
2010 Annual Forum

WATER ENERGY
IN CHANGING CLIMATES



**PRESENTATIONS
&
PRESENTATION SYNOPSES**



U.S. DEPARTMENT OF
ENERGY



PRESENTATIONS

To view a presentation in Adobe .pdf® format click on the presenters name

Monday, September 27

Session Staff: Mike Nickolaus

Workshop: Water Issues (And Solutions) Associated with Hydraulic Fracturing

***This Special Workshop is FREE to the Public
-Pre-registration required-***

Welcome: **Mike Nickolaus** (GWPC Special Projects Director)

Part 1: Technical Aspects of Hydraulic Fracturing Water Management

Moderator -Viola Schatzinger (PTTC's lead for Environmental/Water Issues Tech Center)

- GTI Water Management Consortiums, Marcellus & Barnett Shale – **Tom Hayes**, GTI
- **Abstract: 183** Well Stimulation 101 (the process, water requirements, and the chemicals used) – **Robert Garland**, Universal Well Services
- Short video - Basics of Hydraulic Fracturing by Chesapeake Energy
- **Abstract: 168** Marcellus Shale Water Management – **Tony Gaudlip**, Range Resources
- **Abstract: 52** WVU's (DOE) - Zero Discharge Management of Marcellus Frac Water Returns - **Paul Ziemkiewicz**, WV Water Research Inst
- **Abstract: 100** GE Global Research (DOE) Cost Effective Recovery of Low-TDS Frac Flowback Water for Re-Use – **Harish Acharya**, GE Global Research Center
- **Abstract: 40** ALL, Inc. (DOE) Considerations for Water Treatment and Re-Use in Shale Gas Development– **David Alleman**, ALL Consulting

Part 2: Regulatory Aspects of Hydraulic Fracturing Water Management

Moderator: **Lori Wrotenbery**, Director of Oil and Gas, OCC

Abstract: 31 STRONGER Guidelines on Hydraulic Fracturing – **Lori Wrotenbery**, Oklahoma Corporation Commission

- State Regulator Panel - **Joe Lee/Scott Perry** Pennsylvania Depart. Environmental Protection; **Brad Field**, New York Dept. Environmental Conservation; and **Stan Belieu**, Nebraska Oil & Gas

Workshop participants are invited to attend the Dr. Engelder Luncheon for a cost of \$20. For those registered for the entire symposium, there is no additional charge.

Session Sponsored by: Schlumberger

Session Staff: Steve Musick

Short Course: The Legal Framework: Water Allocation, Quality, and Energy

Abstract: 39

Moderator - Seth Mendelsohn, Corporate Counsel, Pennsylvania-American Water Company

The treatment and distribution of water to customers requires energy. Low-cost energy availability is essential to keeping water production costs and rates low for customers. At the same time, demand-side management approaches need to be considered for conservation reasons. This seminar will discuss the legal issues involved in the nexus between water and energy. It will also examine various legislative approaches to deal with the issue. Finally, it will present the latest case law addressing the water industry.

Kathy L. Pape, President, Pennsylvania-American Water Company

Brandon Kernan, New Hampshire Department of Environmental Services

David M. Flannery, Jackson Kelly

Abstract: 164 Jacqueline Daoust, Daoust Consulting
Mary Martha Truschel, Assistant Counsel Department of Environmental Protection

Joshua Becker, Dewey & LeBoeuf LLP.

Session Staff: Dan Yates

Source Water Roundtable - Communicating National, State, and Local Source Water Protection Strategies

Moderator - Mike Eggert, OH EPA

Updates from GWPC and State Programs

Federal Source Water Efforts

- EPA Office of Ground Water & Drinking Water – **Roy Simon**, USEPA
- EPA Office of Wastewater Management- **Maureen Tooke**, USEPA

Source Water Protection Technical Presentations 10:20-11:20

- **Abstract: 42** Protecting Groundwater Quality: The Spring Creek Watershed Drilling Ordinance Success Story - **Todd Giddings**, Todd Giddings and Associates, Inc
- **Abstract: 135** American Water Works Association G-300 Standard (Source Water Protection): Steps to Protect Source Water Quality - **Chi Ho Sham**, The Cadmus Group
- **Abstract: 188** Watershed-Based Source Water Protection Programs in Pennsylvania - **G Patrick Bowling**, PA DEP



Lunch Presentation by: **Dr. Terry Engelder Bio 47**
Professor of Geosciences, Pennsylvania State University

Over 1,000,000 hydraulic fracturing stimulations within the USA without compromising fresh groundwater: True or False?

Monday, September 27 Cont'd.

12:50-6:00 Opening General Session

WATER ENERGY

IN CHANGING CLIMATES

Session Staff: Mike Paque

12:50-2:50

Water & Energy in Changing Climates: State, Federal, and Local Views

Welcome - **Mike Paque**, GWPC Executive Director

Moderator- **Joe Lee**, Pennsylvania Department of Environmental Protection & GWPC President



1:00 Keynote : Robert F. Kennedy Jr.,
President Waterkeeper Alliance **Bio 155**



1:35 Glenn H. Rider II, Director, Bureau of
Watershed Management, PA DEP **Bio 137**



2:00 Chris Smith, Deputy Assistant Sec.
Oil & Natural Gas, DOE **Bio 134**



2:25 Cynthia Dougherty, Director, Office of
Ground Water & Drinking Water, EPA **Bio 131**

BREAK

Session Staff: Mike Paque

3:20-6:00

Water & Energy in Changing Climates: Research, Applied Science, & Other Initiatives

Moderator- **Stan Belieu**, Nebraska Oil & Gas & GWPC Vice-President

3:20-3:40 Water-Energy Research at the U.S. Department of Energy – **Allan Hoffman**, Office of Energy Efficiency and Renewable Energy, US Department of Energy **Abstract 44**

3:40-4:00 Groundwater Banking: One Management Option to Meet Marcellus Water Needs - **Richard R. Parizek**, Professor of Geology and Geo-Environmental Engineering, Department of Geosciences, The Pennsylvania State University **Abstract 82**

4:00-4:20 Energy & Water: Potential Futures - **C. Andrew Miller**, Chief, Atmospheric Protection Branch, US EPA – National Risk Management Research Laboratory **Abstract 166**

4:20-4:40 Natural Gas and Water in the New Energy Economy – **Richard Ward**, Energy Future Coalition **Abstract 14**

4:40-5:00 BREAK - in Exhibit Hall

5:00-5:20 Water Impacts of a Changing Energy Policy - **Michael E. Webber**, University of Texas - The Future of the Water-Energy Nexus **Abstract 190**

5:20-5:40 Global Drivers and Mechanisms to Balance the Energy-Water Nexus - **Jan Dell**, CH2MHill and World Business Council for Sustainable Development **Abstract 17**

5:40-6:00 The Water Energy-Nexus: The Role of Global Change Science – **Charles Vorosmarty**, The City University of New York **Abstract 163**

Tuesday, September 28

8:00-10:00

Morning Sessions

Water/Energy Sustainability Symposium Tracks

GWPC Annual Forum Tracks

Session Staff: Mike Nickolaus

Session Staff: Steve Musick

Session Staff: Mary Musick

Water for Energy

Water Availability & Sustainability

Water Quality

Related Posters: 29, 154, 184

Planning for Future Demands

Nutrient and other Nonpoint Source Impacts to Ground Water

Moderator- John Rogers, Union of Concerned Scientists

Related Posters: 102

Related Posters: 25

Moderator- Jamie Crawford, Mississippi DEQ

Moderator- Glenn Rider, Pennsylvania DEP

8:00-8:20 Abstract 8

8:00-8:20 (full paper available) Abstract 10

8:00-8:20 Abstract 57

Incorporating Water Constraints into Electric Transmission Planning – **Alex Schroeder**, Western Governors' Association

How Water Treatment Drives Regional Power Demands And What Can Be Done About It - **Frederick Bloetscher**, Florida Atlantic University

Protecting Pennsylvania's Drinking Water through Computer Modeling and Geospatial Analysis - **Alfred Guisepppe**, SSM Group, Inc

8:20-8:40 Abstract 68

8:20-8:40 Abstract 27

8:20-8:40 Abstract 81

Great Lakes Energy Water Nexus Initiative - **Victoria Pebbles**, Great Lakes Commission

Assessing Water Use and Availability Trends in New Hampshire - **Brandon Kernen**, New Hampshire Department of Environmental Services

The Unintended Energy Impacts of Increased Nitrate Contamination from Biofuels Production - **Kelly Twomey**, NSF Graduate Research Fellow

8:40-9:00 Abstract 24

8:40-9:00 Abstract 72

8:40-9:00 Abstract 83

Water Use, Electric Power, and Nuclear Energy: A Holistic Approach to Environmental Stewardship - **William Skaff**, Nuclear Energy Institute

Water Supply Reservoir Viability and Water Conservation Study in Oklahoma – **Karl Stickley**, C.H Guernsey & Company

Best Agricultural Management Practices (BMPs) for Biofuels Feedstock Production - **Xiaobo Xue**, University of Pittsburgh

9:00-9:20 Abstract 122

9:00-9:20 Abstract 109

9:00-9:20 Abstract 45

Future Projections of Water Demands for Energy – **Robin Newmark**, National Renewable Energy Laboratory

Integrated Water and Energy Planning for Sustainable Rural Economies - **Brian Starkebaum**, Yuma Conservation District

The Impact of Non-Point Source Contamination on the Surficial Aquifer of the Delmarva Peninsula - **Judith M. Denver**, Hydrologist, U.S. Geological Survey

9:20-9:40 Abstract 124

9:20-9:40 Abstract 102

9:20-9:40 Abstract 173

Quantifying Indirect Water Impacts of Buildings' Energy Efficiency – **Doug Elliott**, Pacific Northwest National Laboratory

Improving Community Resilience through Water Preparedness - **John Whitley**, US EPA Office of Water

Nutrient Problems in the U.S. Call for Urgent Action - **Jim Taft**, Association of State Drinking Water Administrators

9:40-10:00 Abstract 116

9:40-10:00 Abstract 132

9:40-10:00 Abstract 59

A Carbon Footprint is not Enough - **Brandy Lellou**, Executive Director, Nature's Voice Our Choice

GIS and Water Sustainability: A Taunton River Basin Case Study - **Mark E. Nelson**, Horsley Witten Group

Applications in the Use of Isotope Geochemistry to Identify the Origin of Methane in the Environment - **Fred Baldassare**, Pennsylvania Department of Environmental Protection

Tuesday, September 28 Cont'd.

10:20-12:10

Mid-Morning Sessions

Water/Energy Sustainability Symposium Tracks

GWPC Annual Forum Tracks

<p>Session Staff: Mike Nickolaus Water and Unconventional Natural Gas Production <i>Supplying Water for Well Stimulation</i> Related Posters: 1 Moderator- Natenna Dobson, USDOE</p>	<p>Session Staff: Jacqueline Daoust Water and Geothermal Energy <i>Ground Source Heat Pumps</i> Moderator- Kevin McCray, NGWA</p>	<p>Session Staff: Mary Musick Joint Water Availability & Sustainability/Water Quality Session <i>Managed Aquifer Recharge</i> Moderator- Derek Smithee, Oklahoma Water Resources Board</p>	<p>Session Staff: Paul Jehn Data Needs for Resource Management: <i>Current Application & Future Development</i> Moderator- Stan Belieu, Nebraska Oil & Gas</p>
<p>10:20-10:40 Abstract 4 Water Availability and Management in Shale Gas Operations – John Veil, Argonne National Laboratory</p>	<p>10:20-10:40 Abstract 156 State Regulatory Oversight of Geothermal Heat Pump Installations: A National Survey - Kevin McCray, NGWA</p>	<p>10:20-10:40 Abstract 85 A Collaborative Process to Identify the Most Feasible Aquifer Recharge Sites in Oklahoma - Nathan Smith, CDM</p>	<p>The RBDMS Oil and Gas National Data Portal - Stan Belieu, NOGCC</p>
<p>10:40-11:40 Abstract 89 Mitigating for Energy-related Consumptive Water Use in the Susquehanna River Basin - Andrew Dehoff, Susquehanna River Basin Commission</p>	<p>10:40-11:00 Abstract 139 Preventing Source Water Zone II Impacts on High-Capacity Well Fields from Geothermal Heat Pump Systems Todd Giddings, Todd Giddings & Assoc.</p>	<p>10:40-11:00 Abstract 125 Stormwater: Benefit or Detriment to Groundwater? - Barb Adkins, City of Portland, Oregon, Bureau of Environmental Services</p>	<p>Abstract 58 GWPC's Risk Based Data Management System (RBDMS) Overview - Paul Jehn, GWPC</p>
<p>11:00-11:20 Abstract 105 Hydrogeologic and Water Resource Considerations Related to Natural Gas Production in the NYC Water Supply Watershed - Frank Getchell, Leggette, Brashears & Graham, Inc.</p>	<p>11:00-11:20 Abstract 32 Diversion of Existing Groundwater Infrastructure for Geothermal Heat Exchange - Matthew J. Hammer, Sanborn, Head & Associates</p>	<p>11:00- 11:20 Abstract 186 EPA Office of Wetlands, Oceans and Watersheds: Stormwater Update – Edward W. Lavery, USEPA Region1</p>	<p>Abstract 191 Using RBDMS to Manage Oil and Gas Activities in New York and Display Data Using the RBDMS Wellbore Schematic Utility - Amanda Trotter, New York DEP</p>
<p>11:20-11:40 Abstract 136 Significance of Uncertainty in Water Resources Decisions for Western Pennsylvania's Marcellus Shale - Austin Mitchell, Carnegie Mellon U.</p>	<p>11:20-11:40 Abstract 54 Assessing Thermal Impacts of an Open-Loop Ground Source Heat Pump Vicky L. Freedman, Pacific Northwest National Laboratory</p>	<p>11:20-11:40 Abstract 187 EPA Office of Ground Water and Drinking Water: Stormwater Update – Roy Simon, USEPA HQ</p>	<p>Abstract 167 RBDMS Water a New Regulatory Tool Water Data Management - Gregg Miller, Ohio DNR</p>
<p>11:40-12:00 Abstract 172 Evaluation of Abandoned Mine Drainage as a Water Supply for Hydraulic Fracturing in the Marcellus Shale - Elise Barbot, U. of Pittsburgh</p>	<p>11:40-12:00 Abstract 147 Standing Column Wells at Villanova University - Albert A. Koenig, ARB / Geowell</p>	<p>11:40-12:00 Abstract 43 Low Impact Development Stormwater Controls and Changing State and Federal Regulations – Steven P. Roy, Geosyntec</p>	<p>Abstract 71 Use of Existing Public Databases to Improve Groundwater Monitoring - Evan Kane, Groundwater Planning Supervisor, NC Department of Environment and Natural Resources</p>
<p>12:00-12:20 Abstract 127 Developing Sustainable New Water Supplies for Natural Gas Development - Kenneth Nichols, CH2M HILL</p>	<p>12:00-12:20 Abstract 80 Ground Source Heat Pump Monitoring to Ensure Source Water Protection, Jacqueline Daoust, Daoust Consulting</p>	<p>12:00-12:20 Abstract 140 Incidental Recharge in Montana, John LaFave, Montana Bureau of Mines and Geology</p>	<p>Abstract 144 Panel - UIC National Database: Building Data Quality for More Effective Use: Beth Hall, USEPA -- Lead/Moderator Trang Le, USEPA -- QA/QC Tools and Reports to Validate Data Beth Hall, USEPA -- Use of Data to Identify Issues and target resolution. Kurt Hildebrandt, USEPA, R7 -- Experiences in Addressing program inconsistencies in QA/QC Sessions</p>

Tuesday, September 28 Cont'd.

1:40-3:40 Afternoon Sessions

<i>Water/Energy Sustainability Symposium Tracks</i>		<i>GWPC Annual Forum Tracks</i>	
<p>Session Staff: Paul Jehn</p> <p>Water and Unconventional Natural Gas Production</p> <p><i>Protecting Ground Water During Well Stimulation</i></p> <p>Related Posters: 55, 142</p> <p>Moderator- Leslie Savage, Texas Railroad Commission</p>		<p>Session Staff: Laura Dufresne</p> <p>Water Utilities</p> <p><i>Improved Technology for Water/Energy Savings and Sustainability</i></p> <p>Related Posters: 159, 160, 161</p> <p>Moderator- Vanessa M. Leiby, The Cadmus Group, Inc</p>	
<p>Session Staff: Mike Nickolaus</p> <p>CO₂ Geosequestration</p> <p><i>Technical and Policy Considerations</i></p> <p>Moderator- Ben Knape, Texas Commission of Environmental Quality</p>		<p>Session Staff: Mary Musick</p> <p>Water Quality</p> <p><i>Underground Injection Practices And Ground Water Protection</i></p> <p>Related Posters: 56, 93</p> <p>Moderator- John Taylor, EPA Region 5</p>	
<p>1:40-2:00 Abstract 15</p> <p>Zero Discharge Recycling Process for Marcellus Shale Frac Water - Tom Lewis III, Lewis Environmental Services, Inc.</p>	<p>1:40-2:00 Abstract 141</p> <p>Micro-Hydro Energy Recovery Opportunities in Water Distribution Systems: Impacts of Seasonal and Diurnal Demand Variabilities on Estimating Payback - Anna Zaklikowski, HDR Engineering</p>	<p>1:40-2:00 Abstract 74</p> <p>The Energy-Water Nexus and the Role of Carbon Capture and Sequestration - Vincent Tidwell, Sandia National Laboratories</p>	<p>1:40-2:00 Abstract 23</p> <p>Underground Injection and Sequestration and Underground Sources of Drinking Water - Richard Brown, Subsurface Technology, Inc.</p>
<p>2:00-2:20 Abstract 26</p> <p>Biocides 101: The Chemistry, Use, and Regulation of Biocides Used for Hydrocarbon Production - Donald J. Love, The Dow Chemical Company</p>	<p>2:00-2:20 Abstract 90</p> <p>Sustainable Solutions and Cost-Saving Applications for Small Water Systems: Case Studies - James J. Rhoades, Jr., Alfred Benesch & Company</p>	<p>2:00-2:20 Abstract 150</p> <p>Physico-Chemical Treatments for Flue-Gas Derived Water from Oxy-Fuel Power-Production with CO₂-Capture - Danylo Oryshchyn, DOE / NETL</p>	<p>2:00-2:20 Abstract 176</p> <p>ASR Application in Climate Change Adaptation: The Need, Issues and Research Focus - Y. Jeffrey Yang, USEPA ORD</p>
<p>2:20-2:40 Abstract 41</p> <p>Water Issues Related to Unconventional Oil and Gas Production - John Lucey, HDR Engineering</p>	<p>2:20-2:40 Abstract 101</p> <p>Scheduling Pump Operation to Save Energy Cost - Christine Dejan, The Regional Municipality of Durham</p>	<p>2:20-2:40 Abstract 60</p> <p>U.S. Geological Survey National Geologic Carbon Dioxide Sequestration Assessment Project - Peter D. Warwick, USGS</p>	<p>2:20-2:40 Abstract 126</p> <p>Demonstrating Stormwater Infiltration is Protective of Groundwater Quality - Heidi Blischke, GSI Water Solutions Inc</p>
<p>2:40-3:00 Abstract 162</p> <p>State Investigations of Oilfield Ground Water Contamination Incidents and Their Role in Advancing Regulatory Reforms - Scott Kell, Consulting Geologist</p>	<p>2:40-3:00 (full paper avail.) Abstract 120</p> <p>Applying a Sustainability Metric to Today's Standard Economic Analyses - Holly Johnson, N.A. Water Systems, a Veolia Water Solutions & Technologies Company</p>	<p>2:40-3:00 Abstract 177</p> <p>Proposed CO₂ Rules and the National UIC Program: A Multi-Stakeholder Perspective – Bob Van Voorhees, The Carbon Sequestration Council, and Scott Anderson, Environmental Defense Fund</p>	<p>2:40-3:00 Abstract 157</p> <p>Water Quality Considerations in Aquifer Storage & Recovery Systems: A Safe Drinking Water Act Perspective - Anna Zaklikowski, HDR Engineering</p>
<p>3:00-3:20 Abstract 16</p> <p>The "Bainbridge Natural Gas Incident" in Geauga County, Ohio: What Really Happened! - Tom Tomastik, Ohio DNR, Division of Mineral Resources Management</p>	<p>3:00-3:20 Abstract 88</p> <p>Feed Water Reduction in Industrial Water Purification Systems, William V. Collentro, Worcester Polytechnic Institute</p>	<p>3:00-3:40 DOE/NETL Initiatives Abstract 91</p> <p>Water and Carbon Storage Related Research at DOE/NETL - Andrea McNemar, Department of Energy / National Energy Technology Laboratory</p>	<p>3:00-3:20 Abstract 21</p> <p>Sustainable UV Disinfection Solutions for Large-Scale Municipal Applications – Katrina Williams, Trojan Technologies</p>
<p>3:20-3:40 Abstract 51</p> <p>The Comparative Analysis of Hydraulic Fracturing and Underground Injection – Dan Arthur, All Consulting</p>	<p>3:20-3:40 Abstract 145</p> <p>The Energy and Water Efficiency Benefits of Distributed Recycled Water Production Delivery – Graham Symmonds, Global Water Resources</p>	<p>Abstract 2 Regional Carbon Sequestration Partnership Water Working Group - Ryan J. Klapperich, Energy and Environmental Research Center, University of North Dakota</p> <p>Abstract 3 Managing Water from CCS Programs - Christopher Harto, Argonne NL</p>	<p>3:20-3:40 (full paper avail.) Abstract 174</p> <p>Need for Improvement in Methodology for Assessing Induced Seismicity Potential at an Injection Site - Dr. Chester Miller, Retired DuPont</p>

Tuesday, September 28 Cont'd.

