaches to aquifer recharge and storage, water conservation, and regulation of groundwater withdrawals and use.

12c

High Nitrate in Shallow Groundwater: Status and Implications for Our Linked Surface-Water and Groundwater Resources

Neil M. Dubrovsky

Neil Dubrovsky is Chief of the Nutrients and Trace Elements National Synthesis team of the USGS's National Water-Quality Assessment (NAWQA) Program. He earned his doctorate in hydrogeology from the University of Waterloo.

A comprehensive national analysis of nutrient concentrations in groundwater by the United States Geological Survey (USGS) shows that nitrate has been accumulating in the shallowest groundwater under areas with significant nitrogen sources at the surface, and that this shallow groundwater has been progressively moving toward valued water resources. The data, collected from 1992 through 2010 by the USGS National Water-Quality Assessment (NAWQA) Program, show that nitrate contamination of groundwater used for drinking water, particularly shallow domestic wells in agricultural areas, is an increasing human-health concern. In addition, nitrate in groundwater can discharge to streams and receiving water (lakes and estuaries), where it contributes to widespread nutrient enrichment and ecological degradation.

Multiple lines of evidence indicate that nitrate concentrations have remained the same or increased in many aquifers across the Nation, a conclusion supported by quantitative models of nitrate movement in aquifers. Similarly, nitrate concentrations in most streams have remained the same or increased. In addition, recent analyses suggest that increasing nitrate concentration in some streams is due to increases in nitrate in the groundwater component of streamflow.

Because of the direct connection between surface water and groundwater, the fate of the high nitrate concentrations in shallow groundwater is a question of concern for all water resource managers. Nitrate concentrations are likely to increase in some deeper aquifers used for drinking-water supplies during the next decade, or longer, as shallow groundwater with high concentrations moves downward into the groundwater system. Similar increases are also expected for streams that receive considerable discharge of groundwater from areas with large nitrate sources and conditions conducive to nitrate transport. Because of the slow rate of groundwater flow, improvements in nutrient concentrations in surface-water and groundwater resources may lag years to decades behind improvements in nutrient management practices on the land surface.

12d

The Groundwater-Energy-Food Nexus

Jay Lazarus[1] & Robert Hagevoort, PhD[2]

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Food and energy-- security are directly related to water security. New groundwater sources for irrigation of food crops are critical for food security and to sustain agricultural communities that provide food to an expanding world population. Increased food production requires additional irrigated lands, groundwater and energy that far exceed current demands. Municipalities compete directly with energy suppliers and irrigators for water rights and wet water. Water rights and wet-water sources transferred to municipal and energy needs often originate from formerly irrigated lands, decreasing our agricultural land base. The inescapable nexus between groundwater, energy and food production must be sustainable. Corn ethanol and other biofuels have been developed for energy generation with the help of tax credits and every year since 1997, increasing percentages of US corn production are diverted to ethanol production. Increased demand for biofuels has resulted in increased competition for groundwater for food production and groundwater to grow crops for fuel. After harvest, corn ethanol uses 4 gallons of water per gallon of ethanol, reduces food available for human consumption or animal feed, and diverts water from food crops. The increased demand for corn as a fuel drives up feed prices and supermarket prices. Falling water tables and increased drought cycles have forced many farmers to drill new or deeper wells to provide irrigation water supply. Costs associated with new production wells and associated equipment can run into the hundreds of thousands of dollars. Municipalities are drilling deeper and more expensive wells to produce water from deeper aquifers that do not affect senior agricultural water rights. These deeper wells often require expensive treatment to achieve drinking water standards. Increased irrigation efficiencies, proper well design and construction and implementation of water conservation measures in both urban and agricultural settings can reduce the stresses and lessen competition for limited aquifers.

13a

CONJUNCTIVE REGIONAL MANAGEMENT TO OFFSET DECLINGING WATER SUPPLIES

Dean Pennington, Ph.d and Jeff A. Ballweber, J.D.

Dean Pennington received his B.S. in Chemistry from the University of Idaho in 1974 and his Ph.D. in Soil Science from the University of Idaho in 1980. He then spent 5 years at the University of Arizona followed by 5 years at with Mississippi State University at the Delta Branch Experiment Station in soil and water research. Dean became the first Executive Director of the Yazoo Mississippi Delta (YMD) Joint Water Management District when it was formed in 1990 to provide local approaches to water resource problems of the intensive agricultural area of Northwest Mississippi.

Jeff Ballweber received B.S. degrees in Philosophy and Political Science from Oregon State University (1987) and his J.D. from the University of Oregon School of Law in (1990). From 1993 through 2006 Jeff was with Mississippi's Water Resources Research Institute where he managed projects on integrated water resources development and management. Mr. Ballweber has published and presented widely on collaborative partnerships for integrated water resources management and development in various professional and lay forums. Jeff joined the Pickering Firm in 2007 where he works in conjunction with Pickering's established transportation, environmental, water resources, civil and facilities services.

Abstract

Northwest Mississippi's Delta is experiencing water supply problems. The main problems are; a) declining water levels in the major aquifer used for irrigation and b) poor in stream base flows to support aquatic life. Conjunctive management and development of ground and surface water can provide a sustainable regional water supply to support the region's long-term economic and environmental needs. Potential solutions may include a mix of; a) conservation; b) better storage and use of the region's 50+ inches of annual rainfall, c) the Delta's four large U.S. Army Corps of Engineers (Corps) flood control reservoirs, and d) the Mississippi River itself. Mississippi's strong basic state water laws along with excellent support from federal natural resources agency programs can be used to better develop and manage these water supplies. Institutional coordination to support conservation and conjunctive development of ground and surface water presents perhaps the greatest challenge and opportunity for water managers in the Delta and throughout Mississippi. Mississippi's robust water laws, enacted in 1985, include the fundamental concepts that all water in the State is held in trust by the State, recognizes and supports conjunctive use of ground and surface water, and created a permit system administered by the Mississippi Department of Environmental Quality (MDEQ) to manage water for beneficial use. Mississippi State laws also allow the formation of regional water management districts to provide a local perspective on water resource problems and solutions in coordination with MDEQ. Also, the Natural Resources Conservation Service, the Corps and other federal agencies have technical and financial assistance programs to support and leverage regional efforts to better manage water. This presentation discusses how private, local, state and federal institutions can use research, regulation, projects, financial incentives, and education in a coordinated, proactive fashion to address regional water resource problems.