4:00-6:00 Late Afternoon Sessions

<i>Water/Energy Sustainability Symposium Tracks</i>			<i>GWPC Annual Forum Tracks</i>
<p>Session Staff: Mike Nickolaus</p> <p>Water and Unconventional Natural Gas Production</p> <p><i>Managing Water After Well Stimulation</i></p> <p>Related Posters: 76</p> <p>Moderator- Robert Vagnetti, NETL</p>	<p>Session Staff: Dan Yates</p> <p>Water & Electric Power Generation</p> <p>Related Posters: 33</p> <p>Moderator-Kurt Hildebrandt, USEPA R7</p>	<p>Session Staff: Paul Jehn</p> <p>Water & Power Utilities</p> <p><i>Saving Water/Energy Resources</i></p> <p>Related Posters: 35, 53, 75, 115</p> <p>Moderator- Kathleen O'Connor, NY State Energy Research & Development Authority</p>	<p>Session Staff: Steve Musick</p> <p>Joint Water Availability & Sustainability/Water Quality Session:</p> <p><i>Water Resource Characterization and Assessment – Quality and Quantity</i></p> <p>Moderator- Marty Link, Nebraska DEQ</p>
<p>4:00-4:20 Abstract 73</p> <p>Economic Treatment of Frac Flow-Back Water to Recyclable Condition Using Physical Chemical Processes - David H. Manz, Pure Filtered Water International Ltd.</p>	<p>4:00-4:20 Abstract 19</p> <p>Water and Coal: A Case Study of Carbon Capture's Influence on Water in Colorado River Basin - Anna Sommer, Sommer Energy</p>	<p>4:00-4:20 Abstract 96</p> <p>Listening to Your System – Thomas Watts, Badger Meter, Inc.</p>	<p>4:00-4:20 Abstract 30</p> <p>Approach to Delineating and Assessing Saline Groundwater Resources in the Southern Mid-Continent and Adjacent Areas - Stanley T. Paxton, USGS OK Water Science Center</p>
<p>4:20-4:40 Abstract 165</p> <p>An Integrated Water Treatment Solution for Sustainable Water Resource Management in the Marcellus Shale - Matthew Bruff, Altela, Inc. Denver Technology Center</p>	<p>4:20-4:40 Abstract 133</p> <p>Beyond the Energy-Water Nexus – Developing Sustainable Water Supply Solutions for the Electric Power Industry - James M. Oliver, Schlumberger</p>	<p>4:20-4:40 Abstract 66</p> <p>The Link Between Water Loss & Energy Consumption: Southern California Edison's Embedded Energy in Water Pilot Program - Reinhard Sturm, Water Systems Optimization, Inc.</p>	<p>4:20-4:40 Abstract 175</p> <p>The North Carolina Groundwater Resource Evaluation Program - A Decade of Characterization of Fractured Bedrock Aquifers of the Piedmont and Mountains – Evan Kane, NC Dept. of Environment & Natural Resources</p>
<p>4:40-5:00 Abstract 169</p> <p>The Integrity of Ground Water Supplies in Areas of Oil and Gas Development-Andrew Stone, American Ground Water Trust</p>	<p>4:40-5:00 Abstract 97</p> <p>Measuring the Sustainability of Wastewater Reuse in Power Plant Cooling Systems - Briana Niblick, University of Pittsburgh</p>	<p>4:40-5:00 Abstract 153</p> <p>Recycling Conserves Water AND Energy - David J. Reardon, HDR, Inc.</p>	<p>4:40-5:00 Abstract 185</p> <p>Groundwater Classification Approaches: Importance and Applications – Kevin Frederick, WY DEQ</p>
<p>5:00-5:20 Abstract 119</p> <p>Sustainable Natural Gas Development through Superior Water Management - Robert Waits, 212 Resources</p>	<p>5:00-5:20 **Cancellation** Abstract 99</p> <p>Electric Utility Investment in Alternative Condenser Technologies: A Real Options Approach - Christian Lastoskie, University of Michigan</p>	<p>5:00-5:20 Abstract 171</p> <p>Easing the Water Constraints on Power Plant Cooling with Treated Municipal Wastewater: Insights from Pilot-scale Cooling Tower Tests- Radisav D. Vidic, University of Pittsburgh</p>	<p>5:00-6:10 Session Staff: Mary Musick</p> <p>GWPC Water Quality Division Meeting <i>(open to everyone)</i></p> <p>Division Chair- Audrey Eldridge, OR DEQ</p> <ul style="list-style-type: none"> -Ground source heat pump ground water protection regulation -Stormwater (Federal Regulatory Coordination) -open discussion
<p><i>Wrap up: Unconventional NG Production</i></p> <p>5:20-5:50 Abstract 22</p> <p>Deep Shale Natural Gas and Water Use, Part Two: Abundant, Affordable, and Still Water Efficient - Matthew E Mantell, Chesapeake Energy Corporation</p>	<p>5:20-5:40 Abstract 146</p> <p>Water Vulnerabilities for Existing Coal-fired Power Plants - Deborah Elcock, Argonne National Laboratory</p>	<p>5:20-5:40 Abstract 182</p> <p>The Carbon Footprint of Water - Wendy Wilson, National Program Director, River Network</p>	
<p>5:50-6:00 Discussion Session</p>	<p>5:40-6:00 Abstract 108</p> <p>Improvements in Thermoelectric Power Plant Water-use Data Collection and Dissemination by Federal Agencies – Timothy H. Diehl, USGS</p>	<p>5:40-6:00 Abstract 78</p> <p>Chicago Pump Station Upgrades Expected to Achieve LEED Certification and Reduce Carbon Footprint – Steven Hall, AECOM</p>	

Wednesday, September 29

8:00-10:00 Morning Sessions

<i>Water/Energy Sustainability Symposium Tracks</i>			<i>GWPC Annual Forum Tracks</i>
<p>Session Staff: Steve Musick Water Needs for Emerging Energy Technologies Moderator- Victoria Pebbles, Great Lakes Commission</p>	<p>Session Staff: Dan Yates Energy for Water Related Posters: 38, 69, 107 Moderator- Allan Hoffman, US DOE, Energy Efficiency & Renewable Energy</p>	<p>Session Staff: Paul Jehn Water Utilities <i>Saving Water/Energy Resources</i> Related Posters:123 Moderator- Art Hartstein, IBM</p>	<p>8:00-9:00 Session Staff: Mary Musick Joint Water Availability & Sustainability/Water Quality Session <i>Climate Change Adaptation</i> Moderator- Jim Taft, ASDWA</p>
<p>8:00-8:20 Abstract 7 Managing Renewable Energy Variability with Water – Tom Grabowski, Horizon Energy Group</p>	<p>8:00-8:20 (full paper avail.) Abstract 149 Evaluating Green Energy Options at Water and Wastewater Treatment Facilities - Fred Bloetscher, Florida Atlantic University</p>	<p>8:00-8:20 Abstract 65 Research to Help Drinking Water Utilities Optimize Energy Use - Linda Reekie, Water Research Foundation</p>	<p>8:00-8:20 Abstract 98 Assessing Water and Carbon Footprints for Green Water Resource Management - Y. Jeffrey Yang, USEPA ORD</p>
<p>8:20-8:40 Abstract 110 Analysis of Biofuel Production Scenarios and Their Regional Water Quality Impact – at the Upper MS River Basin May Wu, Argonne National Lab</p>	<p>8:20-8:40 Abstract 12 The Nexus of Asset Management and Energy Efficiency/Management - Heather Himmelberger, Environmental Finance Center New Mexico Tech</p>	<p>8:20-8:40 Abstract 111 Sustainable Wells: Role of Well Rehabilitation and Maintenance in Conservation - Stuart A. Smith, Smith-Comeskey Ground Water Science LLC.</p>	<p>8:20-8:40 Abstract 103 EPA's Climate Ready Water Utilities Activities - John Whittle, Water Security Division U.S. Environmental Protection Agency</p>
<p>8:40-9:00 Abstract 112 Water Use in Utility-Scale Solar Power Systems – Jordan Macknick, National Renewable Energy Laboratory</p>	<p>8:40-9:00 Abstract 37 Energy Efficiency Best Practices for Drinking Water Utilities - Vanessa M. Leiby, The Cadmus Group, Inc</p>	<p>8:40-9:00 Abstract 67 Energy Conservation Measures for Municipal Wastewater Treatment and Case Studies of Innovative Technologies and Practices - Laura Dufresne, The Cadmus Group, Inc.</p>	<p>8:40-9:00 Abstract 92 Water Supply Reliability for Energy Development Demands: Adaptation for Potential Climate Change – Andrew Wolfsberg, Los Alamos National Laboratory</p>
<p>9:00-9:20 Abstract 106 Algae as a Transportation Fuel: Research Direction and Initiatives – Mike Hightower, Sandia National Laboratories</p>	<p>9:00-9:20 Abstract 61 From Awareness to Implementation: How to Specify Energy Efficiency in Treatment Facility RFPs - Jess Burgess, CEE Municipal Water-Wastewater Initiative</p>	<p>9:00-9:20 Abstract 79 Water Efficiency at Public Power Utilities - J.P. Blackford, Environmental Services Engineer at the American Public Power Association</p>	<p>9:00-10:00 Session Staff: Steve Musick GWPC Water Availability & Sustainability Division Meeting <i>(open to everyone)</i> Division Chair- Jamie Crawford, MS DEQ Abstract 181 USGS National Water Census Groundwater Resources Program - Susan S. Hutson, USGS and Eric J. Evenson, Water Census Coordinator, USGS -open discussion</p>
<p>9:20-9:40 Abstract 20 GIS-Based Water Resource Geospatial Infrastructure for Oil Shale Development - Wei (Wendy) Zhou, Colorado School of Mines</p>	<p>9:20-9:40 Abstract 130 Finding Funding for Energy Efficiency Improvements at Water Utilities - Jonathan Gledhill, Policy Navigation Group</p>	<p>9:20-9:40 Abstract 104 Case Study of Energy Efficient, Sustainable Improvements and Technologies Implemented at Water Treatment Plants - Andrew L. Casolini Dal Bo, Wendel Companies</p>	
<p>9:40-10:00 Abstract 94 Potential Geochemical Releases to Groundwater from an In-situ Oil Shale Retort - Earl D. Mattson, Idaho Nat. Lab.</p>	<p>9:40-10:00 Abstract 84 Water Energy Relationship - Arvind Akela, CDM</p>	<p>9:40-10:00 Abstract 143 Accounting for the Carbon Costs of Alternative Water Supplies in the Tampa Bay Region - M. Jennison Kipp, University of Florida</p>	

10:20- 12:00 Mid-Morning Sessions			
<i>Water/Energy Sustainability Symposium Tracks</i>		<i>GWPC Annual Forum Tracks</i>	
<p>Session Staff: Paul Jehn</p> <p>Produced Water and Power Plant Discharge Water for Reuse</p> <p>Related Posters: 128 Moderator- Sandra McSurdy, NETL</p>	<p>Session Staff: Dan Yates</p> <p>Energy for Water (continued)</p> <p>Moderator- Allan Hoffman, US DOE, Energy Efficiency & Renewable Energy</p>	<p>Session Staff: Steve Musick</p> <p>Water Availability & Sustainability <i>Allocation Implementation of Water Rights/Laws</i></p> <p>Moderator- Andy Tolman, Maine Drinking Water Program</p>	<p>Session Staff: Mary Musick</p> <p>Water Quality <i>Green Projects</i></p> <p>Moderator- John Barndt, Delaware Dept. of Natural Resources & Envi Control</p>
<p>10:20-10:40 Abstract 5 Water Disposal, Emissions and Renewable Energy in the Oilfield – Zack Wasser, Purestream Technology</p>	<p>10:20-10:40 Abstract 13 The Energy-Water Nexus in Texas - Amy Hardberger, The Environmental Defense Fund</p>	<p>10:20-10:40 Abstract 28 Water Rights and Water Wrongs: Balancing the Interests of the Individual and the State in Water Allocation - Francine Rochford, La Trobe University School of Law</p>	<p>10:20-10:40 Abstract 117 Beyond Clean Water: The Triple Bottom Line Benefits of Green Stormwater Infrastructure - Matthew Vanaskie, CDM Water Resources</p>
<p>10:40-11:00 Abstract 50 Considerations for Use of Produced Water at Coal-Fired Power Plants – David Alleman, ALL Consulting</p>	<p>10:40-11:00 Abstract 70 Sustainable Use of Hydropower in a Drinking Water System - Pittsfield, MA - Christian Murphy, AECOM</p>	<p>10:40-11:00 Abstract 118 Developing a Sustainable Water Supply Strategy for the City of Plantation, Florida - Courtney Licata, Hazen and Sawyer, P.C</p>	<p>10:40-11:00 Abstract 49 Application of the Energy Service Company Model to Green Stormwater Infrastructure in Philadelphia - Matthew Condiotti, CDM</p>
<p>11:00-11:20 Abstract 64 Water Recovery, Recycling, Environmental Mitigation/Alternative Use of Brackish Coal Bed Methane Produced Water for Production and Well Completion Purposes - Allan R Sattler, Sandia National Lab.</p>	<p>11:00-11:20 Abstract 86 Memorandum of Understanding for Hydropower - Michael R. Gabaldon, Director, Technical Resources, Bureau of Reclamation</p>	<p>11:00-11:20 Abstract 11 Managing Groundwater on the Texas High Plains: Is Local Government Control Effective in Managing Regional Groundwater Resources? – Sherry Stephens, High Plains Underground Water Conservation District</p>	<p>11:00-11:20 Abstract 178 Recovery Act Financing for Ground Water Systems – Chuck Job, USEPA</p>
<p>11:20-11:40 Abstract 77 Use of Produced Water from the Illinois Basin by Coal-Based Power Plants – Chad Knutson, University of Illinois Urbana-Champaign</p>	<p>11:20-11:40 Abstract 6 Counting What Counts: Energy Audits and Efficiency Programs for Water Utilities and End Uses - Cat Shrier, Watercat Consulting, & Shahid Chaudhry, California Energy Commission</p>	<p>11:20-11:40 Abstract: 63 Groundwater Withdrawal and Regulations in the Eastern United States - Brandon Kernen, New Hampshire Department of Environmental Services</p>	<p>11:20-11:40 Abstract 138 Revised Rhode Island Stormwater Manual Incorporates Ground Water Protection Practices – Mark E. Nelson, Horsley Witten Group</p>
<p>11:40-12:00 Abstract 129 Pilot-Scale Constructed Wetland Systems for Treating Energy-Produced Waters - James W. Castle, Clemson University</p>	<p>11:40-12:00 Abstract 148 Making WaterSense – EPA Activities to Address the Energy/Water Nexus - Maura Browning, EPA, OGWDW</p>	<p>11:40-12:00 Open Discussion</p>	<p>11:40-12:00 Open Discussion</p>

Wednesday, September 29 Cont'd.

1:10-5:50 Closing Sessions

Session Staff: Paul Jehn		Session Staff: Steve & Mary Musick	
<p>1:10-3:00</p> <p style="text-align: center;">Water and Unconventional Natural Gas Production <i>Regulatory / Policy Consideration and Initiatives</i></p> <p>Moderator- Bob Sandilos, Chevron & State Review of Oil & Natural Gas Environmental Regulations (STRONGER) President</p>		<p>1:10-3:00</p> <p style="text-align: center;">Ground Water Quality and Availability and Sustainability <i>Regulatory / Policy Considerations and Initiatives</i></p> <p>Moderator- Jamie Crawford, MS DEQ, & John Barndt, Delaware Dept. of Natural Resources & Environmental Control</p>	
<p>1:10-1:30 Abstract 151</p> <p>Louisiana Haynesville Shale Model: Finding Success through Development of Flexible Institutions and Balanced Adaptive Water/Energy Management - Gary M. Hanson, Red River Watershed Management Institute Louisiana State University in Shreveport</p>		<p>1:10-1:30 Abstract 36</p> <p>Considerations for Implementation of the Underground Injection Control (UIC) Program for Carbon Dioxide Geologic Sequestration (GS) Wells - Jill Nogi, and Mary Rose Bayer, US Environmental Protection Agency</p>	
<p>1:30-1:50 Abstract 34</p> <p>Natural Gas Development in the Susquehanna River Basin - Jennifer Hoffman, Susquehanna River Basin Commission</p>		<p>1:30-1:50 Abstract 179</p> <p>Contaminants in Groundwater Sources Used for Public Supply - Patty Toccalino, USGS</p>	
<p>1:50-2:10 Abstract 18</p> <p>Hydraulic Fracturing and Drinking Water Resources – Robert Puls, USEPA - Robert S. Kerr Environmental Research Center Ground Water and Ecosystems Restoration</p>		<p>1:50-2:10 Abstract 62</p> <p>Unregulated Drinking Water Initiative for Environmental Surveillance and Public Health - Lorraine C. Backer, Team Lead and Senior Scientist, National Center for Environmental Health, Center for Disease Control and Prevention</p>	
<p>2:10-2:20 Abstract 107</p> <p>The RBDMS National Oil and Gas Data Portal - Stan Belieu, NE Oil & Gas & GWPC Vice-President</p>		<p>2:10-2:30 Abstract 48</p> <p>National Groundwater Monitoring Network- Pilot Studies- Daryll Pope, New Jersey Water Science Center, US Geological Survey</p>	
<p>2:20-3:10</p> <p><i>Panel – federal, state, & local regulatory update</i></p> <p>Moderator- Lori Wrotenberry, OK Corporation Commission</p> <ul style="list-style-type: none">• Ann Codrington, USEPA Office Of Ground Water & Drinking Water• David Neslin, Colorado Oil & Gas Conservation Commission• Jim Weaver, Tioga County Planning Department		<p>2:30-2:50 Abstract 180</p> <p>Evaluating Sustainability of Projected Water Demands under Future Climate Change Scenarios – Sujoy B. Roy, Tetra Tech</p>	
		<p>2:50-3:10</p> <p style="text-align: center;"><i>State Crystal Ball—Where Do We Go From Here?</i></p> <p><i>Climate Change Adaptation</i> <i>Protecting Drinking Water Supplies (Public and Unregulated)</i></p>	

Wednesday, September 29 Cont'd.