13b

Keeping it on the Farm: Potential Water Quality and Quantity Benefits of On-Farm Storage Reservoirs

Mary Love Tagert, Joel Paz, Jonathan Pote, and Charles Wax

Author Bios:

Mary Love Tagert, Ph.D. Assistant Research Professor, Mississippi Water Resources Research Institute, Mississippi State University,

Joel Paz, Ph.D., Assistant Professor, Department of Agricultural and Biological Engineering, Mississippi State University

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Charles Wax, Ph.D., Professor, Department of Geosciences, Mississippi State University

Abstract:

The Mississippi River Basin contains over 60% of the United States' harvested cropland, and the Mississippi and Atchafalaya Rivers contribute more than three-fourths of the total nutrient load to the Gulf. Since the 1970's, groundwater levels in the Mississippi Alluvial Aquifer have decreased at a rate of approximately 100,000 acre-feet per year due to increased irrigated acres. There are roughly 13,000 permitted irrigation wells dependent on water from the Mississippi Alluvial Aquifer. Adequate supply of good quality water is important to sustaining agriculture, the primary industry in the economically depressed Mississippi Delta. Due to concerns over groundwater declines and increasing fuel costs to run irrigation pumps, farmers have begun implementing irrigation conservation measures, such as creating on site storage areas to capture irrigation and surface water runoff from the field for later use. However, while decreases in groundwater levels have been of particular concern to agricultural producers withdrawing from the Mississippi Alluvial Aquifer in recent years, there has also been a push by federal agencies to reduce the Gulf of Mexico hypoxic zone. The Mississippi River/Gulf of Mexico Nutrient Management Task Force, formed in 1997, set a goal to reduce the size of the Gulf hypoxic zone to less than 5,000 km^2 by the year 2015. In 2010, the Natural Resources Conservation Service launched the Mississippi River Basin Healthy Watersheds Initiative to support the implementation of conservation practices to reduce nutrient loading in the Basin and improve water quality in the Basin and Gulf of Mexico. This abstract presents the basis for a proposal 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 in watersheds throughout the lower Mississippi River Basin.

13c

A Farm Storage Reservoir Optimization Model for the Mississippi Delta

Jonathan Pote, Charles Wax, Robert Thornton, Chad Swindoll, Jason Sydejko

Authors Bios:

Jonathan W. Pote, PhD. Professor and Interim Department Head, Department of Agricultural and Biological Engineering, Mississippi State University

Charles L. Wax, PhD., Mississippi State Climatologist, Professor, Department of GeoSciences, Mississippi State University

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Chad Swindoll, Under Graduate Student, Department of GeoSciences, Mississippi State University

Jason Sydejko, Under Graduate Student, Department of GeoSciences, Mississippi State University

Abstract:

This research developed a model for optimizing the size of on-site water retention structures (ditches) to capture rainfall to use in place of groundwater for irrigation in agricultural fields in the Mississippi Delta region. The climatological driver for the model is precipitation minus evaporation, which is then adjusted by a crop coefficient to produce an irrigation demand value based on the age of the crop. The model uses long-term weather records (50 years of daily data) to estimate daily values of these climatological inputs, which are then summed to weeks through the year. Total field irrigation demand, ditch demand, ditch volume, overflow, and ground water used are outputs of the model, calculated according to specified field size and ditch volume. The percentage of required irrigation demand that is met by rain stored in the ditch is calculated weekly for the entire growing season.

Field acreage, runoff coefficient, ditch acreage, and ditch depth are interactive inputs in the model. Groundwater use, surface water use, total field irrigation demand, and overflow from the storage structure recalculate as inputs are changed. Optimization is achieved when groundwater use is minimized, annual overflow is minimized, and the smallest possible amount of the field is used for the ditch. A graphical results sheet allows the user to instantly view the results of changing the inputs.

In previous work, these researchers correlated annual groundwater use and recharge to similar records to predict the impact of crop type and irrigation system selected on aquifer volume. 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

Interpretation of Groundwater Quality Using Multivariate Statistical Technique in Gharesoo - Gorganrud watershed, Caspian sea basin, Iran

Maryam Mazidi[1], Mojtaba Khoshravesh[2]

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ABSTRACT

Many activities can cause groundwater contamination. Contamination sources can be sudden releases from spills or accidents, gradual releases from long-term leaks, or industrial or agricultural practices since the 1800s. Contaminants may be from a point source or from a wider, diffuse area. A large number of point sources in an area, such as septic tanks, can combine to give an impact that is similar to a diffuse source. Groundwater samples from Gharesoo - Gorganrud watershed were analyzed for chemical parameters. Considering that people main activity in the study area is agricultural, often to enhance the efficiency of agricultural products, use of pesticides and the agricultural fertilizers are common. This is one of the causes of pollution in groundwater. According to studies the most toxic element in the groundwater zone, is arsenic magnesium and nitrate. For present study 137 water samples were collected from wells. Water quality data collected from wells are used in conjunction with multivariate statistical technique to identify key variables. The first four components were chosen for interpretation of the data, which accounts for 89% of the total variance in the data set. The maximum number of variables, i.e. Cl, Na, TH, TDS, EC and salinity were characterized by first component, while second component is characterized by Mg. The third and fourth components were characterized by Ca, HCO3 and K respectively. This shows that hydro chemical constituents of the groundwater are mainly controlled by TDS and EC. For cluster analysis single linkage method was used. The findings of the cluster analysis are presented in the form of the sampling stations (cases) as well as hydro chemical variables, which produced four major groupings, suggests that groundwater monitoring can be consolidated.

14a

Timing for Applying for Class VI Primacy and Issuing Class VI Permits

Lisa M. McWhirter

Bio

Lisa M. McWhirter, Office of Ground Water and Drinking Water, US Environmental Protection Agency
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.

Abstract

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.

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).

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.

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.

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.

14b

Geologic Sequestration Data System

Joe Tiago - US Environmental Protection Agency

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

Abstract

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.

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.

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. Case Study of upgrading Produced Water to Meet Recycling Criteria to supplement Fresh Water Drilling Needs

Tom Lewis, *President,* LEWIS ENVIRONMENTAL SERVICES, INC.

Mr. Lewis' presentation will summarize a field demonstration of its innovative shale gas waste water recycling technology. The successful trial upgraded produced water scheduled for deep well injection which was instead recycled 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

Air versus Water Cooling in Engineered Geothermal Systems

Joanna McFarlane, Lou Qualls, Adrian Sabau, Steve Wright, Hebi Yin

Authors Bio: The authors represent a collaboration between Oak Ridge National Laboratory (ORNL) and Sandia National Laboratory (Steve Wright). The project, led by Adrian Sabau (ORNL, Materials Science and Technology Division (MSTD)) includes the computational efforts of Hebi Yin (also ORNL-MSTD), power cycle experience of Lou Qualls (ORNL, Advanced Reactor Systems and Safety Division), and physical properties calculations of Joanna McFarlane (ORNL, Energy and Transportation Science Division).

Abstract: To address problems such as greenhouse gas emissions and energy security, the US is considering large investments in renewable sources such as geothermal energy. Hydrothermal systems − that have the advantages of plentiful heat, water, and permeable rock − already produce about 3 MWe and more systems are in development. However, the potential for generating electricity from geothermal resources extends well beyond the traditional sources in the Western US. The US Department of Energy is actively supporting research on enhanced and engineered systems that may overcome issues such as low-permeability rock, limited water, and the drilling of deep wells. One of the issues associated with engineered geothermal systems is siting, and beyond the concern about rock type is the performance of the power conversion system under ambient conditions. Engineered sites can be located in areas where surface water is limited or water use rights are an issue. One way of minimizing water use is to have a power cycle that can work efficiently with air cooling rather than water cooling. Oak Ridge National Laboratory is developing more efficient power cycles that take advantage of the physical properties of mixtures of refrigerants in Brayton or organic Rankine cycles. Experiments on an air-cooled test loop employing 10% isobutane in CO_2 have given a respectable 18.1% cycle efficiency versus 14.5% for pure super-critical CO_2, demonstrating a 25% increase. These experiments are complemented by thermodynamic calculations that have demonstrated the effects of sizing of components in supercritical versus transcritical cycles for mixtures of supercritical CO_2 and SF_6. In these calculations, air temperatures are varied between 10 and 40°C to account for seasonal variability.

15c

Beneficial Reuse in the Oilfield: A Study of Water Distillation Technology and Beneficial Reuse of Waste Brine

By: Andrea Metil & Chris Jahn

Bio: Chris Jahn has over 42 years of experience in produced water systems designed for the oil and gas industry. He is a U.S Patent holder of hydraulic induced gas separation equipment. His current position is as Vice President of Research and Development with Purestream technology. He graduated San Diego State University with a B.S. in Biology and Chemistry and resides in Southern California.

Abstract:

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.

15d

Environmental Costs of Managing Geological Brines Produced or Extracted During Energy Development

Christopher Harto, Argonne National Laboratory

Author Bio:

Chris is an Energy and Environmental Policy Analyst at Argonne National Laboratory. His research focuses on the environmental impacts of energy development and associated policy implications. He holds a master's degree in sustainability from Arizona State and a bachelor's degree in chemical engineering from Ohio State.

Abstract:

A number of energy development activities may result in the production or extraction of geological brines with varying concentrations of dissolved salts and minerals. The most common example is "produced water" from oil and gas production. Other examples that are less prevalent today, but may become greater in the future include water extracted from formations used for carbon sequestration and geofluids produced for geothermal energy production from geopressured systems. While in most geothermal systems the geofluid is pumped back down into the same formation it came from, in geopressured systems high pressures make reinjection infeasible.

Traditionally these produced fluids have been treated strictly as a waste product to be disposed of, but with increased concern over water resources there has been growing interest in the potential for beneficial reuse of these brines. However, many beneficial reuse applications require varying degrees of treatment, that may be costly and energy intensive. Recent life cycle assessment work at Argonne National Laboratory has begun to quantify the environmental costs (energy, greenhouse gas emissions, net water consumption) of different water management practices for produced 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.

16a

State Regulator / USEPA Roundtable Brownbag Lunch Session

Tuesday September 27, 12:30-1:50 PM

1. EPA Draft Stormwater Rule

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?

2. Class V stormwater funding and CWA §319 Funding

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?

General §319—Having problems with reporting requirements such as in-kind match demonstration, cost allocation plan for direct and indirect costs, gathering and report information to demonstrate project effectiveness, and regional differences in programs.

3. Clean Water Act §106 and Drinking Water SRF funding for groundwater projects

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 ground water assessment and protection?

4. Aquifer Storage and Recovery Issues

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 developing technical assistance on ASR projects and how to deal with the endangerment issue.

5. UIC Funding for Class V (What is not getting done due to lack of funding?)

What is the current thinking at EPA on the allocation formula? What is not being done due to a lack of funding?

6. 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

Daniel O'Rourke, P.G.[1], Mary Anne Taylor, P.E.[2] and Matthew Gamache, P.E.[3]

Biographical Sketches

Daniel O'Rourke, P.G. is a project hydrogeologist located in CDM's Edison, New Jersey office. He has been with CDM since 2002 and has worked on various water resources projects pertaining to ground water and surface water quality and supply. He has a B.S. degree in Earth and Environmental Sciences from Lehigh University, a M.S. degree in Geosciences/Hydrogeology from the State University of New York at Stony Brook and a M.S. degree in Environmental Engineering at Manhattan College. E-Mail: orourkede@cdm.com.

An Associate in Camp Dresser & McKee's Woodbury office, Mary Anne Taylor, P.E. has thirty years of experience in water resource engineering. She has directed a wide variety of water resources projects in the New York metropolitan area, including the Suffolk County groundwater modeling project and the Suffolk County Water Resources Management Plan, which included the evaluation of water supply needs in Southold. She holds a bachelor's degree in civil engineering and a master's degree in environmental engineering from Manhattan College. E-Mail: taylormb@cdm.com.