Closing General Session

3:20-5:50



Session Staff: Mike Paque

3:20-5:50 *Moving Forward – Emerging Water, Energy, and Climate Change Adaptation Considerations*

Moderator- Joe Lee, Pennsylvania Department of Environmental Protection & GWPC President

Perspective of Water, Energy and Climate Change

3:20-3:40 ****Cancellation**** Coal, Natural Gas, Climate & Water: Towards the Right Mix for Colorado, **Kristen Averyt** – NOAA Western Water Assessment **Abstract 113**

3:40-4:00 The Environmental Costs of Energy: A Discussion of the Trade-offs Involved in Energy Choices, **J. Daniel Arthur**, ALL Consulting **Abstract 170**

4:00-4:20 Adding Water to the Energy and Economic Equation — **Valerie Strassberg**, Nature's Voice Our Choice, Water/Energy **Abstract 114**

4:20-4:40 Energy Security: Water, Land, and Climate Change Adaptation – **Mike Hightower**, Sandia National Laboratory **Abstract 95**

Policy Strategies for Going Forward

4:40-5:00 US DOE Efforts to Broaden the Understanding of the Energy- Water-Climate Nexus — **Craig Zamuda**, Office of Climate Change Policy and Technology Office of Policy and International Affairs U.S. Department of Energy **Abstract 158**

5:00-5:20 Water, Energy, Climate Change Legislation—**Josh Johnson**, Senate Committee on Energy and Natural Resources **Bio 189**

Wrap-up: Water, Energy and Climate Change Adaptation

5:20-5:40 Water-Energy Nexus: Strategic Thinking – **Dr. Carey King**, University of Texas **Abstract 9**

5:40-5:50 GWPC Role... Final wrap-up **Joe Lee**

Scholarships Sponsored by: Range Resources

Student Event Scholarship Recipients:

Ashlynn Stillwell – University of Texas
Mindy Haulman - Duquesne University
Seth Sheldon – University of Massachusetts

Jenica Lee – Kalamazoo College
Xuexiang He - University of Cincinnati
Jessica Wilson – Carnegie Mellon University
Rachel Frohman – California University of Pennsylvania

Miguel Pelaez – University of Cincinnati
Changseok Han - University of Cincinnati
Rachel Michael - Duquesne University

Local Gov/Advocacy Scholarship Recipients:

Rick Torix – Oklahoma Marginal Well Commission
Joe Osborne – Group Against Smog & Pollution

Zelda Curtiss – Nine Mile Run Watershed Association
Mark Isaacson – Green County Combined Health Dist. Xenia OH
Ted Popovich – Group Against Smog & Pollution

Jim Weaver - Tioga County, PA
Ned Mulcahy – Three Rivers Waterkeepers

Event Exhibitors:

National Ground Water Association
Wendel
Alfred Benesch & Company
Idaho National Laboratory

National Farmers Union
212 Resources
Dow Microbial Control
EPA Decentralized MOU Group

Pennsylvania Department of Environmental Protection
National Energy Technology Laboratory
Pennsylvania Ground Water Association

Watercat Consulting
Environmental Service Laboratories, Inc.
Underground Injection Technology Council

Room: Grand Station Ballroom Foyer

Session Staff: Ben Grunewald

POSTER PRESENTATIONS

**All posters will be displayed Monday –Wednesday in Grand Station Ballroom Foyer
(presenters will be available during breaks and lunches as noted)**

Abstract #	Poster Title and Presenter	Presentation Time
Abstract: 1	Stimulating Gas Shale Without Hydraulic Fracturing - Ernest E. Carter , Carter Technologies Co.	Tuesday 1:00
Abstract: 25	Cyberinfrastructure for the Visualization and Simulation of Proposed Sustainable Practices in Dunkard Creek Watershed - Amanda Hughes , Carnegie Mellon U.	Tuesday 10:00
Abstract: 29	Hydrologic Cycle Energy Flux and the Water-Energy Nexus - Michael Sevenser , KCI Technologies, Inc	Tuesday 3:40
Abstract: 33	Water Requirements for Existing and Future Coal-Fueled Power Plants: Empirical and Modeled Data - Erik Shuster , USDOE– NETL	Tuesday 6:20
Abstract: 35	The Embedded Electricity in Water: Single-family Home, Phoenix, Arizona - Karen Collins , Salt River Project	Tuesday 6:20
Abstract: 38	Evaluating Water Quality & Energy Efficiency of Standard and Marketed "Green" Home Water Heating Systems - Randi Lieberman , Virginia Tech	Tuesday 6:40
Abstract: 46	The Energy-Water Collision: 10 Things You Should Know, Nadia Madden , Union of Concerned Scientists	Tuesday 6:40
Abstract: 53	Sustainable Cooling Water Treatment Using Controlled Hydrodynamic Cavitation - Philip Vella , VRTX Technologies	Wednesday 10:00
Abstract: 55	Use of Nanofiltration to Reduce Cooling Tower Water Usage - Susan J. Altman , Sandia National Laboratories	Tuesday 3:40
Abstract: 56	Potable Reuse Aquifer Storage Recovery Projects and Regulations - Cat Shrier , Watercat Consulting	Tuesday 3:40
Abstract: 69	Pilot Projects on Sustainable Water Management and Green Building Approaches - Laura Dufresne , The Cadmus Group, Inc	Wednesday 10:00
Abstract: 75	Evaluating Sustainable Non Chemical Water Treatment Technologies for Commercial/Industrial Cooling Tower Applications - Peter F. Johnson , AECOM	Wednesday 12:20
Abstract: 76	Source Water Quality and Drinking Water Disinfection By-Product Specifications in the Monongahela River Basin - Jessica Wilson , Carnegie Mellon University	Tuesday 6:20
Abstract: 87	Approaches for Assessing Groundwater Availability Under Competing Demands and Climate Change – John Vaccaro , USGS, Washington Water Center	not attending
Abstract: 93	Zeolite Sorbents for Treatment of Water for Reuse – William Collentro , Worcester Polytechnic Institute	Tuesday 1:20
Abstract: 102	Understanding Water Sector Interdependencies – A Critical Step to Enhancing Resiliency - Laura Flynn , Water Security Division U.S. EPA	Tuesday 1:00
Abstract: 107	Risk and Insurance Issues -- Green Infrastructure Design - Robert Hughes , Insurance and risk advisor to design firms	Wednesday 12:20
Abstract: 115	Rainfall = CO2: Green Infrastructure as Solution - Valerie Strassberg , Nature's Voice Our Choice	Wednesday 10:00
Abstract: 123	Going Green In Your Power and Automation Design is Like a River - Grant Van Hemert , Water Wastewater Competency	Monday 11:30
Abstract: 128	Produced Water Treatment and Use as a Water Resource, Forbes Guthrie , Produced Water Development, LLC	Wednesday 12:20
Abstract: 142	North American Unconventional Fuel Resources Interactive Map & Digital Repository Project - Michelle M. Kline , University of Utah	Tuesday 1:20
Abstract: 154	Design and Development of the Alternative Water Source Information System (AWSIS) - Roy Arthur , ALL Consulting; and Nathan Alleman , ALL Consulting	Tuesday 10:00
Abstract: 159	NF-co-doped TiO ₂ for Visible/Solar Treatment and Disinfection of Water Including Applications in Developing Countries - Miguel Pelaez , U. of Cincinnati	Tuesday 1:20
Abstract: 160	UV/H ₂ O ₂ Process for Treatment of β-lactam Antibiotics in Water - Xuexiang He , University of Cincinnati	Tuesday 10:00
Abstract: 161	Development of CNT-based sensors for detecting cyanotoxins in water - Changseok Han , University of Cincinnati	Tuesday 3:40
Abstract: 184	Interdependent Water, Energy and Carbon Management Issues and Assessment Models for Basin-Scale Energy Development - Andrew Wolfsberg , Los Alamos National Laboratory	Tuesday 1:00

PRESENTATION SYNOPSES

1	<p style="text-align: center;">Stimulating Gas Shale Without Hydraulic Fracturing</p> <p>Ernie Carter, P.E., President Carter Technologies Co <i>Carter, is a former downhole tools designer for the Halliburton Co, now a professional consultant in underground environmental engineering, grouting, and deep earth barriers.</i> Shale contains vast deposits of natural gas but recovering it requires hydraulic fracturing. The huge volumes of water injected raise many environmental questions. In 2009 a preliminary study was done to come up with an alternative to fracturing that injects less water, is more predictable, and costs less than hydraulic fracturing. The approach selected was to mechanically cut a planar slot from a horizontal lateral within the shale. The typical slot would have 500,000 square feet of surface and be wide enough to eliminate pressure drop back to the well. Two competing drilling hardware concepts were developed and modeled.</p>
2	<p style="text-align: center;">Regional Carbon Sequestration Partnerships Water Working Group</p> <p>Ryan J. Klapperich, Research Scientist, Energy & Environmental Research Center (EERC), University of North Dakota (UND) <i>Ryan Klapperich has an M.S. in Geology from UND and is a Research Scientist at the EERC specializing in hydrogeology.</i> Contributing Authors: Charles Gorecki, EERC, UND; Andrea McNemar, U.S. Department of Energy National Energy Technology Laboratory The U.S. Department of Energy National Energy Technology Laboratory has been developing the technology, infrastructure, and regulations to implement large-scale carbon capture and storage (CCS) from a regional perspective through the Regional Carbon Sequestration Partnerships Program, which consists of seven regional partnerships. Partnership members have formed the Water Working Group, the goals of which are to address the concerns of the public and industry regarding CCS technology and its potential relationships with water resources. Members of the WWG represent different regions of North America, and each region has its own opportunities and challenges related to water resources and CCS.</p>
3	<p style="text-align: center;">Managing Water from CCS Programs</p> <p>Christopher Harto, Energy and Environmental Policy Analyst, Argonne National Laboratory <i>B.A. Chemical Engineering – Ohio State University; M.S. Sustainability – Arizona State University; Research - life cycle assessment, water quality, and water consumption</i> Contributing Authors: John Veil, Argonne National Laboratory, Andrea McNemar, DOE National Energy Technology Laboratory This presentation explores how large volumes of salty water, extracted from a formation receiving CO₂ for sequestration, can be managed when they are brought to the surface. The presentation provides preliminary information on options for managing the water that is removed from the formations, the costs of those options, and the potential for beneficial use of the water. It also looks at the characteristics and composition of water within targeted formations and how they impact the options for managing these waters and any risks they may pose to drinking waters if not managed responsibly.</p>
4	<p style="text-align: center;">Water Availability and Management in Shale Gas Operations</p> <p>John A. Veil, Manager - Water Policy Program, Argonne National Laboratory <i>John Veil studies and analyzes water and waste issues affecting the oil and gas and electric power industries.</i> This presentation describes the steps involved with production of natural gas from shale formations. It focuses on the use of water to develop the wells and on management of the resulting wastewater from the wells. Individually, wells require a moderate amount of water, but collectively, over a region, the total volume of water needed can be significant. Likewise, management of the wastewater from many wells requires multiple options and some infrastructure.</p>
5	<p style="text-align: center;">Water Disposal, Emissions and Renewable Energy in the Oilfield</p> <p>Chris Jahn, Vice President of R&D, Purestream Technology <i>Mr Jahn has over 40 years of experience in the oil and gas industry, relative to water treatment and disposal</i> Purestream Technology introduces The Trilogy System. An economically viable, environmentally responsible solution created to address waste water disposal, air emissions and create combined heat and power. Trilogy effectively treats wastewater at the well head by removing 97% of total dissolved solids (TDS) from input streams, including oil and condensate. Clarified output streams exit at less than 10 ppm, exceeding drinking water standards, and are then evaporated or reused beneficially. Hydrocarbons are also recovered and isolated for future use. Trilogy also provides complete, remote tracking of produced wastewater, oil and condensate from point of origin to point of disposal or sale.</p>

6	<p style="text-align: center;">Counting What Counts: Energy Audits and Efficiency Programs for Water Utilities and End Uses</p> <p>Cat Shrier, Ph.D., P.G., President, Watercat Consulting LLC <i>Cat Shrier is President of Watercat Consulting, facilitating communication and understanding of innovative approaches to water management and policy. Shahid Chaudhry is the California Energy Commission's Water and Energy Integration Program Manager, with more than 28 years' experience on water and energy and climate change impacts.</i> Contributing Authors: Shahid Chaudhry, California Energy Commission</p> <p>This paper reviews different approaches to efforts by state and federal agencies to address the energy needs of water supply, and to move towards more sustainable and integrated approaches to water and energy related to water supply and end use. The 2005 California Energy Commission (CEC) Water-Energy study, which found that the state's water supplies account for roughly 19% of the state's annual electricity use and 33% of its non-electricity-related natural gas consumption, leading to development of CEC's Integrated Water-Energy Program to provide technical assistance and project financing for water and wastewater utilities for energy efficiency, energy cost management and carbon emissions reductions. More recently, Executive Order 13514, signed October 5, 2009, called for Federal Leadership in Environmental, Energy and Economic Performance, including development, implementation, and annual updates by Federal Agencies of Strategic Sustainability Performance Plans to prioritize sustainability actions based on a positive return on investment for the American taxpayer and to meet energy, water, and waste reduction targets.</p>
7	<p style="text-align: center;">Managing Renewable Energy Variability with Water</p> <p>Thomas A. Grabowski, Smart Grid Systems Architect, Horizon Energy Group <i>Mr. Grabowski has 30 yrs+ of electrical engineering and project management experience in the utility industry, including managing the design, development and installation of substation controls, evaluating and implementing new Smart Grid technologies, and working with utility agencies to improve transmission system plans, and design/build procedures to reduce process costs. He holds a BSEE and MSEE.</i> Contributing Authors: Steven W. Pullins (lead author), President, Horizon Energy Group</p> <p>To increase the penetration of renewable energy, the US is transforming to a Smart Grid environment. With renewables typically comes a variability issue. A Smart Grid addresses the variability through active application of controls and energy storage. New research shows that distributed renewables in a Smart Grid environment can be effectively paired with water production (e.g. desalination) to mitigate the variability of renewables. This presentation describes the concept and how such an architecture will benefit the industry and consumers.</p>
8	<p style="text-align: center;">Incorporating Water Constraints into Electric Transmission Planning</p> <p>Alex Schroeder, Program Director, Western Governors' Association <i>Alex Schroeder is a program director with the Western Governors Association and works on issues related to electricity, transportation fuels, and nuclear waste and spent fuel. Alex joined WGA in 2005 and holds a B.S. in General Engineering from the University of Illinois and an M.S. in Engineering and Technology Management at the Colorado School of Mines.</i> Contributing Authors: Tom Iseman, Program Director, Western Governors' Association</p> <p>The Western Governors' Association, Western Interstate Energy Board and Western Electricity Coordinating Council are working with diverse stakeholders through the Regional Transmission Expansion Project (RTEP) to analyze electric transmission requirements under a broad range of alternative energy futures to develop long-term, interconnection-wide transmission expansion plans. As part of the RTEP, WGA is working with the Western States Water Council, the national labs and other stakeholders with responsibility for water supply management and electricity production to develop a better understanding of the impacts of our energy choices on water and identify policies that will facilitate sustainable use of a limited resource.</p>
9	<p style="text-align: center;">Water-Energy Nexus: Strategic Thinking</p> <p>Carey King, PhD, Research Associate, Center for International Energy and Environmental Policy, The University of Texas at Austin <i>Dr. King studies the energy-water nexus, net energy and implications for economics, and other subjects of energy systems integration</i></p> <p>This closing keynote presentation highlights some of the broad trends of the energy-water nexus from electricity to transportation. I also introduce policy concepts that can be influential in mitigating conflicts between energy and water resource development in the future.</p>
10	<p style="text-align: center;">How Water Treatment Drives Regional Power Demands and What Can Be Done About It</p> <p>F. Bloetscher, Ph.D., P.E. and Laura Simons, Florida Atlantic University, Boca Raton, FL 33431 <i>Dr. Bloetscher is an Assistant Professor at Florida Atlantic University and President of Public Utility Management and Planning Services, Inc. He has worked for local governments in utility management for 20 years.</i></p> <p>This paper outlines the impact of water treatment on the power grid, conflicts for water resources between power and water and potential solutions to better use limited water resources. The water supply situation is most limited in the west, but the south is not far behind. Both regions are growing as opposed to the water-rich Midwest. As a result, to meet power needs, changes in current power generation should be evaluated. Water quality needs should be reviewed to optimize the water/power nexus. An example of where this water quality issue has arisen is southeast Florida where limited fresh water supplies have cause regulatory agencies to push utilities to higher levels of treatment that are expected the generate over 2 GW of power demands in the next 20 years. Meanwhile the grid cannot support this demand to FPL is looking at nuclear power on very low lying property.</p>

11	<p align="center">Managing Groundwater on the Texas High Plains: Is local government control effective in managing regional groundwater resources?</p> <p>Sherry Stephens, Executive Aide, High Plains Underground Water Conservation District <i>Professional experience includes 25 years of operations and personnel management, twelve of which occurred in the municipal water utilities field.</i> It's called the "right to capture." Texas water law affirms a landowner's ownership of groundwater beneath his tract of land and the right to use it for beneficial purposes as long as it is not wasted. The water district is a local organization designed to maintain those individual rights, while at the same time providing for the orderly development and wise use of the groundwater within its jurisdiction.</p>
12	<p align="center">The Nexus of Asset Management and Energy Efficiency/Management</p> <p>Heather Himmelberger, Director, NM Environmental Finance Center <i>Ms. Himmelberger is a professional engineer with degrees from Penn State and Johns Hopkins who has delivered numerous trainings in asset management throughout the country.</i> Asset Management is used by the water/wastewater industry to determine the most cost effective way to deliver the desired level of service. This process changes the way a utility looks at its assets and leads a utility to a more sustainable economic and operational future. The water/wastewater industry is also being asked to look more closely at energy usage and reduce energy usage or convert to more "green" energy approaches. Currently much of these two efforts are taking place independently of each other. However, there are extremely strong ties between the two that will be explored in this presentation.</p>
13	<p align="center">The Energy-Water Nexus in Texas</p> <p>Amy Hardberger, Environmental Defense Fund <i>Any is a hydrologist and an attorney with the Texas office of Environmental Defense Fund. Ms. Hardberger works with the Energy Program and the Water Program on Texas policy issues.</i> Energy and water are intimately interrelated: we use energy for water and we use water for energy. To understand this issue locally University of Texas and EDF sought to quantify this relationship in Texas. Results revealed that approximately 482,100 acre-feet of water are consumed annually for cooling the state's thermoelectric power plants. At the same time, Texas uses an estimated 2.1 to 2.7 TWh of electricity for water systems and 1.1 to 2.2 TWh for wastewater systems each year. This study highlighted data gaps as well as the need to integrate these systems through policy.</p>
14	<p align="center">Natural Gas and Water in the New Energy Economy</p> <p>Richard Ward, Energy Future Coalition <i>Shell Group, EHS Strategy and Plan Manager (The Netherlands); Environmental Manager / Hydrologist (Saudi Arabia); Contaminant Hydrologist (San Francisco); Exploration Geologist; (Houston); BS Stanford Univ. (Geology); MS Stanford Univ. (Petroleum Geology)</i> Natural gas promises to be a game changer in the energy system with positive and negative effects on water supply and quality. The past decade has spawned dozens of initiatives aimed at responsibly producing unconventional natural gas. To date, these initiatives have not been successful in assuring the public. Indeed as the development has progressed, public concern about the environmental impact on groundwater has swelled to civic outrage leading to drilling moratoria in many basins. This talk describes a multi-lateral initiative bringing together industry, NGOs and government leaders as a force for change. The aim is to consolidate initiatives and lead key stakeholders in a collaborative effort to promote improved standards by codifying the best in class processes and procedures for natural gas development.</p>
15	<p align="center">Zero Discharge Recycling Process for Marcellus Shale Frac Water</p> <p>Tom Lewis, President & CEO, Lewis Environmental Services, Inc. <i>Mr. Lewis is a graduate of Carnegie-Mellon University with a B.S. in Chemical Engineering. Mr. Lewis is leader in using activated carbon for nontraditional applications and has successfully treated over 500,000,000 gallons of waste water. The innovated and efficient use of this material has him widely known as "George Washington Carbon".</i> Mr. Lewis' presentation will discuss the technical and economic advantages of recycling Marcellus Shale frac water utilizing the ENVIRO-SHALE PROCESS (ESP) (patent pending). Shale gas waste water has a matrix of organic and inorganic contaminants which makes brine recovery difficult. The zero discharge process utilizes a proprietary treated activated carbon, which simultaneously removes organic and inorganic contaminants from the same waste stream. The ESP process effectively removed organic and inorganic contaminants such as barium and strontium and recovered a pure salt product. Treatment economics and the technology's ability to meet Pennsylvania's new discharge limits will be reviewed.</p>

16	<p style="text-align: center;">The “Bainbridge Natural Gas Incident” in Geauga County, Ohio: What Really Happened!</p> <p>Tom Tomastik, Geologist 4, Ohio DNR, Division of Mineral Resources Management <i>BS and MS in Geology from Ohio University, Oil and Gas Consultant 1982-1988, UIC Geologist ODNR, DMRM 1988-Present</i> Contributing Authors: Dr. E. Scott Bair, Professor, The Ohio State University, Department of Geological Sciences On December 15, 2007, an explosion occurred in the home at 17975 English Drive, Bainbridge Township, Geauga County, Ohio. The cause of the explosion and subsurface migration of natural gas into the nearby water wells was quickly determined to be caused by the overpressurization of the surface-production casing annulus of the English #1 gas well. The severity and duration of the ensuing health and safety issues and determination of how the natural gas reached the local water wells was the focus of the Division’s investigation. In May of 2009, the Division assembled an expert panel to evaluate as to how the natural gas migrated to the water wells, the areal extent of the gas invasion, and the future duration of the natural gas within the aquifers.</p>
17	<p style="text-align: center;">Global Drivers and Mechanisms to Balance the Energy-Water Nexus</p> <p>Jan Dell, Vice President, Energy Division, CH2M HILL <i>Ms. Dell is a chemical engineer (M.S. UC Berkeley) with 20+ years of experience on energy and water projects in 40 countries.</i> Water availability is becoming a critical factor in energy production operations and development plans and is anticipated to influence long-term profitability in the Energy sector. If the water intensity of energy production is overlooked, significant risks to business and society will result: (1) power shortages and higher costs as droughts are proven to cause supply interruptions to all users, (2) increased water scarcity: increased use of water by power producers will increase stress to all users, and (3) inadvertent overuse of water by corporations. The development of new Energy-Water module to the WBCSD Global Water Tool will be presented.</p>
18	<p style="text-align: center;">Hydraulic Fracturing and Drinking Water Resources</p> <p>Robert W. Puls, Ph.D., Ground Water & Ecosystems Protection Division, National Risk Management Research Laboratory, Office of Research and Development, U.S. EPA <i>Dr. Robert Puls is the technical lead for the EPA’s Hydraulic Fracturing Study and Senior Research Scientist in the Ground Water and Ecosystems Restoration Division of the National Risk Management Research Laboratory in Ada, Oklahoma.</i> Natural gas plays a key role in our nation’s energy future and the process known as hydraulic fracturing (HF) is one way of accessing that resource. Over the past few years, several key technical, economic, and energy developments have spurred increased use of HF for gas extraction over a wider diversity of geographic regions and geologic formations. Advances in horizontal drilling technologies and new hydraulic fracturing fluid compositions have greatly increased the extraction efficiency for shale gas development. Along with the expansion of HF, there have been increasing concerns about its potential impacts on drinking water resources, public health, and environmental impacts in the vicinity of these facilities. In its Fiscal Year 2010 budget report, the U.S. House of Representatives Appropriation Conference Committee identified the need for a focused study of this topic by the Environmental Protection Agency. Key questions to be addressed by the study are:</p> <ul style="list-style-type: none"> • Under what hydraulic fracturing scenarios might drinking water resources be adversely impacted? • What approaches are effective for protecting drinking water resources throughout each stage of the hydraulic fracturing lifespan? <p>Objectives of the study are:</p> <ul style="list-style-type: none"> • Identify vulnerability factors and risks relevant to hydraulic fracturing and protection of water resources • Document and assess factors that affect the vulnerability of water resources throughout the hydraulic fracturing lifespan • Produce tools that can be used to support decisions relevant to hydraulic fracturing and protection of water resources <p>A case study approach together with collection and analysis of existing data will be used to accomplish these objectives. The case studies will allow collection of new data on a site-specific and regional or basin-wide scale.</p>
19	<p style="text-align: center;">Water and Coal: A Case Study of Carbon Capture’s Influence on Water in the Colorado River Basin</p> <p>Anna Sommer, President, Sommer Energy <i>Ms. Sommer is an electricity consultant. She has an MS from UC-Berkeley and studies civil engineering at McGill University.</i> Coal-fired power plants generate 50 percent of our electricity and yet are responsible for roughly a third of greenhouse gas emissions in the U.S. Though it can decrease emissions by as much as 90 percent, carbon capture at coal plants increases water use by up to 85 percent. A system of equations that can estimate the water consumed by coal plants retrofitted with post-combustion capture is given. That system of equations is applied to a case study of the Upper Colorado River to ask the questions, “How much more water is needed and what impact will it have on streamflow?”</p>

20	<p style="text-align: center;">GIS-Based Water Resource Geospatial Infrastructure for Oil Shale Development</p> <p>Wei (Wendy) Zhou, Ph. D., wzhou@mines.edu,(303)384-2181 Department of Geology and Geological Engineering, Colorado School of Mines, 1516 Illinois St. Golden, CO 80401, Associate Professor Presentation Synopsis <i>Dr. Wendy Zhou is an associate professor at the Department of Geology and Geological Engineering, Colorado School of Mines. Her education background includes a Ph.D. degree in Geological Engineering, and a Master's degree in Computer Science, both from Missouri University of Science and Technology.</i> Contributing Authors: Matthew Minnick (mminnick@mines.edu), Mengistu Geza (mgezanis@mines.edu), Kyle Murray (Kyle.Murray@utsa.edu) Her presentation today is about development of a GIS-based regional/basin water resource geospatial infrastructure for storing, managing, analyzing, visualizing, and disseminating oil shale related data. The goal of this research is to develop products that can facilitate solutions for environmental and water resource issues and data management related problems for potential oil shale development in the Western United States.</p>
21	<p style="text-align: center;">Sustainable UV Disinfection Solutions for Large-Scale Municipal Applications</p> <p>Katrina Williams, P. Eng., Product Platform Manager, Trojan Technologies <i>Katrina Williams is the Product Manager at Trojan Technologies responsible for UV disinfection products for wastewater applications. She is an environmental engineer with a Bachelor of Applied Science from Queens University in Kingston Ontario Canada.</i> Contributing Authors: Wayne Lem, P.Eng., Trojan Technologies ; Jennifer L. Muller, Trojan Technologies Global water quality and quantity issues are set to dominate the sustainability agenda in the 21st century. Population growth, climate change and increasing demand for water mean we have to do more with less. Large urban areas are especially vulnerable and recent trends in rainwater harvesting and water reuse will become mainstream. As municipalities face the pressing issue of water scarcity, Trojan Technologies has led the way providing solutions for some of the largest applications using environmentally responsible, cost-effective ultraviolet (UV) light for drinking water and water recycling applications. Three large-scale projects in the US employing UV disinfection technology will be presented along with how UV helps meet their sustainability goals and address their local water issues.</p>
22	<p style="text-align: center;">Deep Shale Natural Gas and Water Use, Part Two: Abundant, Affordable, and Still Water Efficient</p> <p>Matthew E. Mantell, P.E., Corporate Environmental Engineer, Chesapeake Energy Corporation <i>Matt is responsible for produced water management, water treatment and reclamation, environmental issues with hydraulic fracturing, and water sourcing and supply development.</i> This presentation is an update to “Deep Shale Natural Gas: Abundant, Affordable, and Surprisingly Water Efficient” originally developed for the 2009 GWPC Water/Energy Symposium. This presentation will discuss the water efficiency of deep shale natural gas compared to other energy resources using the most up to date operational data for shale gas development and incorporating the current successes in produced water reuse and recycling; address concerns regarding the “permanent removal of water from the hydrologic cycle” compared to other water users; and will discuss the parasitic effect that carbon capture and sequestration technology has on power generation.</p>
23	<p style="text-align: center;">Underground Injection and Sequestration and Underground Sources of Drinking Water (Protecting Valuable Resources)</p> <p>Rick Brown, Subsurface Technology, Inc. and Jerry W. Taylor, PG, Certified Geologist/Project Manager, Subsurface Technology, Inc. <i>Mr. Taylor is a professional geologist with over 30 years experience in petroleum exploration and production, underground injection and sequestration and groundwater quality protection.</i> Underground injection and sequestration has proven to be an excellent method for management and final disposition of liquid wastes. More recently, underground injection and sequestration has emerged as the leading candidate to manage anthropogenic CO2 in response to climate change concerns. Given the continued stress on groundwater resources due to rising demand and changing climate conditions, it is imperative that all necessary efforts be taken to protect this diminishing resource. Underground injection and sequestration offers an excellent method for management of liquid waters (instead of surface water discharge) while also protecting underground sources of drinking water. There are over 150,000 injection wells currently operating throughout the United States to inject and sequester various types of liquid waste deep underground. Emerging uses of underground injection and sequestration include disposal of “reject” from groundwater desalination plants, aquifer storage and recovery operations, and sequestration of anthropogenic CO2. Protection of underground sources of drinking water is an integral part of the injection well siting, construction, operating, and abandonment process. This presentation will discuss the multi-layered groundwater protection methods in the underground injection and sequestration regulatory program.</p>

24	<p style="text-align: center;">Water Use, Electric Power, and Nuclear Energy: A Holistic Approach to Environmental Stewardship</p> <p>William Skaff, Nuclear Energy Institute <i>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.</i></p> <p>Holistic environmental management requires balancing the relationships among all relevant environmental media and making responsible trade-offs appropriate to the unique characteristics of each ecosystem where an electricity generation facility already exists or is to be deployed. Holistic environmental management applies to EPA 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. But pending EPA regulations may force once-through systems to retrofit to cooling towers. Cooling towers consume twice as much water as once-through cooling systems. Scientific study demonstrates that once-through cooling systems do not have an adverse impact on aquatic life populations. 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.</p>
25	<p style="text-align: center;">Cyberinfrastructure for the Visualization and Simulation of Proposed Sustainable Practices in Dunkard Creek Watershed</p> <p>Amanda Hughes, Ph.D. Student, Carnegie Mellon University <i>Amanda is a joint Ph.D. student in Civil & Environmental Engineering and Engineering & Public Policy at Carnegie Mellon University.</i></p> <p>Contributing Authors: Jeanne VanBriesen Ph.D, Carnegie Mellon University</p> <p>Dunkard Creek meanders across the Pennsylvania-West Virginia border several times. In September 2009, the Creek experienced a complete fish and mussel kill. The primary cause of the kill was a toxic bloom by an invasive algal species. It is believed that the bloom was enabled by high total dissolved solids, which likely originated from local mining activity. Integration of a cyberinfrastructure with a watershed model is enabling analysis of spatio-temporal correlations of potentially relevant water quality variables, particularly those associated with high TDS. Results will inform policies for sustainable water withdrawal and hydraulic fracturing fluid disposal.</p>
26	<p style="text-align: center;">Biocides 101: The Chemistry, Use, and Regulation of Biocides Used for Hydrocarbon Production</p> <p>Donald J. Love, Technical Service and Development Specialist, The Dow Chemical Company <i>Graduate of Saginaw Valley State University with a B.S. in Chemistry, 13 years experience in chemical industry</i></p> <p>The use of biocides is critical to the safe and efficient operation of hydrocarbon production. Recently, there has been significant concern about the chemical additives that enable hydraulic fracturing technology, and much of that concern is due to misinformation. This is especially true regarding the use of biocides, which due to their name and their intended use have elicited an inflated perception of danger. This presentation seeks to inform the audience of the science behind biocides, their use in hydrocarbon production, and how they are regulated in the United States to assure safety for both the environment and workers.</p>
27	<p style="text-align: center;">Assessing Water Use and Availability Trends in New Hampshire</p> <p>Brandon Kernen, New Hampshire Department of Environmental Services <i>New Hampshire Department of Environmental Services - Supervisor, Hydrology and Conservation</i></p> <p>NH has partnered with the USGS to conduct several studies to assess trends associated with water use and availability in NH. These studies include assessing statistical trends associated with thousands of water levels historically collected in NH, measuring and developing and applying approaches to estimate state-wide water use, developing tools to estimate baseflow and the development of regional groundwater models to assess the relative impact of climate change, land use development and increased water use. Policymakers and scientist are considering this information on specific projects and as NH assesses ways to refine its approach to more proactively and holistically manage water resources.</p>
28	<p style="text-align: center;">Water Rights and Water Wrongs: Balancing the Interests of the Individual and the State in Water Allocation</p> <p>Dr Francine Rochford, Senior Lecturer, La Trobe <i>In 2010 Dr Rochford is a Visiting International Scholar in the Environmental and Natural Resources Law Program at Lewis and Clark Law School in Portland, Oregon</i></p> <p>Overallocation of water in the Murray-Darling Basin in the eastern states of Australia has prompted an extensive overhaul of the principles and techniques of water allocation. This attempts to create a compromise between consumptive and non-consumptive users, including power generators, and the needs of a sensitive and threatened environment. This paper will consider the new techniques of mediating competing uses, and will address the potential for these techniques to apply to arid states in the western United States. In particular, it will compare the capacity of current allocation mechanisms to address environmental concerns in water allocation in the western states, and impediments to change. It will consider the means by which those constraints were overcome in the Australian system, and assess the likelihood of success if similar processes were applied in the United States.</p>

29	<p style="text-align: center;">Hydrologic Cycle Energy Flux and the Water-Energy Nexus</p> <p>Michael Sevenser, P.E., BCEE <i>Mr. Sevenser has worked 30 years in both water and petrochemical industries. From an initial perspective that oil and water do not mix he now believes that both are strongly linked together in current planning and engineering.</i> Contributing Authors: Jonathan Meyers, P.E. The global hydrologic cycle requires massive inputs of energy to evaporate water. The source of energy driving this process is the Sun and the amount of energy required can be estimated by considering the mass of water evaporated on an annual basis and the heat of vaporization (enthalpy) of water. Calculations show that this amount of energy far exceeds energy inputs from human sources. This simplified estimation of the energy embodied in the global hydrologic cycle deals with just one effect of the effects of solar radiation warming the Earth's surface. Others include wind, ocean currents, and vegetative photosynthesis. The focus on the global hydrologic cycle is chosen to demonstrate a more direct link between water and energy for water and wastewater professionals.</p>
30	<p style="text-align: center;">Approach to Delineating and Assessing Saline Groundwater Resources in the Southern Mid-Continent and Adjacent Areas</p> <p>Stanley T. Paxton, Studies Chief, USGS Oklahoma Water Science Center <i>Paxton has industrial, academic, and government work experience. His current position at USGS provides opportunity for conducting interdisciplinary water-resource studies.</i> Contributing Authors: Marvin Abbott – USGS Oklahoma Water Science Center; Jonathan Gillip – USGS Arkansas Water Science Center; and Lester Williams – USGS Georgia Water Science Center Saline groundwater is an untapped resource common to most sedimentary basins. As a result, the USGS is conducting pilot studies in the southern midcontinent and adjacent areas of the U.S. for delineating and assessing volumes of saline groundwater. Products of this effort will be of value to managers and scientists concerned with planning for water-resource needs, including groundwater for commercial use and desalinization of water for consumptive and recreational uses. The methodologies that emerge from this work will be exportable to other parts of the United States where delineation and assessment of saline water is important to economic development and sustainability.</p>
31	<p style="text-align: center;">Stronger Guidelines on Hydraulic Fracturing</p> <p>Contributing Authors: Lori Wrotenbery, Oil and Gas Director, Oklahoma Corporation Commission <i>Harvard Law, Oklahoma Corporation Commission</i> Jim Erb, Consultant Mike Nickolaus, GWPC Presentation of Guidelines for states on Hydraulic Fracturing developed by STRONGER - State Review of Oil and Natural Gas Regulations.</p>
32	<p style="text-align: center;">Diversion of Existing Groundwater Infrastructure for Geothermal Heat Exchange</p> <p>Matthew J. Hammer, P.G., Project Manager, Sanborn, Head & Associates, Inc., Akron, Ohio <i>Matthew is a consulting hydrogeologist, co-author of the Compendium of Hydrogeology and an adjunct geology professor at Kent State University.</i> Contributing Authors: Dr. Vicky Freedman Research Scientist Pacific Northwest National Laboratory A major investment in open loop GSHPs is the capital for a wellfield and associated outside plumbing. A significant savings in costs exists for buildings with groundwater infrastructure in place for manufacturing processes, environmental remediation, or other purposes not associated with geothermal heating and cooling. The diversion of groundwater streams in such facilities for geothermal energy use prior to re-entry into the intended process could significantly save energy costs at groundwater-using facilities across the country. Guidance on how candidate systems could be identified will be presented.</p>
33	<p style="text-align: center;">Water Requirements for Existing and Future Coal-Fueled Power Plants: Empirical and Modeled Data</p> <p>Erik Shuster, Engineer, Department of Energy – National Energy Technology Laboratory <i>Erik Shuster is currently an engineer at the National Energy Technology Laboratory. He holds a Master's degree in chemical engineering from the University of Pittsburgh.</i> Reliable power plant water use data is important for the development of dependable water planning, forecasting, and screening tools and models since thermoelectric power plants are among the largest users of fresh and saline water. The use of water models and screening tools can aid in the forecasting of water demands, the development of future water/energy policies, and the development and placement of emerging technologies. Water/energy related work at the National Energy Technology Laboratory (NETL) provides reliable water use data from reported and modeled coal-fueled power plants in the United States.</p>
34	<p style="text-align: center;">Natural Gas Development in the Susquehanna River Basin</p> <p>Jennifer Hoffman, Manager, Monitoring & Assessment Program, Susquehanna River Basin Commission <i>M.S. Biology, Shippensburg University; Work History: 1997 - present; Susquehanna River Basin Commission</i> The Susquehanna River Basin Commission regulates water withdrawals, consumptive uses, and diversions in the Susquehanna River Basin. The Commission strives to manage the water resources of the Basin responsibly, allowing economic development while protecting the Basin's environmental resources. Since 2008, increased pressure has been applied to the streams and rivers of the Basin in response to natural gas industry activity in the Marcellus Shale formation, particularly on the smaller coldwater, headwater systems. This presentation will focus on the Commission's response to regulating the natural gas industry, as well as provide an overview of water's role in natural gas development.</p>