Matthew Gamache, P.E. is a water resources engineer who specializes in subsurface hydrologic, contaminant transport, and saltwater intrusion modeling. These models have been used to assess groundwater flow paths, travel times, contaminant concentrations, and saltwater movement for litigation support, delineation of drinking water protection zones, drinking water supply management plans, aquifer storage and recovery systems (ASR), tracer tests, and design of groundwater remediation systems. He has a B.S. degree in Civil Engineering from Worcester Polytechnic Institute and a M.S. degree in Environmental Water Resources Engineering from University of Michigan. E-Mail: gamachem@cdm.com.

Suffolk County, New York, overlies a sole source aquifer that provides drinking water for more than 1.5 million residents. As a result, county regulators and water purveyors have been on the forefront of groundwater management and protection for decades. However, groundwater quality has degraded over time in areas of the county where agriculture and the use of residential septic tanks are prevalent.

The town of Southold, located on the north fork of Long Island, has extensive agricultural land use and is underlain by a relatively thin freshwater aquifer that limits individual well capacity, particularly on the east end. Currently, approximately 5,000 households utilize private wells as potable supply, but due to elevated levels of nitrogen and pesticides, the demand for community supply is expanding. Similar to much of Suffolk County, water supply peaking factors exceed 4.25 during the growing season when the system pumps are at or near capacity, largely as a result of residential lawn irrigation. Using existing average water supply well capacity and water use patterns, the need for 23 additional water supply wells is projected by 2030.

A three-dimensional, dual density finite element groundwater model was utilized to evaluate water resources impacts from the additional wells, including impacts to the elevation of the underlying salt-water interface and groundwater-fed wetlands and surface waters. While projected water demand can be supplied without causing significant encroachment of the salt-water interface, surface water impacts may be excessive and groundwater would likely require treatment for nitrate and pesticides.

Alternatively, the development and implementation of an aggressive conservation program can manage the water demand more efficiently and without significant impact to water resources. Reducing the peaking factor to 3.0 will reduce the number of additional wells needed to only three, which could be relatively easily sited and would require minimal additional treatment requirements.

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17b

Exploring Sustainable Regional Groundwater Supply Alternatives to Manage Saltwater Intrusion in the Hilton Head Island Area

Kristina Masterson, Robert Fitzgerald, Dr. Mark Maimone, Dr. James Kennedy and Katherine Zitsch

As part of the Coastal Georgia Sound Science Initiative (CSSI), the Georgia Environmental Protection Division engaged CDM to develop a groundwater flow and saltwater transport model 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. Groundwater chloride measurements at monitoring wells on Hilton Head Island and nearby areas have indicated the presence of saltwater since the late 1970s. Historically groundwater withdrawals in the area of Savannah, Georgia and the Hilton Head Island vicinity have contributed to saltwater intrusion beneath Hilton Head Island.

The CSSI included extensive field investigations of the area, including offshore boring installation, geophysical studies, and downhole specific conductivity profile measurements. Data from these field studies were incorporated into a variable density coupled flow-transport groundwater model developed using a coupled version of the DYNFLOW and DYNTRACK modeling codes (www.dynsystem.com). Once calibrated, the model was used to study the relative impacts of Savannah and Hilton Head pumping on historical saltwater migration, and to evaluate the impact of potential pumping reductions on the projected saltwater transport beneath Hilton Head. Model simulation results are being used by an interstate committee tasked with examining options for managing salt water intrusion to ensure groundwater supply to local industries and municipalities. Some options include combinations of potential pumping reductions and engineered systems such as hydraulic barriers and water treatment.

Authors:

Ms. Kristina Masterson is senior water resources engineer at CDM with more than 20 years of experience in groundwater and surface water studies and water resources management. She specializes in using numerical models to study groundwater and surface water flow for groundwater remediation investigations and water resources management studies.

Mr. Robert Fitzgerald is a senior groundwater modeler at CDM who has been responsible for numerous studies of groundwater flow and dissolved and separate phase contaminant transport in aquifers. Mr. Fitzgerald also has extensive experience in hydrology, hydraulics and water resources management, emphasizing the application of computer simulation models.

Dr. Mark Maimone is a senior water resource management specialist at CDM with experience in groundwater and surface water studies, source water protection and storm water studies, water quality studies, wetlands remediation, and mathematical modeling of ground and surface water.

Dr. James Kennedy is the State Geologist of Georgia. His areas of expertise are groundwater hydrology and engineering geology. As State Geologist, Dr. Kennedy has worked on the Coastal Sound Science Initiative to manage salt-water intrusion into the Upper Floridan aquifer, permitting of coastal groundwater supply wells, and the State Water Plan.

17c

Simulated Influences of Upgradient Multi-Aquifer Wells on the Movement of Contaminants to Public-Supply Wells

Sandra M. Eberts[1], Richard L. Johnson, Leon J. Kauffman, Brian R. Clark, and Matthew K. Landon

[1]Sandra Eberts is a Professional Hydrogeologist certified and registered by the American Institute of Hydrology. She has been with the U.S. Geological Survey (USGS) for over 25 years and is currently team leader of a study within the USGS National Water-Quality Assessment Program to investigate the transport of anthropogenic and natural contaminants to supply wells. Prior to her current assignment, Sandra spent 8 years as a USGS technical liaison to the U.S. Air Force for cleanup of groundwater contamination at weapons manufacturing facilities nationwide.

Wells screened across multiple aquifers can serve as preferential flow pathways for the movement of groundwater and contaminants from shallow, unconfined aquifers to confined aquifers used for public-water supply. The presence of multi-aquifer wells can affect the sources of water to the public-supply well, the length of time it takes water to travel to the public-supply well, and the mobility and persistence of contaminants in the water entering the public-supply well. Model simulations demonstrate that a single multi-aquifer well located upgradient of a public-supply well can contribute nearly 10 percent of the water produced by the public-supply well over a wide range of pumping rates. This is true even when the multi-aquifer well is more than a kilometer from 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

David J. Ebinger, Peter A. Stone, Jeffrey M. Schrag, Christopher A. Wargo, Karin B. Skipper, and James M. Ferguson

Author information: All authors are educated as geologists, or chemist and environmental management (JMS), and are employed in the Bureau of Water of the South Carolina Department of Health and Environmental Control.