35	<p style="text-align: center;">The Embedded Electricity in Water – Single-family Home, Phoenix, Arizona</p> <p>Karen Collins, Senior Analyst, Water Strategy & Sustainability, Salt River Project <i>Karen Collins manages water conservation and sustainability programs for SRP's Water Group. She has a Master's degree in Economics.</i></p> <p>Contributing Authors: Jamie Ashby, Rotating Engineer, Salt River Project</p> <p>Salt River Project (SRP) provides water and power to customers and water shareholders in central Arizona. This analysis examines electricity embedded in the water use cycle for a “typical” single-family household in the City of Phoenix. The water use cycle was broken down into water supply and conveyance, treatment, distribution, household end-use of water, and wastewater collection and treatment. The analysis shows that 3,500 kWhs of electricity are embedded in the water used by the typical household modeled. Reductions in water use at the household level will result in additional water savings back at the power plant.</p>
36	<p style="text-align: center;">Considerations for Implementation of the Underground Injection Control (UIC) Program for Carbon Dioxide Geologic Sequestration (GS) Wells</p> <p>Jill A Nogi, Office of Ground Water and Drinking Water, US Environmental Protection Agency Contributing to the Presentation: <i>Jill Nogi holds a BS in Geology from the College of William and Mary, and an MPH from Johns Hopkins University. She joined EPA in 1997, and has been with the UIC program since 2009.</i></p> <p>Mary Rose Bayer, Office of Ground Water and Drinking Water, US Environmental Protection Agency <i>Mary Rose Bayer holds a BA and an MS in Geology from the SUNY Geneseo and Texas A&M University, respectively. She has been with the UIC program since joining the Agency in 2007.</i></p> <p>Contributing Authors: Joseph Tiago and Bruce Kobelski, Office of Ground Water and Drinking Water, US Environmental Protection Agency</p> <p>In July 2008, EPA issued a proposed rule under the Safe Drinking Water Act (SDWA) to address the GS of carbon dioxide and introduce Class VI injection wells. The proposed regulations recognize the unique nature of this injection activity, and when final, will assure protection of underground sources of drinking water (USDWs). The final rule will apply to owners and operators of permitted Class VI injection wells. States are encouraged to apply to EPA for primary enforcement responsibility (primacy) for the Class VI program. States with approved programs can issue Class VI permits. EPA will be conducting nationwide training workshops on rule implementation for UIC Directors, and on primacy applications for interested states. In addition, EPA is developing guidance documents for UIC Directors, and injection well owners and operators, to assist with meeting the new requirements.</p>
37	<p style="text-align: center;">Energy Efficiency Best Practices for Drinking Water Utilities</p> <p>Vanessa M. Leiby, Principal, The Cadmus Group, Inc. <i>Ms. Leiby has a B.S. and M.S. in Zoology in aquatic ecology and aquatic toxicology from The Ohio State University. She has over 30 years' experience as an environmental scientist and policy analyst in drinking water. Prior to joining Cadmus in 2003, she was the Executive Director of the Association of State Drinking Water Administrators for 10 years.</i></p> <p>Presentation Synopsis: Providing safe drinking water and reliable wastewater services is a highly energy-intensive activity in the U.S. with estimates of \$4 billion spent annually for energy in the water sector. This is equivalent to 56 billion kilowatt hours consumed annually and the release of 44.8 million tons of greenhouse gas. Drinking water systems can significantly reduce energy costs and improve efficiency by working with their energy providers; developing an energy baseline and conducting energy audits; and implementing energy efficiency improvements. This presentation will discuss energy efficiency best practices in management, plant improvements, water treatment, water distribution, water conservation, and alternative/renewable energy.</p>
38	<p style="text-align: center;">Evaluating Water Quality and Energy Efficiency of Standard and Marketed "Green" Home Water Heating Systems</p> <p>Randi Lieberman, PhD Student, Virginia Tech <i>Conducting PhD work in the field of water, energy, and sustainability at Virginia Tech with Dr. Marc Edwards.</i></p> <p>Contributing Authors: Sheldon Masters, Virginia Tech, and Marc A. Edwards, Virginia Tech</p> <p>Residential water heating is linked to the primary source of waterborne disease in the U.S. and accounts for greater energy demand than the combined water/wastewater utility sector. Yet, there has been little practical research characterizing these systems. Scientific uncertainties associated with existing “green” advice have potentially created misguided policy with long-term negative repercussions. This work conducts head-to-head testing of a standard and marketed “green” residential water heater and characterizes the systems in terms of microbial growth, chemical properties, temperature profiles, and energy efficiency. By evaluating these differences, this research seeks to eliminate ambiguity between marketed “green” systems and traditional systems.</p>
39	<p style="text-align: center;">The Changing Legal Landscape of the Water Industry</p> <p>Seth A. Mendelsohn, Corporate Counsel, Pennsylvania American Water Company <i>B.A. University of Pittsburgh; J.D. Dickinson School of Law; M.B.A. Lebanon Valley College Work History: Corporate Counsel, Pennsylvania American Water Company (2004-present); Senior Deputy Attorney General, Pennsylvania Office of Attorney General (1997 - 2004); Adjunct Professor, Lebanon Valley College M.B.A. Program; Author, Pennsylvania Civil Practice.</i></p> <p>The water industry is changing as it responds to the needs of alternative energy suppliers including those engaged in the emerging Marcellus Shale industry. This program will examine what's new in water law, new ideas in water allocation agreements, recent regulatory enactments, the need for infrastructure replacement, and the future of the water industry.</p>

40	<p style="text-align: center;">Considerations for Water Treatment and Re-Use in Shale Gas Development</p> <p>David Alleman, Senior Environmental Manager, - ALL Consulting, LLC <i>Mr. Alleman has over 20 years of experience in energy-related environmental research including management and re-use of produced water.</i> Contributing Authors: David Winter; J. Daniel Arthur, P.E., SPEC; As shale gas development increases, it will become more important to manage produced water in a way that reduces costs, protects the environment, and meets local needs. The National Energy Technology Laboratory has an ongoing program designed to encourage domestic oil and gas production by providing the science and technologies needed to resolve water and energy issues. As part of that Program, ALL Consulting is developing a Produced Water Catalog and Decision Tool that will help shale gas producers make well-informed water treatment decisions with an emphasis on those options that will allow for beneficial use of the water. This paper will review the issues that are causing more and more operators to consider treatment, and the treatment options that are available.</p>
41	<p style="text-align: center;">Water Issues Related to Unconventional Oil and Gas Production</p> <p>John T. Lucey Jr, Senior Vice President, HDR Engineering <i>John has served as process engineer and/or project leader for over 100 industrial water/wastewater projects</i> Presentation Synopsis – Maximum 100 words (This presentation will address the issues that must be considered and alternative approaches that can be utilized to process the flow back water that is generated by hydro fracturing shale formations to produce natural gas. The presentation will focus on the Marcellus Shale formation, and will address the hydro fracturing process, the quantity and quality of water produced, and the alternatives that can be utilized to treat and reuse this water. Specific examples of onsite treatment alternatives and centralized treatment facilities will be discussed.</p>
42	<p style="text-align: center;">Protecting Groundwater Quality: The Spring Creek Watershed Drilling Ordinance Success Story</p> <p>Todd Giddings, Ph.D., P.G., President, Todd Giddings and Associates, Inc. <i>Todd is a consulting hydrogeologist and has more than 40 years of experience in ground-water resources development, management, and remediation.</i> Pennsylvania has no statewide regulations for the proper construction of residential water wells and geothermal heat pump system boreholes. The 100,000+ residents in the 175 square-mile Spring Creek Watershed in Centre County are 99.99% dependent on groundwater and use more than 16 million gallons per day. The Spring Creek Watershed Commission created a workgroup chaired by Todd Giddings that developed a model ordinance that requires residential water well casings and geothermal boreholes to be grouted to protect groundwater quality. Isolation distances, casing materials and minimum lengths, and approved grouting materials and depths are also specified in the model ordinance.</p>
43	<p style="text-align: center;">Low Impact Development Stormwater Controls and Changing State and Federal Regulations</p> <p>Steven P. Roy, Geosyntec Consultants, Inc. <i>Steven Roy is a Principal with Geosyntec in their Acton, MA office. A LEED Accredited Professional, he's been with Geosyntec since 2000 and he has over 30 years experience in water resources assessment and management.</i> State and federal stormwater regulations are directing more stormwater to be managed via infiltrating or retain on site systems. Low Impact Development stormwater controls present the new tools for stormwater management. Maintaining pre-development hydrology appears to be the new standard. Several new federal drivers will be presented including the Energy Independence and Security Act Section 438 and Executive Order 13514. The potential impacts on groundwater quality are likely to vary site-by-site. This presentation will discuss several new state and federal stormwater regulatory and development initiatives that will direct stormwater controls toward infiltration and groundwater recharge</p>
44	<p style="text-align: center;">Water-Energy Research at the U.S. Department of Energy</p> <p>Allan R. Hoffman, Senior Analyst, U.S. Department of Energy (DOE) <i>Dr. Hoffman, Senior Analyst in DOE's Office of Energy Efficiency and Renewable Energy, has most recently focused on water-energy issues.</i> Presentation Synopsis: There is a great deal of research activity underway in several DOE programs and its supporting National Laboratories. This presentation will provide context for and some details of these activities.</p>
45	<p style="text-align: center;">The Impact of Non-Point Source Contamination on the Surficial Aquifer of the Delmarva Peninsula</p> <p>Judith M. Denver, Hydrologist, U.S. Geological Survey <i>Studies of the geochemistry of Coastal Plain groundwater and the transport and transformation of anthropogenic chemicals in different hydrogeologic environments.</i> The surficial aquifer that blankets the Delmarva Peninsula is particularly susceptible to contamination from human activities because soils and aquifer sediments are relatively permeable and the water table is shallow. Nearly half of the peninsula is used for agriculture, and chemicals applied for crop production are commonly detected in groundwater withdrawn for domestic and public supply. Nitrate is the most common chemical detected at concentrations that exceed drinking water standards. Increases in the application of nitrogen in fertilizer and manure from the 1950s through 2000 are reflected in increasing concentrations of nitrate in groundwater over time.</p>

46	<p style="text-align: center;">The Energy-Water Collision: 10 Things You Should Know</p> <p>Nadia Madden, Energy-Water Project Associate, Union of Concerned Scientists <i>Nadia contributes to research and outreach for a UCS initiative focused on how energy choices impact water resources.</i> Contributing Authors: Erika Spanger-Siegfried, John Rogers, and Christopher Wallace, Union of Concerned Scientists When it comes to energy and water, it's hard to have one without the other—producing energy uses water, and providing freshwater uses energy. Power plants, for example, use water to cool the steam that spins the electricity-generating turbines; fuel producers use water for mining coal, extracting petroleum, or growing crops for biofuels. Using water in our communities requires getting it there, treating it, heating it, and more. Because of these links between energy and water, problems for one resource can create problems for the other, and the energy-water connection can easily turn into a collision.</p>
47	<p style="text-align: center;">Terry Engelder</p> <p>Bio: Terry Engelder, a leading authority on the recent Marcellus gas shale play, holds degrees from Penn State B.S. ('68), Yale M.S. ('72) and Texas A&M, Ph.D. ('73). He is currently a Professor of Geosciences at Penn State and has previously served on the staffs of the US Geological Survey, Texaco, and Columbia University. Short-term academic appointments include those of Visiting Professor at Graz University in Austria and Visiting Professor at the University of Perugia in Italy. Other academic distinctions include a Fulbright Senior Fellowship in Australia, Penn State's Wilson Distinguished Teaching Award, membership in a US earth science delegation to visit the Soviet Union immediately following Nixon-Brezhnev détente, and the singular honor of helping Walter Alvarez collect the samples that led to the famous theory for dinosaur extinction by large meteorite impact. He has written 150 research papers, many focused on Appalachia, and a book, the research monograph "Stress Regimes in the Lithosphere". In the international arena, he has worked on exploration and production problems with companies including Saudi Aramco, Royal Dutch Shell, Total, Agip, and Petrobras.</p>
48	<p style="text-align: center;">National Groundwater Monitoring Network- Pilot Studies</p> <p>Daryll Pope, Groundwater Specialist, New Jersey Water Science Center, U.S. Geological Survey <i>Daryll has a B.S. in Watershed Science from Colorado State University and a Masters in Contaminant Hydrology from Oregon Graduate Institute.</i> Contributing Authors: William L. Cunningham, Assistant Chief, Office of Ground Water, U.S. Geological Survey The Subcommittee on Ground Water (SOGW) is a subgroup of the federal Advisory Committee on Water Information (ACWI) working to develop a National Ground Water Monitoring Network (NGWMN). Five pilot projects are testing the concepts outlined in the NGWMN design document and producing information that will be incorporated into the NGWMN design. The pilot projects are evaluating the distribution of wells, well measurement and/or sampling frequency, field practices, database elements, data management procedures, and overall network costs. A web-based data portal prototype will be developed to serve data from the pilots.</p>
49	<p style="text-align: center;">Application of the Energy Service Company Model to Green Stormwater Infrastructure in Philadelphia</p> <p>Matt Condiotti, Project Engineer, CDM <i>Matt Condiotti works for CDM in Philadelphia and works with the Philadelphia Water Department</i> Contributing Authors: Mark Maimone, Project Engineer, CDM, and Joanne Dahme, General Manager of Public Affairs, PWD Presentation discusses the concept of applying the energy service company (ESCO) model to green stormwater infrastructure in Philadelphia in the form of stormwater service companies (SSCOs).</p>
50	<p style="text-align: center;">Beneficial Use of Produced Water at Coal-Fired Power Plants</p> <p>David Alleman, Senior Environmental Manager, ALL Consulting, LLC <i>Mr. Alleman has over 20 years of experience in energy-related environmental research including management and re-use of produced water.</i> Contributing Authors: J. Daniel Arthur, P.E., SPEC; David Alleman; Nathan Alleman; ALL Consulting, LLC In recent years, rising populations, regional droughts, and diminishing groundwater levels have forced coal-fired power plants to temporarily curtail or cease energy production for lack of available cooling water. As part of NETL's program to reduce freshwater usage at coal-fired power plants, ALL Consulting is developing an internet-based catalog of alternative sources of cooling water. This paper will discuss the findings associated with the use of produced water at coal-fired power plants, including geographic quantity and quality trends, and considerations of utilizing oil- and gas-produced water as a means towards reducing freshwater withdrawal and consumption at coal-fired power plants.</p>

51	<p style="text-align: center;">The Comparative Analysis of Hydraulic Fracturing and Underground Injection</p> <p>J. Daniel Arthur, P.E., SPEC, President, ALL Consulting, LLC <i>Over 25 years experience in UIC, hydraulic fracturing and unconventional resource development. He has recently been appointed to serve on a National Petroleum Council Study and a DOE Federal Advisory Committee.</i></p> <p>Contributing Authors: Greg Casey, P.E.; Brian Bohm, P.G.; ALL Consulting.</p> <p>Hydraulic fracturing has recently received attention in the press and in Congress. Hydraulic fracturing is a well-developed technology that has been used for more than 40 years, its widespread use for coal-bed natural gas and shale gas development has raised questions about the current regulation and the protection of groundwater resources. In response, Congress introduced the Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act). The FRAC Act would amend the Safe Drinking Water Act to regulate hydraulic fracturing under the same laws and regulations that are used for the Underground Injection Control program. This paper examines hydraulic fracturing and the practice of underground injection and provides a comparative discussion.</p>
52	<p style="text-align: center;">Zero discharge management of Marcellus frac water returns</p> <p>Paul Ziemkiewicz, PhD, Director, West Virginia Water Research Institute <i>BS 1973 Biology, Utah State Univ.; MS 1975 Range Mgt., Utah State Univ. ;PhD 1979 Forestry, Univ. of British Columbia Work History: Alberta Energy 1978-1988 Director, Reclamation Research and Project Manager, Office of Coal Research and Technology West Virginia University 1988-present, Director, West Virginia Water Research Institute</i></p> <p>Contributing Authors: Jennifer Barker Fulton, Program Manager, West Virginia Water Research Institute</p> <p>The objective of our research is to develop and demonstrate a process for treating Frac Water Returns (FWR) from Marcellus horizontal development wells that will allow full recycle while decreasing makeup water and disposal requirements. The costs will be measured against reduced water sourcing, transportation and disposal costs. Treatment consists of electro-coagulation and a multi-media FilterSure, Inc. unit in series with the goal of producing water suitable for frac makeup. The project will also evaluate volumes, chemistries and disposal options for reject streams.</p>
53	<p style="text-align: center;">Sustainable Cooling Water Treatment Using Controlled Hydrodynamic Cavitation</p> <p>Philip Vella, Ph.D., VRTX Technologies <i>Technical Director for VRTX Technologies responsible for technical support and R&D for cooling water, wastewater, biofuels, remediation, drinking water and other environmental areas using Controlled Hydrodynamic Cavitation.</i></p> <p>Cooling towers can account for up to 30% of the total water used in an average building are very dynamic, and treatment of the water is required to control microbial growth, scaling, corrosion and fouling. This paper describes a non-chemical cooling water treatment technology based on the principals of Controlled Hydrodynamic Cavitation (CHC). CHC controls bacteria, converts dissolved calcium into calcium carbonate solids, and limits corrosion. Operational results are presented to summarize the application of CHC for cooling water applications. Performance data, including scale control, corrosion and bacteria reduction are presented. Data showing a 60% – 80% reduction in blowdown water will be presented.</p>
54	<p style="text-align: center;">Assessing Thermal Impacts of an Open-Loop Ground Source Heat Pump</p> <p>Vicky L. Freedman, Senior Research Scientist, Pacific Northwest National Laboratory (PNNL) <i>Ph.D. Environmental Science, Ohio State University; M.S. Watershed Hydrology, University of Arizona; B.A. English, University of Michigan.</i></p> <p>Contributing Authors: Scott R. Waichler, Rob D. Mackley, Jake A. Horner Pacific Northwest National Laboratory</p> <p>A thermal analysis of a large-scale (e.g., 1900 gpm), open-loop ground source heat pump (GSHP) installed on the Pacific Northwest National Laboratory (PNNL) campus in southeastern Washington State has been performed using an integrated field and modeling approach. Since heat rejection to the subsurface will occur year-round, potential thermal impacts to upgradient production wells, and the nearby Columbia River are a potential concern. Hence, thermal impacts of the open-loop GSHP were investigated to identify operational scenarios that minimized downgradient environmental impacts at the river, and upgradient temperature drift at the production wells.</p>
55	<p style="text-align: center;">Use of Nanofiltration to Reduce Cooling Tower Water Usage</p> <p>Susan J. Altman, Principal Member of Technical Staff, Sandia National Laboratories <i>Susan Altman has a Ph. D. in Hydrogeology from The Pennsylvania State University. She has worked at Sandia National Laboratories for over 15 years.</i></p> <p>Contributing Authors: Malynda Cappelle, Center for Inland Desalination, University of Texas at El Paso; Richard Jensen, Randy Everett, Andres L. Sanchez, Sandia National Laboratories</p> <p>Nanofiltration (NF) can effectively treat cooling-tower water to reduce water consumption and maximize water usage efficiency of thermoelectric power plants. A pilot is being run to verify theoretical calculations. A side stream of water from a 900 gpm cooling tower is being treated by NF with the permeate returning to the cooling tower and the concentrate being discharged. The membrane efficiency is as high as over 50%. Salt rejection ranges from 77 – 97% with higher rejection for divalent ions. The pilot has demonstrated a reduction of make-up water of almost 20% and a reduction of discharge of over 50%.</p>

56	<p style="text-align: center;">Potable Reuse Aquifer Storage Recovery Projects and Regulations</p> <p>Cat Shrier, Ph.D., P.G., President, Watercat Consulting LLC <i>Cat Shrier is President of Watercat Consulting, facilitating communication and understanding of innovative approaches to water management and policy. Dr. Shrier has led work on aquifer storage and conjunctive water management policy, planning, and permitting issues for 13 years.</i></p> <p>Reclaimed water reuse is increasingly being seen as a means of expanding and conserving available water supplies, with aquifer storage via direct injection considered as a means of storing reclaimed water, providing an economically viable means of storing advanced treated water while providing an “environmental buffer” and additional subsurface treatment before reuse. While aquifer recharge and storage have often been used for nonpotable reclaimed reuse, there are a few potable reuse direct injection systems currently in operation or under development in Texas, California, Florida, and Arizona. There are regulatory concerns regarding water quality and injection of microorganisms into underground sources of drinking water, as well regulations that recognize aquifer storage as a means of creating subsurface water quality improvements and an “environmental buffer.” As managers, practitioners, regulators, and other stakeholders involved in aquifer storage and potable reuse become more familiar with each others’ risks, constraints, and management measures, there will be greater opportunities to practice safe Potable Reuse ASR.</p>
57	<p style="text-align: center;">Protecting Pennsylvania’s Drinking Water through Computer Modeling and Geospatial Analysis</p> <p>Alfred Guisepppe, Professional Geologist, SSM Group, Inc. <i>Specializing in groundwater computer modeling, Mr. Guisepppe has been working on numerous water resources projects for the past ten years.</i></p> <p>The quality of Pennsylvania’s drinking water is threatened by a variety of land use activities. Mining, natural gas exploitation, urbanization, and agriculture activities force the Commonwealth to protect its most valuable natural resource from further loss. The Source Water Protection Technical Assistance Program (SWP-TAP) is a Pennsylvania Department of Environmental Protection (PADEP) project aimed to assist community water systems develop a source water protection plan. This session will provide three examples from across the commonwealth where computer modeling and geospatial analysis can help a water system identify and manage potential water quality threats to its water supply.</p>
58	<p style="text-align: center;">GWPC’s Risk Based Data Management System (RBDMS)</p> <p>Paul Jehn, GWPC</p> <p>The GWPC developed the Risk Based Data Management System (RBDMS) for regulatory agencies to use in managing and analyzing oil, gas and water program data. The GWPC’s approach to increasing data availability through the RBDMS and its Web interfaces focuses on partnering with federal and state agencies, industry groups, and citizens. Developing and sustaining a family of RBDMS e-commerce applications that have specific purposes for water resources protection and oil and gas regulation depends on such partnerships. The success of the RBDMS initiative reflects the dedication and contributions of the agency project managers to build consensus among the stakeholders, and the willingness of industry to be an active partner in these endeavors. States use RBDMS to assess and reduce risks to USDWs. RBDMS provides data about well locations, permitting, and production to the public and industry owners through its Web interfaces. RBDMS also integrates oil and gas resource data and state source water protection planning. States using RBDMS have collectively saved millions of dollars and have greater confidence in regulatory decisions.</p>
59	<p style="text-align: center;">Applications in the use of Isotope Geochemistry to Identify the Origin of Methane in the Environment</p> <p>Fred Baldassare, P.G., Geologist, Pennsylvania Department of Environmental Protection <i>Fred Baldassare serves as the statewide consultant for the Department of Environmental Protection in the application of isotope geochemistry to characterize sources of stray carbon dioxide and methane.</i></p> <p>Isotope geochemistry provides powerful geochemical evidence for investigations to identify the origin of stray methane in groundwater and the shallow subsurface. Methane in groundwater and the shallow subsurface can occur naturally, or as the result of anthropogenic activity, including operating and abandoned gas wells, coal mines, and landfills. Molecular analyses combined with the analyses of the stable carbon and hydrogen isotopes, and the radioactive isotope of carbon allow us to distinguish microbial gas from thermogenic gas, and thermogenic gases of different origins. Interpretations of isotope data provides focus early on in a stray gas investigation, and when combined with other elements of the investigation, provides multiple lines of evidence to identify the source of stray methane. Case studies utilizing this approach will be discussed.</p>
60	<p style="text-align: center;">U.S. Geological Survey National Geologic Carbon Dioxide Sequestration Assessment Project</p> <p>Peter D. Warwick, Chief, Carbon Sequestration - Geologic Project, U.S. Geological Survey, Reston, VA <i>Dr. Warwick is a Research Geologist specializing in energy resource assessments in the USGS Energy Resources Program.</i></p> <p>In 2007, the Energy Independence and Security Act (Public Law 110–140) authorized the U.S. Geological Survey (USGS) to conduct a national assessment of available geologic storage resources for carbon dioxide (CO₂) in consultation with the U.S. Environmental Protection Agency, the U.S. Department of Energy, and State geological surveys. An assessment methodology report (Brennan and others, 2010, http://pubs.usgs.gov/of/2010/1127), published in June, 2010, documents the probability-based methodology to be used by the USGS to assess the Nation’s geologic storage resources for CO₂. Assessment results will be compiled and released to the public as a USGS publication.</p>