Investigations in South Carolina's Sandhills region, a highly leached and acidic sedimentary regime of quartz sands and kaolinitic clays, show a clear association between radium as a contaminant in drinking water wells and the following water chemistry characteristics: elevated nitrate (with no natural source), elevated conductance (evidencing dissolved salts), and certain other elevated chemical constituents, often including calcium and magnesium. These evidence or reflect human impact on groundwater chemistry and quality. USGS researchers have noted this same association in similar sediments in Maryland and New Jersey. The South Carolina and USGS studies additionally show an inverse relationship with pH, with highest radium concentrations associated with pH values below the normal acidic values found in nearby unimpacted groundwater. Natural pH values range to as low ~4.5, being as low as dissolved CO_2 can drive pH in poorly buffered water. The source of the additional acidity is not yet known, however USGS researchers suspect that it is from microbial oxidation of ammonia from fertilizer or organic sources into nitrate (the nitrification process).

What now seems clear is that 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. Innocuous, even beneficial mineral cations (e.g., Ca, Mg) may be releasing radium from where it is naturally adsorbed on mineral grains (desorption of radium), the lower pH condition may be leaching the radium off of grains, or both processes may be occurring. By whatever means, human impact to shallow water chemistry appears to be creating radium problems in drinking-water aquifers and wells. 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

Alexander Leff, Sher Leff, LLP

Alexander Leff graduated Phi Beta Kappa from Stanford University with degrees in Economics and Biology. He received his J.D. from Yale Law and is a member of the State Bar of California. Previously a consultant for an international management consulting firm, Leff is now Managing Partner of Sher Leff, LLP – a law firm dedicated exclusively to the representation of water suppliers in cases involving water contamination by pollutants. Since 2003, Leff's firm has obtained over $400 million for water supplier clients, including $105 million for the City of New York against ExxonMobil. Sher Leff represents water suppliers across the county.

Abstract

Water utility managers face unprecedented financial challenges as they endeavor to comply with environmental regulations which are driving MCLs ever lower and also regulating previously unregulated chemicals. Where will the funds necessary come from in an era of limited financial resources and rate-conscious customers? Despite the fact that much contamination was man-made and caused by businesses which released chemicals into the environment as part of their profit-making operations, water suppliers have traditionally been reluctant to use tort litigation to recover treatment costs from polluters. One reason is that water suppliers typically believe that the only prospective defendants are small local businesses (gas stations, dry cleaners, farmers, etc.) who were the last to touch products whose chemical components eventually entered the water supply. These local businesses generally do not have sufficient financial resources or insurance coverage to reimburse water suppliers for the cost of responding to the contamination.

Recent lawsuits by some water suppliers have successfully pursued an innovative legal strategy. These cases do not focus on the small local end user, but on the large corporate manufacturer of the products. These cases have resulted in hundreds of millions of dollars paid to water suppliers by the refiners of gasoline containing MTBE and the manufacturers of other products including PCE (used by dry cleaners), TCE (used by a variety of industrial users), and DBCP, TCP, and Atrazine (used by farmers).

This innovative approach to water contamination litigation has important implications for water suppliers, lawyers, regulators, and environmental consultants. This presentation will discuss the legal theories underlying these landmark cases and the status of lawsuits currently pending in jurisdictions around the country. The presentation will also discuss the legal and political responsibilities facing a water supplier whose water supply has been impacted by man-made pollution.

18b

Minnesota's Source Water Protection Grant Program

Bruce M. Olsen
Source Water Protection Unit Supervisor
Minnesota Department of Health

Minnesota voters approved a constitutional amendment in November 2008 that increased the state sales tax by three eights of one percent to create a dedicated fund for addressing a variety of cultural, ecological, and water resource protection needs. This financial resource will remain in effect until June 30, 2034. One third of the revenue is deposited into a Clean Water Fund and "may be spent only to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater from degradation, and at least five percent of the clean water fund must be spent only to protect drinking water sources." (Article XI, Section 15 of the Minnesota Constitution).

The Minnesota Department of Health (MDH) administers the source water protection (SWP) program and established the SWP Grant Program using CWF money. Three types of grants are available and all have a $10,000 grant cap so that the funding may reach as many users as possible. SWP plan implementation grants are available only to community and nontransient noncommunity water suppliers that have a SWP plan that has been approved by the MDH and no cost share is required. SWP competitive grants are available to all community and noncommunity nontransient water suppliers and 1) require an equal financial cost share and 2) must address either a potential or known contamination threat or a SWP action that is recognized by the MDH. SWP competitive grants for noncommunity transient systems 1) require an equal financial cost share and 2) address a potential contamination source that presents a high risk to a source of drinking water as determined by the MDH. MDH awarded $1,026,139 in SWP grants during the 2010-2011 state biennium and anticipates duplicating this amount for the 2012-2013 biennium.

Response by public water suppliers has been very positive and several communities have received both SWP plan implementation and competitive grants. MDH has awarded 142 grants of all types since making the first announcement of grant availability in April 2010. Grants are used for a wide variety of purposes and include public education, eliminating potential contamination sources, monitoring water quality in wellhead protection areas, correcting deficiencies identified in a sanitary survey, updating inventories of potential contamination sources, supporting efforts by local watershed management groups to protect surface water intakes evaluating sites for replacing vulnerable public water supply wells, increasing security, and contingency planning. Although grants are capped at $10,000, the program is enabling public water suppliers to implement many SWP measures that would not have been possible given their current financial conditions.

19a

Water Management and Sustainability Planning for Unconventional Resource Development

J. Daniel Arthur, P.E., SPEC (ALL Consulting); Damian Zampogna, P.G. (ALL Consulting); Preston Wilson (ALL Consulting); and Jason Veale (ALL Consulting)

Abstract: Water management planning has become an ever more critical piece of the puzzle for unconventional resource development in the United States, North America, and throughout the World. In North America, environments vary from extremely remote areas like the Horn River Basin of British Columbia to water challenged areas like the Eagle Ford Shale of South Texas. However, regardless of the area, sustainable water management planning is critical and must take into account a much broader variety of issues compared to what was common with such plans only a few years ago. Today, water management and sustainability needs to consider not only pre-development assessments and baseline studies, development based water sourcing strategies, transportation, and disposal, but protection of existing ground and surface water resources, alternative water sourcing, long-term management of the resource, environmental concerns, landowner coordination, reuse and recycling, water treatment and conditioning, vulnerability assessment, among other considerations. This paper will lay out some of the key components of a comprehensive Water Management and Sustainability Plan (WMSP). Benchmarking comparison from multiple shale plays and sample analysis methods will be presented. Case study information will be provided as extra slides and presented as time permits.

Note: this presentation is a result of a U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Research Project on lifecycle water management for development of the Marcellus Shale.

19?

Shale Gas: It's Not Just in North America Anymore

John A. Veil, President, Veil Environmental, LLC

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.

Synopsis of Presentation

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.

19?

Overview of Shale Gas Produced Water Recovery and Recycling Technologies Options: Implementation, Effectiveness and Economic Lessons Learned

Tom Lewis, *President*, Lewis Environmental Services, Inc.

Mr. Lewis' presentation will compare water recycling strategies used in two major shale gas plays, the Barnett and Marcellus Shale. The presentation will discuss the economic advantages of recycling flowback water and the difference in the two plays to implementing various technologies to achieve that end. Flowback water has a matrix of organic and inorganic contaminants which makes recycling difficult. Recovery/recycling guidelines will be discussed and how several technologies meet the criteria.

19c

Geochemistry of Natural Gases in Quaternary through Devonian Age Strata in the Northern Appalachian Basin: Implications for Investigations of Stray Gas Migration

Fred Baldassare, Sr. Geoscientist, Echelon Applied Geoscience Consulting
Christopher D. Laughrey, Weatherford Laboratories
Mark McCaffrey, Ph.D., Weatherford Laboratories
John A. Harper, Ph.D., Pennsylvania Geological Survey

Author's Bio:
Fred Baldassare owns Echelon Applied Geoscience Consulting and previously served as the statewide consultant to advise, investigate and characterize the origin of stray gases in the shallow subsurface for PA. DEP. 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.

As the pace of drilling activity to the Marcellus Formation in the northern Appalachian Basin has increased, so have the number of alleged incidents of stray natural gas migration to shallow aquifer systems.

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 from mud gas samples during drilling of Marcellus formation gas wells, and during comprehensive pre-drill background groundwater water quality testing programs. Historic data sets from previous studies were also reviewed and analyzed.

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. The data reveal a complex thermal history with distinct thermogenic gases, gas mixtures, and isotope reversals ($\delta 13C1 > \delta 13C2 > \delta 13C3$) documented throughout the stratigraphic section.

Defining a specific source of stray natural gas migration requires the investigation and synthesis of different data types at a site specific level that includes the interpretation and evaluation of gas geochemistry and mechanism of migration. Proper analyses and interpretation of molecular and isotope geochemistry provides evidence of gas origin, and focus for investigations where pre-existing and multiple potential stray gas sources occur. Following these analyses, additional evaluation and investigation to determine the mechanism of migration is necessary to identify the specific stray gas source, or at least minimize and rule out potential sources.

20a

Update: Unregulated Drinking Water Initiative for Environmental Surveillance and Public Health

Lorraine C. Backer, PhD, MPH, Team Lead and Senior Scientist, National Center for Environmental Health, Centers for Disease Control and Prevention

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.

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

Jackson, D.A., Blair, R.J., Carigan, E.D., Currens, J.C., O'dell, P.W., Ray, J.A., and Seay, J.S.

Author Bio

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. Prior to his current position David worked as a geologist in the Division of Waste Management and the Division of Water's Louisville Regional Office. David also holds a degree in Fire Science Technology, is Vietnam Veteran and father to four children.

Abstract

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.

Incorporating previously omitted subsurface flow data into the NHD will provide several benefits, primarily: 1) demonstration of local deviation of karst drainage from topographic watershed divides, 2) establishing a baseline for mapping karst features and groundwater flow paths within the NHD, and 3) improving accuracy and applicability of information used for hydrologic modeling, research and field investigation.

20c

The National Ground Water Monitoring Network: Six States Test the Framework Design

William L. Cunningham[1], Daryll A. Pope[2], Robert P. Schreiber[3], P.E., D.WRE, and Christine Reimer[4]

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[2]U.S. Geological Survey, 810 Bear Tavern Road, West Trenton, NJ 08628
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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 the Montana Bureau of Mines and Geology (evaluating statewide Principal aquifers), the Minnesota Department of Natural Resources and Minnesota Pollution Control Agency (Cambrian-Ordovician aquifer system), the Texas Water Development Board (statewide), the New Jersey Geological Survey (statewide), and the Illinois State Water Survey, Illinois Environmental Protection Agency, Indiana Department of Natural Resources, and Indiana Department of Environmental Management (Mahomet-Teays aquifer system). Pilot projects evaluated the distribution of existing wells within principal and major aquifers, well measurement and/or sampling frequency, field practices, database elements, and data management procedures. Each pilot produced a report that included this evaluation along with estimates of overall network costs, benefits, and proposed Framework changes. Three common benefits were cited; the NGWMN results in a single, consistent dataset from which to evaluate shared interstate ground-water resources; the Network provides an opportunity to share data among state agencies; and participation in the NGWMN is an impetus for a critical review of field and data-management procedures, as well as network data gaps. A compilation of the pilot reports demonstrated several conclusions. Ground-water monitoring is done by many federal, tribal, state, and local agencies for many purposes. These groups record data in a variety of ways and use various database platforms, but most minimum data elements are available. The incremental costs of incorporating existing state monitoring systems are low, however existing monitoring will not fill all gaps. 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.