61	<p style="text-align: center;">From Awareness to Implementation: How to Specify Energy Efficiency in Treatment Facility RFPs</p> <p>Jess Burgess, Industrial Program Manager, Consortium for Energy Efficiency <i>Jess leads the Municipal Water-Wastewater Initiative at the Consortium for Energy Efficiency. His professional background focuses on energy efficiency program design and policy planning. Jess holds a Masters of City Planning from MIT.</i> Awareness is growing that energy efficiency offers significant value to water and wastewater utilities. However there is no accepted standard for specifying energy efficient process design in treatment facility project RFPs. The result is that cost-effective high-efficiency designs are often not seriously considered for implementation, allowing the municipal water treatment industry to lag far behind its technical potential. This presentation will provide straightforward guidance on how to specify energy efficiency in project requests, and how to leverage local and federal resources to assist with implementation. It draws from the CEE Energy Efficiency RFP Guidance for Water & Wastewater Facilities, a public information resource developed by the Consortium for Energy Efficiency in cooperation with the Water Environment Federation.</p>
62	<p style="text-align: center;">Unregulated Drinking Water Initiative for Environmental Surveillance and Public Health</p> <p>Lorraine C. Backer, PhD, MPH, Team Lead and Senior Scientist, National Center for Environmental Health, Centers for Disease Control and Prevention <i>Research includes assessing public health impacts from contaminants in drinking and recreational waters, including marine and freshwater harmful algal blooms.</i> 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.</p>
63	<p style="text-align: center;">Groundwater Withdrawal and Regulations in the Eastern United States</p> <p>Brandon Kernen, PG - Supervisor, Hydrology and Conservation Program State water law in the eastern United States is highly variable. While almost all eastern states rely on common law (case study law interpreted by the court system), a number of states have developed additional codified (written) laws or regulations that establish regulatory processes, standards, or criteria for entities that have or want to develop large groundwater withdrawals. Many states have also prioritized water uses and some even have established water use fees. This talk will summarize the work of New Hampshire's legislative Groundwater Commission to assess how other eastern water law states manage their groundwater.</p>
64	<p style="text-align: center;">Water Recovery, Recycling, Environmental Mitigation/Alternative Use of Brackish Coal Bed Methane Produced Water for Production and Well Completion Purposes</p> <p>Allan R Sattler, Sandia National Laboratories <i>Allan Sattler, recently in carbon sequestration, spent much of last decade, reclaiming produced water from hydrocarbon production for alternative uses.</i> Contributing Authors: Malynda Cappelle and Susan Altman Sandia National Laboratories, Enid Sullivan, Los Alamos National Laboratory * Now at UTEP Recently, the producer asked us to consider moving desalination equipment to salt water disposal facilities and treat brackish water for potential alternative uses (including hydraulic fracturing). The production areas are isolated and transportation of fresh water is very costly. There are obvious advantages to treating water produced on site: (1) economic (on site production of frac water), (2) simplified oversight agency interaction- little water hauling, use of treated water for alternative purposes, (3) engineering/QC since RO/NF water is in the 200-500 TDS range, and "new water". Additional alternative uses include drilling, well maintenance/cleanout, fire suppression and weed control.</p>
65	<p style="text-align: center;">Research to Help Drinking Water Utilities Optimize Energy Use</p> <p>Linda Reekie, Project Manager, Water Research Foundation <i>Linda Reekie graduated with a Bachelor of Science degree from Penn State and currently manages research projects on water utility management, environmental, and energy topics.</i> Contributing Authors: Steve Conrad, Simon Fraser University; Jack Geisenhoff, EMA, Inc.; Vanessa Leiby, The Cadmus Group Energy demand for water utilities to deliver a safe, reliable water supply to customers is expected to increase in the short term in response to population growth, energy intensive advanced treatment for challenged water quality source waters, and water extraction from sources that are farther from the treatment plant. The Water Research Foundation has funded research projects to help water utilities manage their energy demand more effectively to reduce both energy costs and consumption. This presentation will showcase findings of some projects including:</p> <ul style="list-style-type: none"> • Decision Support System (DSS) for Sustainable Energy Management, which resulted in the development of a DSS tool that can help a water utility make decisions to support goals for energy and emissions reductions. Typical goals for water and wastewater utilities include reductions in non-renewable energy use, GHG emissions and cost. Additionally, increasing renewable energy use is another typical goal. The tool uses quantitative measures of energy use, energy cost, GHG emissions, and the percentage of renewable energy use. • Energy Efficiency in the North American Water Supply, which through the development of a literature review and a series of case studies, identifies a variety of potential options for drinking water utilities to explore to reduce energy consumption and save money. These practices were organized and consolidated into eight major areas including management tools, plant improvements and management changes, water treatment, water distribution, water conservation, alternative / renewable energy sources, financial assistance, and partnerships.

66	<p style="text-align: center;">The Link between Water Loss and Energy Consumption – Southern California EDISON’s Embedded Energy in Water Pilot</p> <p>Reinhard Sturm, VP-Operations, Water systems Optimization, Inc., <i>Reinhard Sturm is a leading water loss control specialist with extensive experience in North America and internationally.</i> Contributing Authors: Paul Thomas, Southern California EDISON The presentation will discuss the components and results of one of Southern California Edison’s pilot projects, which looked at the link between distribution system water losses and the energy embedded in distribution system water losses.</p>
67	<p style="text-align: center;">Energy Conservation Measures for Municipal Wastewater Treatment and Case Studies of Innovative Technologies and Practices</p> <p>Laura Dufresne, P.E. Senior Associate, The Cadmus Group, Inc. <i>Ms. Dufresne is an Environmental Engineer with the Cadmus Group, Inc. specializing in sustainable water and wastewater treatment technologies.</i> Contributing Authors: Steve Couture, the Cadmus Group Inc. and Ken Henderson, HDR The presentation will describe energy conservation measures (ECMs) for municipal wastewater treatment plants with a special focus on innovative and emerging ECMs that have been developed and implemented over the last 5 years. Examples of innovative ECMs are ultra-efficient motors, new high-speed “turbo” blowers with low-friction bearings, and advanced aeration control systems. The presentation will also describe case studies of selected facilities that have implemented innovative ECMs and will include capital cost information, energy use and costs before and after implementation of ECMs, impacts on other processes and operational parameters (e.g., chemicals, solids processing, equipment maintenance), energy efficiency gains, and payback period.</p>
68	<p style="text-align: center;">Great Lakes Energy Water Nexus Initiative</p> <p>Victoria Pebbles, Program Director, Great Lakes Commission <i>With 25 years of experience in national and regional environmental policy, Victoria Pebbles directs the Great Lakes Commission’s program on Economy and Society. Her current work focuses on wind energy, the energy-water nexus, climate change, and aquatic habitat restoration.</i> This presentation will describe the Great Lakes Commission’s “Great Lakes Energy Water Nexus Initiative” or GLEW. GLEW is developing Great Lakes region-specific energy-water nexus maps, a modeling tool that can demonstrate water resource impact tradeoffs under different power production scenarios, and a report on the region’s energy-water nexus that analyzes the relationships between energy and the Great Lakes environment. These Initiative outputs aim to better integrate environmental considerations into existing energy planning and regulatory decision-making and offer a new framework for analyzing power generation impacts on Great Lakes aquatic resources. GLEW will be about half complete at the time of the conference and this presentation will report on methods, progress and findings to date.</p>
69	<p style="text-align: center;">Pilot Projects on Sustainable Water Management and Green Building Approaches</p> <p>Laura Dufresne, P.E. Senior Associate, the Cadmus Group, Inc. <i>Ms. Dufresne is an Environmental Engineer with the Cadmus Group, Inc. specializing in sustainable water and wastewater treatment technologies.</i> Contributing Authors: Tina Taylor, Electric Power Research Institute; Jeff Moeller, Water Environment Research Foundation; Victoria Kiechel, the Cadmus Group, Inc This presentation examines how well green building rating systems assess and reward good practices in sustainable water management by presenting findings from three pilot projects: The Merrill Center in Annapolis, MD; the Millennium Tower Residences in New York City, NY; and the Wetland Studies and Solutions, Inc. building in Gainesville, VA. The presentation will provide results of a quantitative assessment of their water-related impacts in a wider, watershed context. It will also show how three green building rating systems would rate these projects, making note of their strengths and weaknesses. The presentation will summarize findings with respect to barriers and challenges to good water management practices.</p>
70	<p style="text-align: center;">Sustainable Use of Hydropower in a Drinking Water System - Pittsfield, MA</p> <p>Christian A. Murphy, Electrical Engineering Dept. AECOM <i>B.A. Williams College. M.S. University of Illinois. Designs industrial power systems. Interests: efficiency, green-design, simulation, information presentation and design methodologies.</i> Contributing Authors: Doug Gove, PE, Project Manager AECOM, Bruce Collingwood, PE, Director of Public Works & Utilities, Pittsfield, MA The 42,000 residents of the Massachusetts city of Pittsfield drink water supplied by reservoirs between 300 and 900 feet above the City. The City operates one, and is currently constructing a second, hydropower turbine that extracts energy by reducing the water pressure on a transmission main from 165 psi to 100 psi. The new hydropower turbine is expected to power the new facility and allow for the sale of excess electricity. This presentation will discuss how the hydropower turbines operate and will provide an overview of planning, design, and permitting steps taken to construct the new flow control station.</p>

71	<p style="text-align: center;">Use of Existing Public Databases to Improve Groundwater Monitoring</p> <p>Evan Kane, Groundwater Planning Supervisor, NC Department of Environment and Natural Resources Evan Kane oversees North Carolina's groundwater quality monitoring program and development of classifications and other regulations for groundwater protection. Contributing Authors: Rick Bolich, NCDENR Division of Water Quality North Carolina regulations require submission of well records and require sampling of both private and public supply wells. Side-by-side examination of these three datasets reveals influences on drinking water quality from both hydrogeology and well construction practices. Attempts to correlate the datasets to each other also point to needed data management improvements. Environmental and public health agencies are collaborating with researchers to implement these improvements and to develop analytical tools so that the data may provide a cost-effective complement to the state's existing ambient groundwater quality monitoring network and improve public awareness of groundwater quality.</p>
72	<p style="text-align: center;">Water Supply Reservoir Viability and Water Conservation Study in Oklahoma</p> <p>Karl Stickley, P.E., Vice President, C. H. Guernsey & Company <i>Karl Stickley, P.E., holds a BS and MS in Civil Engineering and has 33 years of water resource experience.</i> Contributing Authors: Ken Senour, Sr. Vice President, C. H. Guernsey & Company In 1980, the <i>Oklahoma Comprehensive Water Plan</i> (OCWP) envisioned a series of reservoir sites and extensive conveyance of water from Southeast Oklahoma to Central and Northwest areas of the State. This presentation will review the effort to update comprehensive water supply activities, reservoir viability, and water conveyance in Oklahoma. Over 100 reservoirs previously identified have been re-evaluated for potential for development as a water supply source or as terminal storage. Additionally, the study also updates previous water conveyance concepts in moving water from "water rich" eastern Oklahoma to "water poor" western Oklahoma.</p>
73	<p style="text-align: center;">Economic Treatment of Frac Flow-Back Water to Recyclable Condition Using Physical Chemical Processes</p> <p>Dr. David H. Manz, P. Eng., P. Ag., Pure Filtered Water International Ltd. <i>V.P. Marketing and Product Development, Pure Filtered Water International Ltd. and Oasis Filter International Ltd., professor and consultant.</i> Economic treatment of frac flow-back water to a recyclable condition; that is, for reuse for in subsequent fracturing operations, has been developed and demonstrated in Southern Alberta. The treatment technology uses physical-chemical processes that were successfully demonstrated using pilot plant studies. The treatment process is scalable to treat several thousand cubic metres of wastewater per day using fixed or movable treatment plants - suitable for use in unconventional natural gas development. The treatment technology promises maximum utility of diverted water resources and elimination of the need for disposal by deep well injection or other means.</p>
74	<p style="text-align: center;">The Energy-Water Nexus and the Role of Carbon Capture and Sequestration</p> <p>Vincent Tidwell, Principal Member of the Technical Staff, Sandia National Laboratories <i>Dr. Tidwell has 20 years experience conducting and managing research on basic and applied projects in resource management, and energy systems.</i> Contributing Authors: Peter Kobos, Len Malczynski, Sandia National Laboratories, Erik Shuster, National Energy Technology Laboratory Currently, thermoelectric power generation uses about 143 billion gallons of water per day in the U.S. accounting for over 36% of all freshwater withdrawals thus competing with irrigated agriculture as the leading user of water. Expanding electrical power production and looming policies related to Carbon Capture and Sequestration (CCS) are expected to place even greater demands on our nation's finite water supplies. In this presentation we explore the magnitude of water withdrawal and consumption for various levels of CCS and its potential contribution to regional water stress. The basis of the analysis is Sandia National Laboratories' Energy-Power-Water Simulation (EPWSim) model.</p>
75	<p style="text-align: center;">Evaluating Sustainable Non Chemical Water Treatment Technologies for Commercial/Industrial Cooling Tower Applications</p> <p>Peter F. Johnson, CEM, CEA; Project Manager, AECOM <i>Pete is a professional energy consultant and works on major site projects. He has worked on several Water and Waste Treatment facilities' energy reduction projects.</i> Co-Presenter: James E. Protin Jr., Sr. Marketing Manager, AECOM <i>Jim is a professional marketing manager and has nearly 20 years in the industry on Water and Waste Treatment facilities' project development.</i> A 3rd party non biased review on "Non chemical treatment systems" for cooling towers to address corrosion & scale control, pH adjustment and for biological growth reduction. Some systems work and some don't – hear why! Also traditional Chemical treatment has discharges to the sanitary sewer but working "non- chemical programs" are safe for irrigation and surface discharge. Conclusions are drawn from years of equipment observations and offer review on claims of energy savings, performance and sustainability issues. Learn key maintenance requirements, how to determine if the savings are accurate and how to figure out "IF non chemical is right for your application".</p>

76	<p style="text-align: center;">Source Water Quality and Drinking Water Disinfection By-Product Speciation in the Monongahela River Basin</p> <p>Jessica M. Wilson, Graduate Student, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA 15213 <i>Jessica Wilson (B.S., Russell Sage College, M.S., Manhattan College) is a graduate student at CMU. Her research interests are in source and drinking water quality.</i> Contributing Author: Jeanne M. VanBriesen, Professor, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA 15213 The Monongahela River has been impacted in the past by coal mining activities which contribute to elevated dissolved solids. The expansion of natural gas extraction from the Marcellus Shale has led to concerns that highly saline “produced water” will further impair the river’s water quality. The river is a drinking water source for over 700,000 people. Shifts in the speciation of disinfection by-products in finished drinking water have caused concern for drinking water providers. One year of field sampling was performed in this basin and the focus of this work is on the bromine in the source water and its effects on the speciation of brominated disinfection by-products.</p>
77	<p style="text-align: center;">Use of Produced Water from the Illinois Basin by Coal-Based Power Plants</p> <p>Chad Knutson, research engineer, Illinois State Geological Survey <i>Chad Knutson has a PhD in environmental engineering from the University of Illinois at Urbana-Champaign.</i> Contributing Authors: Yaning Yang and Seyed Dastgheib, Illinois State Geological Survey In the Illinois Basin, a large volume of water is produced from oil, gas, and coal production operations. This work investigates the feasibility of reusing this produced water as cooling/process water in the coal-based power generation industry. Produced water samples were collected from multiple oil fields, coal-bed methane projects, and coal mines and analyzed. Results from bench-scale water treatment processes including filtration, adsorption, and reverse osmosis membrane separation are shown for several water samples. Quality of treated water is discussed along with implications for its use at power plants.</p>
78	<p style="text-align: center;">Chicago Pump Station Upgrades Expected to Achieve LEED Certification and Reduce Carbon Footprint</p> <p>Steven Hall, P.E., Project Engineer, AECOM <i>BS, Electrical Engineering, Marquette University</i> Contributing Authors: John Spatz, Chicago Department of Water Management, Burt Rezko, Chicago Department of Water Management, Robert Butterworth, AECOM The City of Chicago Department of Water provides safe drinking water to over 5,500,000 people in the City of Chicago and over 120 suburban communities. The Department operates two water purification plants and twelve pumping stations. The Department is proceeding with improvements at Springfield Avenue Pumping Station as part of an ongoing capital improvements program. The project will convert the 360 MGD steam-driven pump station to a completely electrically operated pump station. The improvements associated with this project will significantly reduce operating costs, energy use, and carbon footprint; while also achieving LEED Certification.</p>
79	<p style="text-align: center;">Water Efficiency at Public Power Electric Utilities</p> <p>J.P. Blackford, Senior Environmental Services Engineer, American Public Power Association <i>J.P. received a received a B.S.(C.E.) degree in Civil Engineering, summa cum laude, an M.S. in Environmental Engineering and is pursuing a Doctorate in Environmental and Energy Engineering Management at The George Washington University.</i> This presentation will provide an overview of the many factors, including regulatory as well as technological -- new environmental controls and methods of power production may increase the water demand, that motivate electric utilities to reduce water demand for electricity generation and to reuse gray water in power production. Since more than 80% of municipal or public power electric utilities also provide drinking water for their communities, they see this pressure more directly and have made strides to reduce water usage. A brief case study will be presented to outline what APPA’s public power electric utility members have accomplished and opportunities for future innovation.</p>
80	<p style="text-align: center;">Ground Source Heat Pump Monitoring to Ensure Source Water Protection</p> <p>Jacqueline Daoust, Daoust Consulting <i>A graduate from Johnson State College with a B.S. in environmental science and Vermont Law School with a Master’s in environmental law and policy.</i> Contributing Authors: Paul Jehn, The Ground Water Protection Council Over thirty years experience in ground water resource management. Currently, program manager for GWPC’s Risk Based Data Management System. In order to determine if sources of drinking water may be impacted by ground source heat pumps, the GWPC proposes to partner with Massachusetts DEP and New Hampshire DES to use RBDMS Water to record and evaluate water data quality associated with open-loop heat pump wells. Water quality sampling from open-columns wells would be conducted on a regular basis to determine background levels and then to determine if there is an increasing trend of any regulated constituents. The monitoring data will be made available via GIS software system that will allow for a geospatial and time series analyses.</p>