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, Nate Booth, I-Lin Kuo, Jessica Thompson, Daryll Pope, and Bill Cunningham

Author's Bio:

Jessica Lucido is an IT Specialist for the U.S. Geological Survey's Center for Integrated Data Analytics (CIDA), which has been charged with the development of the National Ground Water Monitoring Network Data Portal. In that role she coordinates the development of the portal and the data-exchange mechanism that drives it and works with participating state groundwater agencies to aid them in making their groundwater data available through the portal. In addition, Jessica holds a Bachelors degree from the University of Illinois at Urbana-Champaign in Mechanical Engineering and a Masters degree in Environmental Engineering from the University of Wisconsin – Madison.

Abstract:
The need for national ground-water monitoring is profound and has been recognized by organizations outside government as a major data gap for managing ground-water resources. Our country's communities, industries, agriculture, energy production and critical ecosystems rely on water being available in adequate quantity and suitable quality. To meet this need the Subcommittee on Ground Water**,** established by the Federal Advisory Committee on Water Information, created a National Ground Water Monitoring Network envisioned as a voluntary, integrated system of data collection, management and reporting that will provide the data needed to address present and future ground-water management questions raised by Congress, Federal, State and Tribal agencies and the public.

The Ground Water Data Portal is the means by which policy makers, academics and the public will be able to access ground water data through one seamless web-based application from disparate data sources. Data systems in the United States exist at many organizational and geographic levels; however differing vocabulary and data structures have prevented data sharing and reuse. The data portal will facilitate the retrieval of and access to ground-water data on an as-needed basis from multiple, dispersed data repositories allowing the data to continue to be housed and managed by the data provider while being accessible for the purposes of the national monitoring network.

This work leverages the Open Geospatial Consortium (OGC) data exchange standards and existing XML schemas (WaterML2.0, GWML, WQX). Data exchange between disparate repositories and the portal has been achieved through the use of OGC web services and a central mediation hub, which performs both semantic and syntactic mediation of the raw data and outputs it in a single common format. This architecture allows for the presentation of 'real-time' data pulled and re-organized on the fly to be viewed in a common format through a web application.

20e

Updating the Framework Document for the National Ground Water Monitoring Network-Incorporating Sound Science and Sensible Realities

David R. Wunsch and Michael Wireman

David R. Wunsch is the Director of Science & Technology for the National Ground Water Association (NGWA). He is an Honorary member of the Association of American State Geologists (AASG), and represents AASG on the Subcommittee on Ground Water.

Michael Wireman is a Hydrogeologist for EPA Region 8 in Denver, Colorado, where he serves as the regional groundwater expert. Wireman is a federal representative on the Subcommittee on Ground Water.

The Subcommittee on Ground Water (SOGW), under the auspices of the Federal Advisory Committee on Water Information (ACWI), produced a framework document for the development and implementation of a national ground water monitoring network in July of 2009. The document represents the work of a diverse committee, and recommends a national network design that would function by cooperative efforts between states, regional water authorities, and tribes, with federal partners. The report included from input from 70 volunteers representing 54 organizations. In January of 2010, a pilot project program was initiated with collaboration from 6 states and the USGS in order to test the concept and feasibility of meeting the framework recommendations, while simultaneously evaluating data gaps, and the costs associated to fully implement the network. The preliminary results of the piloting effort demonstrated that the concept and protocols could be met in a limited but acceptable way. However, individual state partners encountered issues with classification schemes, ambiguity in directives, as well as policy-driven issues that suggested that modifications would be needed so eventually all states could participate. moreover, the USGS also recognized shortcomings in the data transfer protocols and computational infrastructure, mainly from the state side. In addition to the pilot process, the SOGW collected comments from interested partners at public meetings, as well as from internal deliberations and subsequent re-evaluation of the framework protocols. However, it was anticipated from the onset of the SOGW framework development that valuable feedback would be gained from the piloting exercise, and subsequent revisions would ultimately improve the monitoring framework. Examples of some of the major issues, inconsistencies, and ambiguities in the original framework document will be presented, along with the SOGW's strategy and subsequent approaches to rectify the problems, which will lead to the overall goal of an enhanced and improved network design.

21a

Partnership to Improve Source Water Quality through Habitat Restoration at Remsen, Iowa

Chi Ho Sham, The Cadmus Group, Inc.; Rebecca Ohrtman, Iowa Department of Natural Resources; Dan Cook, Iowa Department of Natural Resources; and Steve Pick, Remsen Municipal Utility

Authors:
Chi Ho Sham, Ph.D. is a Vice President at The Cadmus Group, Inc.; Rebecca Ohrtman is the Source Water Protection Coordinator for High Priority Targeted Community Water Systems at Iowa Department of Natural Resources; Dan Cook is a Senior Environmental Specialist of the Contaminated Site Section of Iowa Department of Natural Resources; and Steve Pick is the Director of Utilities Operations of Remsen Municipal Utility.

Abstract:
The City of Remsen relies on a number of shallow alluvium municipal wells as a part of its water supply. These wells had shown significant nitrate contamination since 2005. With assistance from the Iowa Department of Natural Resources (DNR) Contaminated Sites Section, potential areas of concerns were identified and investigated using ground water flow models and ground water sampling in 2008 and 2009. A specific plot of land where over application of manure had been practiced was identified to a major source of nitrate to the shallow alluvium wells. Through a partnership effort with the Remsen Source Water Protection Community Planning Team, the Remsen Utilities Board and City Council, Plymouth County U.S. Department of Agriculture - Natural Resources Conservation Service, Sioux River Resource Conservation and Development Council, Iowa DNR Source Water Protection Program and Contaminated Sites Section staff, Iowa DNR Clean Water State Revolving Fund, State Watershed Improvement Review Board, USDA Agricultural Research Service, and Plymouth County Pheasants Forever Chapter, a combination of loan and grant were used to purchase source water protection's identified priority land where Pheasants Forever prepared seedbed and planted the acquired areas for conversion to prairie grasses in the Spring of 2009. Additional ground water modeling and ground water sampling have shown that the prairie habitat restoration is effective in gradually and continuously lowering the nitrate concentration in shallow aquifer. Additional ground water samples will be collected in 2011 to monitor the changes in water quality and quantify the rate of water quality improvement.