81	<p style="text-align: center;">The Unintended Energy Impacts of Increased Nitrate Contamination from Biofuels Production</p> <p>Kelly Twomey, NSF Graduate Research Fellow, University of Texas at Austin <i>Kelly Twomey is pursuing a MSE/PhD in Mechanical Engineering at the University of Texas at Austin under the supervision of Dr. Michael Webber.</i> Contributing Authors: Ashlynn Stillwell, University of Texas at Austin, NSF Research Fellow; Dr. Michael Webber, University of Texas at Austin, Assistant Professor, Department of Mechanical Engineering Increases in corn cultivation for biofuels production, due to the Energy Independence and Security Act of 2007, are likely to lead to increases in nitrate concentrations in both surface and groundwater resources in the United States. This presentation will discuss how these increases might trigger the requirement for additional energy consumption in the water treatment sector to remove excess nitrates in order to comply with the US Environmental Protection Agency's Safe Drinking Water Act.</p>
82	<p style="text-align: center;">Groundwater Banking: One Management Option to Meet Marcellus Water Needs</p> <p>Richard R. Parizek, Professor of Geology and Geo-Environmental Engineering, Department of Geosciences (1961-Present), The Pennsylvania State University <i>His research emphasizes hydrogeologic, environmental and energy-related themes: coal mining and nuclear waste isolation. Supervised 100 advanced degree recipients.</i> Precipitation is abundant within the Marcellus play compared to many shale-gas occurrences. Aquifers are not universally distributed and limited base flow especially within smaller tributaries restricts even preclude seasonal withdrawal of frack waters in some areas of the play. Innovative water management strategies should allow growing water needs to be met together with the thousands of gas wells expected to be drilled throughout the play. Excess stormwater can be banked within aquifers for later withdrawal. Gravity injected water can be contained within pumping cones of depression, quarries, subsurface mines and reclaimed surface mines. Several hydrogeologic examples are provided.</p>
83	<p style="text-align: center;">Best Agricultural Management Practices (BMPs) for Biofuels Feedstock Production</p> <p>Xiaobo Xue, Graduate student, Department of civil & environmental engineering, University of Pittsburgh <i>Xiaobo is a PhD student under advisory of Dr. Amy E. Landis at University of Pittsburgh. Her research focuses on evaluating environmental impacts of biofuels and foods using life cycle assessment methods.</i> Contributing Authors: Amy E. Landis, Assistant professor, Department of civil & environmental engineering, University of Pittsburgh Biobased fuels from renewable resources have gained high research and development priority due to national security and environmental concerns. To ensure resilience and sustainability of the nation's agricultural and fuel sectors, it is essential to evaluate the effect of environmental effects from agricultural cultivation. This study examines the environmental impacts of agricultural practices with the aim of improving environmental profile of biofuels. A comparative Life Cycle Assessment (LCAs) is conducted to elucidate overall environmental impacts of agricultural management practices. Integrated farming practices are suggested to reduce environmental impacts resulting from the biofuels feedstock production.</p>
84	<p style="text-align: center;">Water Energy Relationship</p> <p>Arvind Akela, Mechanical Engineer, CDM <i>Arvind Akela is a mechanical engineer with bachelors and masters in mechanical engineering. He is a registered P.E. in California and is a LEED® AP.</i> Urban System Model (USM), a tool developed by CDM, has been developed to provide best-in-class planning processes and tools for sustainable urban development projects created in a multi-objective design environment. The USM is intended to simulate the performance of a city (or portion of a city) according to changes in its parameters or sustainable technology applications. The model will track system behavior of water, energy, solid waste, buildings, transportation, and ecosystems sectors using a triple bottom line performance framework. This presentation will highlight the dynamic of water and energy and impacts of one over the other.</p>
85	<p style="text-align: center;">A Collaborative Process to Identify the Most Feasible Aquifer Recharge Sites in Oklahoma</p> <p>Nathan T. Smith, Environmental Scientist, CDM <i>Mr. Smith is a scientist and project manager with a B.S. and M.S. in Biology from the University of Tulsa.</i> Contributing Authors: Matt Bliss, P.E. – CDM; Michael Smith, P.G. – CDM; Wayne Kellogg – American Water Institute CDM and the American Water Institute (AWI) completed a regional artificial recharge (AR) feasibility study for the State of Oklahoma in response to a legislative initiative to assess means to optimize water resource development. In cooperation with project stakeholders, criteria were defined for scoring and ranking locations for a demonstration AR project. Criteria included source water availability and quality, groundwater storage capacity, groundwater quality, proximity to the local demands, hydrogeologic characteristics, and cost. A geographic information systems analysis was included in the evaluation to allow for visual comparison of site characteristics and completion of necessary storage and distance calculations.</p>

86	<p style="text-align: center;">Memorandum of Understanding for Hydropower</p> <p>Michael R. Gabaldon, Director, Technical Resources, Bureau of Reclamation <i>Michael Gabaldon is the Director of Technical Resources in Denver. He oversees Reclamation's Technical Service Center, Research and Development Office, Power Resources Office, and Design, Estimating, and Construction Office.</i></p> <p>On March 24, 2010, the Department of the Interior, the Department of Energy, and the Department of the Army entered into an agreement with the purpose of enhancing the coordination of their efforts to provide the Nation with affordable, reliable, and environmentally sustainable hydropower. The Agencies understand the widely ranging benefits of hydroelectric power to our Country and recognize that not every site is ideal for new or increased hydropower production. The agreement represents a new approach to hydropower that will harmonize the production of clean, renewable energy with reduced or avoided environmental impacts, and a more viable river ecosystem.</p>
87	<p style="text-align: center;">Approaches for Assessing Groundwater Availability Under Competing Demands and Climate Change</p> <p>Matt Bachmann, Hydrologist, U.S. Geological Survey; Matt Ely, Hydrologist, U.S. Geological Survey; John Vaccaro, Hydrologist, U.S. Geological Survey</p> <p>The Yakima River Basin in eastern Washington, like many areas of the arid West, struggles with issues of water allocation. The \$1 billion per year agricultural economy is supplied by snowmelt runoff, and increasing demands for municipal, fisheries, agricultural, industrial, and recreational uses must be met through the use of groundwater, storage, and conservation. In some areas, groundwater levels have declined more than 300 feet, reducing streamflow in reaches with senior surface-water rights or instream flow requirements for endangered species. A series of groundwater models have been constructed to help accommodate growing needs within the physical limitations of the system.</p>
88	<p style="text-align: center;">Feed Water Reduction in Industrial Water Purification Systems</p> <p>William V. Collentro, Visiting Assistant Professor, Worcester Polytechnic Institute <i>William V. Collentro received his B.S. and M.S. in Chemical Engineering from Worcester Polytechnic Institute. His 42 year career has focused on water purification and treatment technology.</i></p> <p>Classical operation of individual components employed in industrial and high purity water purification system does not consider raw water use. Ripening of particulate removal filters to extend the time between backwash cycles coupled with air sparging during the backwash cycle reduces raw water consumption. Use of counter current regeneration of water softening units and two-bed deionization units not only improves product water quality, but reduces regenerant chemical requirements and raw water consumption. Finally, treatment of a reverse osmosis unit waste stream allows recycle of water, reducing raw water consumption and the volume of water processed by pretreatment components.</p>
89	<p style="text-align: center;">Mitigating for Energy-related Consumptive Water Use in the Susquehanna River Basin</p> <p>Andrew Dehoff, Manager of Project Review, Susquehanna River Basin Commission <i>15 years experience at SRBC, including review and approval of water use applications and long-term planning for sustainable water use.</i></p> <p>The Susquehanna River Basin Commission is required to mitigate for the impacts of consumptive water use in the basin. Although there are many activities along the Susquehanna River, the power and energy sectors account for the bulk of consumptive water use. As natural gas companies eye the Susquehanna's water resources for use in hydrofracturing, SRBC's projections of the need for additional consumptive water use – and accompanying mitigation – continue to see dramatic increases. SRBC has undertaken an effort to assess the mitigation needs expected in the basin and to find, develop and facilitate the implementation of that mitigation.</p>
90	<p style="text-align: center;">Sustainable Solutions and Cost-Saving Applications for Small Water Systems – Case Studies</p> <p>James J. Rhoades, Jr., P.E., Project Manager, Alfred Benesch & Company <i>Mr. Rhoades has over 15 years of engineering experience and managed the PA DEP Small Water System Engineering Services Program for 9 years.</i></p> <p>Co-Author: Michael J. Peleschak, P.E., Project Engineer, Alfred Benesch & Company</p> <p>Small drinking water systems face unique technical, financial, and managerial challenges. The presentation provides practical ideas and results from case studies where sustainable cost saving measures were implemented in the areas of: innovative sustainable solutions for technical issues (backwash waste recycle and infiltration gallery, raw water intake/riverbank filtration), minimizing life-cycle costs (leak detection/water conservation programs/reduce unaccounted for (UAF) water, solar power for remote telemetry), and sustainable operations and maintenance, reducing energy use and costs (replace old pumps/equipment and controls, use of variable frequency drives (VFDs), implement Asset Management Plan to replace aging infrastructure on manageable schedule).</p>
91	<p style="text-align: center;">Water and Carbon Storage Related Research at DOE/NETL</p> <p>Andrea McNemar, Project Manager, Department of Energy / National Energy Technology Laboratory <i>Andrea McNemar is a Project Manager for the Sequestration Division with the Department of Energy's / Office of Fossil Energy's / National Energy Technology Laboratory.</i></p> <p>Contributing Authors: John Litynski, DOE/NETL, and Sean Plasynski, DOE/NETL</p> <p>The Department of Energy's Office of Fossil Energy's Carbon Sequestration Program at the National Energy Technology Laboratory is working toward a technology portfolio for safe, cost-effective, and long-term carbon mitigation, management, and storage. Within this research and development program, activities are underway to understand concerns, opportunities, and research needs related to carbon storage and water. This presentation will discuss ongoing and new research at DOE/NETL related to water and carbon storage.</p>

92	<p style="text-align: center;">Water Supply Reliability for Energy Development Demands: Adaptation for Potential Climate Change</p> <p>Andrew Wolfsberg, Computational Earth Science Group Leader, Los Alamos National Laboratory <i>Ph.D. and M.S. in Civil Engineering from Stanford University, B.S. in Hydrology from University of Arizona, LANL since 1994.</i> Contributing Authors: Daniel Levitt, Cathy Wilson, Richard Middleton (Earth and Environmental Sciences, LANL) We present a basin-scale hydrologic investigation of river flows, diversions, environmental demands, and the impacts of potential climate change for the evaluation of storage capacity requirements to support a new energy industry in the Colorado River Basin. Incorporation of climate-change projections on temperature and precipitation in the model leads to increases in both drought durations and evapotranspiration due to reduced snow pack in the simulations. The impacts on river flow variability and increased storage requirements to meet demand under potential climate change are provocative for this region, implying adaptation in planning and design.</p>
93	<p style="text-align: center;">Zeolite Sorbents for Treatment of Water for Reuse</p> <p>William Collentro, Visiting Assistant Professor, Department of Civil & Environmental Engineering, Worcester Polytechnic Institute <i>William Collentro is a Visiting Assistant Professor at WPI and has more than 40 years experience in water purification.</i> Contributing Authors: John Bergendahl, Associate Professor, Department of Civil & Environmental Engineering, Worcester Polytechnic Institute; Laila Abu-Lail, Doctoral Candidate, Department of Civil & Environmental Engineering, Worcester Polytechnic Institute Water is a crucial resource needed for sustaining society and maintaining economies, yet many water sources are impaired. Large quantities of water are discharged after use as “waste” even with low contamination levels that may include endocrine disruptors, pharmaceuticals, petroleum constituents, solvents, disinfection byproducts, and others. Effective and efficient treatment schemes, such as adsorption to nanoporous, aluminosilicate zeolites may allow water reuse. In this presentation, experimental results using zeolites to remove trace organic contaminants from water are discussed. Results indicate the potential for this class of sorbents to be applied for water reuse.</p>
94	<p style="text-align: center;">Potential Geochemical Releases to Groundwater from an In-situ Oil Shale Retort</p> <p>Earl D. Mattson, Research Scientist, Idaho National Laboratories <i>Dr. Mattson is a research scientist in the Idaho National Laboratory's Energy and Environment Division.</i> Contributing Authors: Carl D. Palmer (Idaho National Laboratories), Robert B. Perkins (Portland State University) In-situ oil shale resource development involves large-scale heating of the subsurface in order to convert kerogen to extractable hydrocarbons. Concurrent with the pyrolysis of the kerogen, there are also changes in the mineralogical makeup of the rock matrix and chemical composition of subsurface waters within and adjacent to retorting zone. These changes along with the expected temperature profiles surrounding the retort are used to conceptualize the potential spatial extent of the geochemical alterations of the shale and serve as a basis for considering contaminant fluxes from the retorting operations including potential thermally induced geochemical alteration of permeability.</p>
95	<p style="text-align: center;">Energy Security: Water, Land, and Climate Change Adaptations</p> <p>Mike Hightower, Distinguished Member of the Technical Staff, Sandia National Laboratories <i>Mike supports efforts at Sandia in evaluating regional, national, and international energy development options and assessing the potential impacts of water and natural resource availability and national and international energy reliability and security.</i> Presentation Synopsis – This presentation will provide an overview of some of the emerging international and national trends in energy development, and how those trends could impact water and other natural resource availability. He will also provide an overview of how some of the changing directions in energy development worldwide could impact U.S. energy security, and adaptations the U.S. will need to consider for future energy development improve long-term energy security and reliability.</p>
96	<p style="text-align: center;">Listening to Your System</p> <p>Thomas K. Watts, Account Manager, Badger Meter, Inc. <i>Tom has five years of experience in the water industry, helping utilities increase their efficiency and water accountability with a systematic process.</i> Most of a water utility's assets are out of sight, underground. Knowing how these assets are performing can be very challenging. By following a systematic approach, non-revenue water can be identified, located and repaired. The IWA/AWWA M36 Water Audit manual provides a starting point for utilities which want to improve their efficiency and effectiveness. This session will give an overview of the relevant parts of the water audit process. Once the sources of non-revenue water are identified, then the work of pin pointing places for repair begins. The repair process can be managed more efficiently through the use of modern acoustic leak detection products. The newest products can establish leak location quickly, easily and accurately. With this information in hand the utility can then prioritize their attack on non-revenue water.</p>

97	<p style="text-align: center;">Measuring the Sustainability of Wastewater Reuse in Power Plant Cooling Systems</p> <p>Briana Niblick, Graduate Student, University of Pittsburgh <i>Briana Niblick is a PhD graduate student and NSF IGERT Fellow in Civil & Environmental Engineering.</i> Contributing Authors: Dr. Amy Landis, University of Pittsburgh; Dr. Dave Dzombak, Carnegie Mellon University; Dr. Radisav Vidic, University of Pittsburgh Given increasing scarcity and regulation of freshwater resources, thermoelectric power plants, which require large amounts of water for cooling, pose serious water supply challenges. Fortunately, treated municipal wastewater can be used as an alternative cooling water source. Due to concerns regarding biofouling, corrosion, and scaling, however, this water usually requires additional treatment, the sustainability of which must be considered. Therefore, this presentation discusses how life cycle assessment and survey methods can be used to evaluate the sustainability of wastewater reuse in the power industry. It also describes the development of sustainability metrics and illustrates their influence on future power generation.</p>
98	<p style="text-align: center;">Assessing Water and Carbon Footprints for Green Water Resource Management</p> <p>Dr. Y. Jeffrey Yang, PE, D.WRE., Physical Scientist, USEPA, Office of Research and Development, MS690, 26W Martin Luther King Dr., Cincinnati, Ohio 45268 <i>Dr. Yang leads R&D activities in water resources and infrastructure adaptation to climate and socioeconomic changes with focus on water-energy sustainability</i> Contributing Authors: Dr. Pratim Biswas, PE, Washington University in St. Louis; Dr. Tim Keener, PE, Dr. Joo-Youp Lee, and Dr. Mingming Lu, University of Cincinnati Carbon footprint is a criterion to evaluate environmental “greenness” of water resource development and water supply operations. Water footprint is the other dimension in the evaluation of energy productions and for energy-intensive systems. This presentation describes the elements of water and carbon footprints as two evaluation criteria, and investigates their interactions. A general procedure is outlined to assess water and carbon footprints for 1) alternative energy production, and 2) domestic water supplies. A combination of water and carbon footprints, compared to either one of them, enables better definition of environmental “greenness” in sustainable water and energy development.</p>
99	<p style="text-align: center;">Electric Utility Investment in Alternative Condenser Technologies: A Real Options Approach</p> <p>Christian M. Lastoskie, Associate Professor of Civil and Environmental Engineering, University of Michigan <i>B.S. Univ. Delaware, Ph.D. Cornell Univ. in Chemical Engineering, Prior research/academic appointments at Sandia Laboratories, Michigan State Univ., Consultant, LimnoTech, Ann Arbor MI</i> Contributing Authors: Peter Adriaens, University of Michigan, Laura Weintraub, LimnoTech, John Wolfe, LimnoTech The development of a decision support system is described that incorporates environmental uncertainties into a real options analysis (ROA) financial framework to make time-dependent investment decisions for alternative cooling technologies. ROA offers a nuanced approach to strategic investment that quantitatively takes into account investment risks and the value of open options for budget decision-makers, once the challenge of defining and pricing the volatility of options has been met. By coupling ROA to watershed model predictions of water quantity and quality, informed decisions on investment in water-conserving technologies can be made that properly evaluate water’s impact on de-rating events.</p>
100	<p style="text-align: center;">Cost-effective Recovery of Low-TDS Frac Flowback Water for Re-use</p> <p>Harish R. Acharya, Senior Research Engineer, GE Global Research <i>Dr. Acharya has 20+ years of extensive experience in process & product development at the laboratory, pilot, and commercial scales for a variety of industries.</i> Contributing Authors: Brian Moore, Ph.D., Hua Wang, Ph.D., GE Global Research Flowback water from hydrofracturing of shale formations is not a uniform “raw material” from a process development perspective. The physical and chemical properties of flowback water vary considerably depending on the geographic location of the shale play, the geological formation, and the chemicals introduced during the drilling and fracturing operations. Moreover, the flowback rate and composition vary throughout the lifetime of the well. For sustainable development of shale gas resources, economical processes are required to recover and re-use water from frac operations. Opportunities and challenges for recycling frac flowback water for re-use will be discussed, especially for flowback waters with low salinity (< 45,000 ppm TDS).</p>
101	<p style="text-align: center;">Scheduling Pump Operation to Save Energy Cost</p> <p>Christine Dejan, P.Eng. <i>Project Engineer in the Works Department of the Regional Municipality of Durham in Ontario Canada. Licensed Member of Association of Professional Engineers of Ontario, Graduated from Civil Engineering in Dresden Germany.</i> Contributing Authors: Jon Morton, EIT, Engineer in Training with Association of Professional Engineers of Ontario; Benny Wan, P.Eng AECOM Canada, Licensed Member of Association of Professional Engineers of Ontario Since the majority of the energy consumption in a water supply system is associated with water pumping, effective pump scheduling can result in significant energy cost savings utilizing online water storage. By automatically collecting and incorporating required data, the optimization model is using following parameter:</p> <ul style="list-style-type: none"> • Demand Constraints - Meet the forecasted system demand and the forecasted demand fluctuations, • Hydraulic Constraints - Maintain system pressure and flow velocities for each pumping station within the operating range, • Storage Constraints - Maintain water level for each storage facility within the operating range. • Forecasted weather conditions, forecasted hourly electricity cost • Optimal pump operation based on pump efficiency curves.