21b

open

21c

Near-decadal changes of Chloride, Dissolved Solids, and Nitrate concentrations in Groundwater in the United States, 1988-2010

Bruce D. Lindsey and Michael G. Rupert

Bruce Lindsey is the coordinator of Groundwater Quality Trends studies for the U.S. Geological Survey, National Water-Quality Assessment (NAWQA) Program. He has a bachelor's degree in engineering from the Pennsylvania State University and Masters degree in geology from Shippensburg University.

The U.S. Geological Survey National Water-Quality Assessment (NAWQA) Program has summarized decadal changes in groundwater quality at the network level for the sampling period of 1988-2010. The data set consists of 1,236 wells in 56 well networks located throughout the nation. The 22 principal aquifers represented by these 56 networks account for about 75 percent of the estimated withdrawals of groundwater used for drinking-water supply for the nation. Water from each well was sampled twice on a near-decadal time period and was analyzed for chloride, dissolved solids, and nitrate concentrations. Comparisons of chloride, dissolved solids, and nitrate concentrations were analyzed at the network level and the majority of comparisons revealed no significant changes over the decadal period. However, statistically significant increases and decreases in chloride, dissolved solids, and nitrate concentrations were found in some well networks over the decadal period. Chloride concentrations had statistically significant increases in 45 percent of the well networks, dissolved solids concentrations increased significantly in 44 percent of the networks, and nitrate concentrations increased significantly in 28 percent of the networks. Statistically significant decreases of chloride were identified in 4 percent of the networks, and nitrate decreased in 7 percent of the networks. One network had a statistically significant decrease in dissolved solids concentrations. The magnitude of change in concentrations was small in most networks; however, the largest median decadal increases in concentrations at the network level were 109 mg/L for chloride, 385 mg/L for dissolved solids, and 2 mg/L for nitrate. The magnitude of change in networks with statistically significant increases was typically larger than the magnitude of change in networks with statistically significant decreases.

21d

Occurrence of Phosphorus in Groundwater and Surface Water of Northwestern Mississippi

Heather L. Welch, Claire E. Rose, and Richard H. Coupe

Co-authors: Claire E. Rose, Physical Scientist, U.S. Geological Survey, Jackson, MS
Richard H. Coupe, Supervisory Hydrologist, U.S. Geological Survey, Jackson, MS

Abstract

Previous localized studies of groundwater samples from the Mississippi River Valley alluvial (MRVA) aquifer have demonstrated that dissolved phosphorus concentrations in the aquifer are much higher than the national background concentration of 0.03 milligram per liter (mg/L) found in 400 shallow wells across the country. Forty-six wells screened in the MRVA aquifer in northwestern Mississippi were sampled from June to October 2010 to characterize the occurrence of phosphorus in the aquifer, as well as the factors that might contribute to high dissolved phosphorus concentrations in groundwater. Dissolved phosphorus concentrations ranged from 0.12 to 1.2 mg/L with a median concentration of 0.62 mg/L. The predominant subunit of the MRVA aquifer in northwestern Mississippi is the Holocene alluvium in which median dissolved phosphorus concentrations were higher than the Pleistocene valley trains deposits subunit. Highest phosphorus concentrations occurred in water from wells located along the Mississippi River. A general association between elevated phosphorus concentrations and dissolved iron concentrations suggests that reducing conditions that mobilize iron in the MRVA aquifer also might facilitate transport of phosphorus. Using baseflow separation to estimate the contribution of baseflow to total streamflow, the estimated contribution to the total phosphorus load associated with baseflow at the Tensas River at Tendal, LA, and at the Bogue Phalia near Leland, MS, was 23 percent and 8 percent, respectively. This analysis indicates that elevated concentrations of dissolved phosphorus in the MRVA aquifer could be a possible source of phosphorus to streams during baseflow conditions. However, the fate of phosphorus in groundwater discharge and irrigation return flow to streams is not well understood.

22a

Joint Water Quality Division and
Water Availability and Sustainability Division Meeting
8:00 to 10:00 AM Wednesday, September 28, 2011 - Atlanta, GA.

Division Chairs: Audrey Eldridge, OR DEQ and Jamie Crawford, MS DEQ

- Welcome and Purpose—*Lighting Discussion of Each Topic (10 Minute Maximum)*
- EPA National Nutrient Initiative – **Jim Taft**, ASDWA
- EPA Proposed Stormwater Rule Update – **Roy Simon**, USEPA
- UIC Issues - Speaker TBA
- EPA Watershed Technical Guidance Document - Speaker TBA
- USDA - Farm Bill EQIP Program Update – **Bruce M. Olsen**, MN DOH
- GWPC Aquifer Storage and Recovery Task Force Report- **Cary Betz**, TCEQ
- Unregulated Drinking Water Initiative Update – **Lorraine C. Backe**r, Centers for Disease Control and Prevention
- Update --Subcommittee on Ground Water—Nation Ground Water Monitoring Network- **Chris Reimer**, NGWA
- State Regulator/USEPA Roundtable Report- **Andrews Tolma**n, ME DWP
- GWPC Source Water Work Group Report - **Mike Eggert**, OH EPA
- Revisions to the GWPC Report to the Nation – **Dan Yates**, GWPC
- Conference Wrap Up--Summary of Issues Heard and Needed Follow-Up -- **Audrey Eldridge**, OR DEQ and **Jamie Crawford**, MS DEQ

23a

Source Water Protection Interregional Exchange Roundtable

Moderator: Source Water Collaborative Steering Committee

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.

- Welcome Comments and “About the SW Collaborative”
- Regional Collaborative (Salmon Falls / Delaware Basin)
- Roundtable (All participants share 3-4 minutes each re: programs, successes, etc)
- Going Forward – Collaboration on Source Water Protection

Attendance for this session only is complimentary.

No registration is necessary. RSVP and/or for comments or questions, please contact Dan Yates at dyates@gwpc.org or 405-516-4972

24a

EPA Technical Workshop:

Class VI Geologic Sequestration Financial Responsibility Guidance

Moderator: **Joe Tiago**, USEPA HQ

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.

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.

The workshop is designed to engage stakeholders—including states, industry, and non-governmental organizations—and it will be available via webcast.

Advance registration is required. The registration link is… https://www2.gotomeeting.com/register/507402386