102	<p style="text-align: center;">Understanding Water Sector Interdependencies – A Critical Step to Enhancing Resiliency</p> <p>Laura Flynn, Team Leader, Active & Effective Security Team, U.S. Environmental Protection Agency <i>Ms. Flynn joined the Water Security Division in 2006 and oversees a team developing and implementing water security and preparedness programs.</i> The U.S. Environmental Protection Agency (EPA) has launched the Community-Based Water Resiliency (CBWR) initiative to increase the understanding of how community services rely on drinking water and wastewater systems. EPA Provides tools and resources to increase the overall preparedness of communities in the event of a water service disruption.</p>
103	<p style="text-align: center;">EPA's Climate Ready Water Utilities Activities</p> <p>John Whittler, Environmental Protection Specialist, Office of Water, U.S. Environmental Protection Agency <i>Mr. Whittler has over 6 years of experience in water sector preparedness and emergency response for the EPA.</i> Climate change impacts pose a daunting challenge to the water sector's ability to fulfill its public health and environmental mission. Extreme weather events, sea level rise, shifting precipitation and runoff patterns, temperature changes, and resulting changes in water quality and availability all have potentially significant implications for sustainability of the Nation's drinking water, wastewater, and stormwater utilities. EPA's Climate Ready Water Utilities (CRWU) program will help enable water and wastewater utilities to create and implement long-range plans that account for climate change impacts. This presentation will provide an overview of the various activities in EPA's CRWU program.</p>
104	<p style="text-align: center;">Case Study of Energy Efficient, Sustainable Improvements and Technologies Implemented at Water Treatment Plants</p> <p>Andrew L. Casolini Dal Bo, PE, LEED AP, Principal, Wendel <i>Andrew leads Wendel's Water/Wastewater Line of Business, managing infrastructure improvement projects with facility capacities ranging from 3,000 to over 48 million gallons per day.</i> Contributing Authors: Brian M. Sibiga, PE, Associate Principal, Wendel One of the challenging issues facing municipal water systems is developing retrofit programs that are economically and environmentally sustainable while enhancing the performance of existing facilities. This paper will provide real life examples from four water entities in New York State that have implemented economically sustainable retrofit programs that reduced their impact on the environment while also saving money. The methods used for identifying potential energy efficiency and sustainable retrofit improvements, the implementation method for the identified improvements, additional operational techniques for reducing and optimizing energy use, and a comparison of projected versus actual energy savings will be discussed during this presentation.</p>
105	<p style="text-align: center;">Hydrogeologic and Water Resource Considerations Related to Natural Gas Production in the NYC Water Supply Watershed</p> <p>Frank Getchell, PG, Hydrogeologist/Principal, Leggette, Brashears & Graham, Inc., Ramsey, New Jersey <i>Frank Getchell has been a consulting hydrogeologist specializing in groundwater resource management since completing his MS/Geology from Syracuse University in 1982.</i> Contributing Authors: Alfred Smith, P.G. (Leggette, Brashears & Graham, Inc.), Ben Wright, P.E. (Hazen and Sawyer), and Kimberlee Kane, PhD (New York City Department of Environmental Protection) In response to concerns over potential impacts to New York City's unfiltered west-of-Hudson (WOH) water supply from possible future natural gas development from the Marcellus Shale in the Catskills Region, the New York City Department of Environmental Protection (NYCDEP) utilized NYCDEP and USGS analytical groundwater and surface-water data collected from 1959 through 2007, along with available well and geological data, to develop a conceptual model of existing groundwater/surface water interactions in the WOH watershed. The model was used to identify future water-quality monitoring efforts for consideration in response to the possibility of future natural gas development in the region.</p>
106	<p style="text-align: center;">Algae as a Transportation Fuel: Research Directions and Initiatives</p> <p>Mike Hightower, Distinguished Member of the Technical Staff Sandia National Laboratories <i>Mike and Ron have supported DOE on evaluating the regional water resource impacts of biofuels development.</i> Contributing Authors: Ron Pate, DOE Biomass Program and Sandia National Laboratories <i>Ron is currently on assignment at DOE supporting the algal biofuels research program.</i> Presentation Synopsis – This presentation will provide an overview of some of the issues and challenges associated with biofuels scale-up that have led DOE to establish a national algal biofuels research program. The presentation will also highlight the major issues, challenges, and research needs identified in a recently released algal biofuels research roadmap. We will then discuss some of the major initiatives underway through DOE's Biomass Program and the current and future focus of algal biofuels research.</p>
107	<p style="text-align: center;">The RBDMS National Oil and Gas Data Portal</p> <p>Stan Belieu Nebraska Oil and Gas Conservation Commission The Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC) propose to develop and to host a Web site of national oil and gas well information for public access. The National Oil and Gas Data Portal will use programming techniques developed in the award-winning Risk Based Data Management System (RBDMS) Initiative. RBDMS connects industry and agencies to automate permitting, well completion reporting, production and injection report filing, laboratory sample results transfer, and data mining. The immediate data access allows users to analyze area trends, to track well history (ownership, bonding, permitting, location, construction, inspection, production, and plugging/restoration), and to monitor regulatory compliance.</p>

108	<p align="center">Improvements in Thermoelectric Power Plant Water-use Data Collection and Dissemination by Federal Agencies</p> <p>Dr. Timothy H. Diehl, Hydrologist, U.S. Geological Survey <i>Tim Diehl is a hydrologist with the USGS. He has a PhD in civil Engineering from the University of Wisconsin.</i> Contributing Authors: Susan S. Hutson U.S. Geological Survey In 2009, GAO recommended that USGS and DOE, Energy Information Administration, coordinate efforts to better inform the nation's understanding of power plant water use and how it affects water availability, and to improve the usefulness of the data collection by the USGS. In response, USGS is investigating methods to improve estimates of consumptive use at the power-plant level with a focus on power plant technologies and plant management processes that control or manage the transport of cooling water. In conjunction with the power-plant level analysis, USGS is developing a model that examines heat rejection from the plant through evaporative losses.</p>
109	<p align="center">Integrated Water and Energy Planning for Sustainable Rural Economies</p> <p>Brian Starkebaum, Yuma Conservation District <i>Brian Starkebaum is the Executive Director of the Yuma Conservation District and Vice President of the Colorado Association of Conservation Districts.</i> Contributing Authors: Cat Shrier, Ph.D., P.G., President, Watercat Consulting LLC <i>Cat Shrier is President of Watercat Consulting, facilitating communication and understanding of innovative approaches to water management and policy.</i> In irrigated agriculture there is a direct relationship between water consumption and energy usage. With each acre inch of water conserved, total energy usage decreases. Agricultural producers also possess vast resources available for producing alternative energy, be it wind, solar, bio-based or geothermal. Understanding the relationship between energy and water usage in irrigated agriculture is pivotal to further conservation of both resources, and creation of jobs and sustainable economies for rural areas. Understanding a total-resource approach to water and energy management is critical to the development of a new model for rural economies. These concepts are integral to recent initiatives by the US Department of Agriculture (USDA). Methods include alternative low water usage crops, technology applications on sprinklers, improved management techniques and alternative energy sources. A watershed-based analysis of opportunities for reduction of energy demands for water use as well as development of alternative energy sources, including wind, solar, bio-based, and geothermal, and infrastructure to support alternative energy production. The infrastructure required to process feed stocks and develop other alternative energy sources create valuable jobs in a rural community, leading to enhanced economic sustainability. This presentation highlights successful strategies implemented on a local level to reduce water and energy consumption, as well as related USDA initiatives that will support a more integrated approach to rural resource management for rural economic development.</p>
110	<p align="center">Analysis of Biofuel Production Scenarios and Their Regional Water Quality Impact at the Upper Mississippi River Basin</p> <p>M. Wu, Energy Systems, Argonne National Laboratory; Y. Demissie & E. Yan Environmental Systems, Argonne National Laboratory Increased production of biofuel from both conventional feedstock and cellulosic feedstock could potentially impact the water quality in the local water system. This is particularly true for the Upper Mississippi River Basin which has been responsible for a majority of current biofuel feedstock production while being a key contributor of nitrogen loading to the Gulf of Mexico. This work presents a watershed model of the UMRB using SWAT that simulates various scenarios to assess the potential changes in nutrient loading and soil loss. It further identifies key steps required to minimize unintended environmental consequences for a sustainable biofuel feedstock production.</p>
111	<p align="center">Sustainable Wells: Role of Well Rehabilitation and Maintenance in Conservation</p> <p>Stuart A. Smith, MS, CGWP, Partner, Smith-Comeskey Ground Water Science LLC <i>Performing hydrogeology and well performance problem consulting for > 30 years, author of several books and numerous sort works.</i> Contributing Authors: Allen E. Comeskey, MS, CPG, partner, Ground Water Science Pumping wells are one of the largest power users power in communities relying on groundwater supply. Modern practices to improve and prevent well performance deterioration conserve energy, as cleaned wells have improved overall efficiency in water pumped per kilowatt-hour. Improved water quality in cleaned wells reduces impacts on water treatment systems, including reduced filter backwash, chemical use, and maintenance. An additional "green" benefit is in reducing the need to take "greenfield" land for new wellfield locations. This talk will briefly summarize methods, performance improvement examples, and also the untapped potential for energy savings of millions of poorly maintained domestic water wells.</p>
112	<p align="center">Water Use in Utility-Scale Solar Power Systems</p> <p>Jordan Macknick, Energy and Environmental Analyst, National Renewable Energy Laboratory, Golden, CO <i>Jordan Macknick is an Energy and Environmental Analyst at the National Renewable Energy Laboratory</i> Contributing Authors: Craig S. Turchi, Michael J. Wagner and Charles F. Kutscher National Renewable Energy Laboratory, Golden, CO Abundant sunlight and renewable portfolio standards have promoted utility-scale solar power projects in the Southwest. Common concentrating solar power (CSP) systems utilize steam power blocks that prefer water for cooling. Some CSP technologies and all photovoltaic systems do not use wet-cooling, but all require some water for collector washing and other plant operations. For steam CSP plants, dry-cooling reduces water consumption by over 90% but increases cost. The cost of dry cooling is dependent on air-cooled condenser size, climate, and time-of-delivery rates for energy. Water consumption for the different plant designs will be discussed along with performance and revenue impacts.</p>

113	<p style="text-align: center;">Coal, Natural Gas, Climate & Water: Towards the Right Mix for Colorado</p> <p>Kristen Averyt, Deputy Director Western Water Assessment University of Colorado, Boulder <i>PhD, 2004, Stanford University MSc, 1999, University of Otago (New Zealand) BSc, 1998, University of Miami, Leadership team for Union of Concerned Scientists Energy & Water in a Warming World Project</i></p> <p>The geologic landscape that creates the Colorado River Basin (CRB) and provides a major water source to the arid Western United States is also the largest store of conventional energy resources in the United States. Coal is the primary energy resource extracted from the Colorado Plateau, and as such, coal-fired power plants dominate energy production in the region. However, natural gas is also an abundant resource, and growing energy demands are driving an increase in production in the region. In an effort to mitigate the emissions of greenhouse gasses associated with the burning of coal, the state of Colorado recently passed the Clean Air-Clean Jobs Act. The law will assist the state's largest utility in switching several major coal-fired power generation plants to natural gas by 2018.</p>
114	<p style="text-align: center;">Adding Water to the Energy Economic Equation</p> <p>Valerie Strassberg, Water/Energy Program Director, Nature's Voice Our Choice <i>Ms. Strassberg is a registered professional engineer and environmental commissioner with experience in designing sustainable water resource projects in the US and abroad.</i></p> <p>Contributing Authors: Brandy Lellou, Director, Nature's Voice Our Choice</p> <p>As global natural disasters increase, so does global acceptance of Climate Change. Yet, controlling GHG and CO2 emissions is not the cure-all for this mounting dilemma. The singular message of energy efficiency is not enough to sustain future generations. To address such a dynamic problem we need a multiple tiered solution. We will discuss how to integrate sustainable solutions into traditional engineering complexities such as storm water management, micro-grid power generation, and climate action planning. And we will show how our media and outreach campaigns can expand to include water into the sustainability equation.</p>
115	<p style="text-align: center;">Rainfall = CO2: Green Infrastructure as Solution</p> <p>Valerie Strassberg, Water/Energy Program Director, Nature's Voice Our Choice <i>Ms. Strassberg is a registered professional engineer and environmental commissioner with experience in designing sustainable water resource projects in the US and abroad.</i></p> <p>Contributing Authors: Brandy Lellou, Director, Nature's Voice Our Choice; Chloe Grabowski, Intern, Nature's Voice Our Choice</p> <p>At first glance it is difficult to see the relationship between CO2 emissions and rainfall events. However, for the nearly 800 combined sewer communities throughout the United States, rainfall events result in peak flows to wastewater treatment plants and tunnel storage; requiring large amounts of energy for pumping and treatment of the combined storm and sewer water. Our poster presentation illustrates the energy use and resulting CO2 emissions from the city of Chicago's combined sewer wastewater treatment facility and the energy/CO2 reduction benefits achievable through the implementation of various green infrastructure solutions.</p>
116	<p style="text-align: center;">A Carbon Footprint is not Enough</p> <p>Brandy Lellou, Founder/Executive Director, Nature's Voice Our Choice (NVOC) <i>BS Civil Engineering, Colorado State University, Brandy is a civil engineer with fourteen years of experience implementing bioremediation and sustainable water resource projects in the US and abroad; including seven years in West Africa with the Peace Corps, US Embassy and local contractors. NVOC's Water Resource Management for Energy Conservation (WRMEC) Program identifies and quantifies links between water and energy sectors nationwide; and uses these links to develop water conservation strategies and projects that have dual benefits of GHG reduction and climate change adaptation.</i></p> <p>Contributing Author: Valerie Strassberg, Water/Energy Program Director, Nature's Voice Our Choice</p> <p>As carbon markets and RPSs continue to grow, it is important to understand that not all carbon neutral energy is water neutral. We will illustrate the variations in carbon emissions and water use for different types of power production systems and make the case that future energy generation must be based on a combined carbon and water footprint. We will demonstrate the complexity of accessing and analyzing cooling water use, and reveal a solution that will make this information easily accessible; thus enabling policy makers to include water as an essential component of our nations' carbon and energy reduction strategies.</p>
117	<p style="text-align: center;">Beyond Clean Water: The Triple Bottom Line Benefits of Green Stormwater Infrastructure</p> <p>Matthew Vanaskie, P.E., Water Resources Engineer, CDM <i>Mr. Vanaskie is a water resources engineer for CDM, and currently provides engineering support to the Philadelphia Water Department for facilities planning.</i></p> <p>R. Dwayne Myers, CDM; James T. Smullen, CDM; Marc Cammarata, PWD</p> <p>This presentation summarizes the types of benefits created through the implementation of green stormwater infrastructure beyond the reduction of combined sewer overflows. Traditional engineering cost analyses do not guarantee that benefits will be maximized because they leave out key variables that affect urban quality of life and long-term sustainability of the urban system. This triple bottom line analysis ensures that those additional benefits are measured. The types of benefits created by green stormwater infrastructure include: enhanced recreation and restored ecosystems, improved quality of life and neighborhoods, reductions in the effects of excessive heat and improved air quality, and savings in energy as well as offsets to climate change.</p>

118	<p style="text-align: center;">Developing a Sustainable Water Supply Strategy for the City of Plantation, Florida</p> <p>Courtney S. Licata, P.E., Principal Engineer, Hazen and Sawyer, P.C. <i>Courtney Licata works with the firm Hazen and Sawyer in Raleigh, North Carolina, primarily in the field of Water Resources Engineering. Her areas of interest include hydrology, water supply planning, climate change, and environmental impacts of water and wastewater treatment.</i></p> <p>Contributing Authors: Michael Wengrenovich, P.E., Hazen and Sawyer, P.C., Hank Breitenkam, City of Plantation, Florida</p> <p>Carbon footprint analysis is a methodology for accounting for greenhouse gas (GHG) emissions associated with a particular activity as one measure of sustainability. The intent of this paper is to examine several proposed alternative water supply projects for the City of Plantation, Florida, in the context of energy consumption through developing carbon footprint assessments. Results of this analysis reveal that a project aimed at providing local golf courses with reclaimed water not only meets recent regulatory requirements regarding the development of alternative water supplies, but was also found to contribute the least to global warming impacts.</p>
119	<p style="text-align: center;">Sustainable Natural Gas Development Through Superior Water Management</p> <p>Robert Waits, Executive VP – Business and Government Affairs / 212 Resources <i>25 years involvement with oil and gas liquids waste management and remediation projects including nine years in Europe and Asia.</i></p> <p>Stringent discharge standards, aquifer and gas field protection, conservation demands and the high cost of transportation are transforming drilling programs and associated water management plans. Solutions are available to meet the heightened demands of industry, agencies and the public. This presentation will consider the context and issues for effective decision making in water management: Where is the water quality tipping point? Is TDS the only issue? How robust should a technology be? What can the O&G industry do to improve its public position? What is new in one of the oldest technologies around: evaporation? What really works?</p>
120	<p style="text-align: center;">Applying a Sustainability Metric to Today's Standard Economic Analyses</p> <p>Holly Johnson, Senior Applications Engineer, N.A. Water Systems – A Veolia Water Solutions & Technologies company <i>Holly Johnson holds two years of experience with Veolia and B.S. and M.S. degrees in Environmental Engineering from MIT and Stanford University.</i></p> <p>Industries currently face challenges ranging from improving operations while reducing costs to achieving sustainability goals and other matters. Water treatment technologies are being developed to aid industries in overcoming these challenges; however, optimization of operational costs and treatment efficiencies is an ongoing process. Non-standard metrics such as carbon footprint offer a unique opportunity to benchmark innovation and demonstrate technological value to meet customer needs, often beyond what standard capital and operating expenditure evaluations may illustrate. A carbon footprint analysis performed on two boiler feed makeup treatment solutions exemplifies the use of atypical metrics to aid industries in meeting current challenges.</p>
121	<p style="text-align: center;">An Assessment of State Needs for a CO2 Geosequestration Regulatory Program</p> <p>Michael Nickolaus, Special Projects Director <i>BA in Geology, 1979, Indiana University, 20 years of experience as a state regulatory official in the Underground Injection Control Program and oil and gas program with the State of Indiana</i></p> <p>Contributing Authors: Bill Bryson, Consultant, Former Director of Oil and Gas, Kansas Corporation Commission</p> <p>The geologic sequestration of carbon Dioxide (CO2) is one of the technologies cited as a way to mitigate the atmospheric release of greenhouse gases. While the technical and scientific aspects of geosequestration have been studied extensively, an evaluation of the needs for the regulation of the practice have not been explored to the same degree. The importance of evaluating the legislative, regulatory, fiscal, training and public outreach aspects of implementing a geosequestration will play a major role in the development of such programs. Under a contract with the U.S. Department of Energy, the Ground Water Protection Council conducted a study of state regulatory needs and developed a report which details these needs. This presentation will explain the methodology, findings, conclusions and recommendations of this study.</p>
122	<p style="text-align: center;">Future Projections of Water Demands for Energy</p> <p>Robin Newmark, Director of the Strategic Energy Analysis Center, National Renewable Energy Laboratory, Golden, CO <i>Robin Newmark is the Director of the Strategic Energy Analysis Center at the National Renewable Energy Laboratory</i></p> <p>Contributing Authors: Jordan Macknick, Robin Newmark, and Margaret Mann National Renewable Energy Laboratory, Golden, CO</p> <p>The current portfolio of energy technologies in the U.S. has highly regionalized and technology-specific requirements for water. This portfolio is likely to evolve in coming years, shaped by various policy and economic drivers on, which will have an impact on power sector water demands. Analysis of future energy scenarios that incorporate technology options and constraints as well as different policies can provide insight into how the technology mix is likely to evolve and the water consumption and withdrawal implications on both a national and regional level. Here we analyze the water implications of future energy scenarios.</p>

123	<p style="text-align: center;">Going Green in You Power and Automation Design is Like a River</p> <p>Grant Van Hemert, Schneider Electric WWCC Application Engineer <i>Grant Van Hemert, P.E., has 15 years experience in water and wastewater. He is the chairperson for the AWWA Instrumentation and Control Committee.</i></p> <p>This poster session illustrates how to think more “green” when working with automation and power systems in ground water applications. Green can be achieved in the following way:</p> <ul style="list-style-type: none"> ○ Making control panels more reliable by: 1) Eliminating components that are susceptible to panel heat; 2) Using enhanced starters with improved fault withstand characteristics; 3) Eliminating rechargeable batteries that violate code; and 4) Understand the impact distance to the part has on repair time ○ Installation factors: 1) Labor and material reduction; 2) Energy Reduction; 3) Harmonic and surge protection; 4) Maintenance; and 5) End of useful life
124	<p style="text-align: center;">Quantifying Indirect Water Impacts of Buildings' Energy Efficiency</p> <p>Doug Elliott, Senior Research Economist, Pacific Northwest National Laboratory <i>16 years experience in energy efficiency and renewable energy at PNNL. B.A. Economics, Whitman College; M.A. Economics, University of Virginia.</i></p> <p>Contributing Authors: Jim Dirks, Pacific Northwest National Laboratory</p> <p>Pacific Northwest National Laboratory (PNNL) regularly analyzes the potential impact of U.S. Department of Energy efficiency programs on energy use, employment, carbon emissions, and other pollutants. In late 2008, PNNL added a capability to its Building Energy Analysis and Modeling System (BEAMS) to estimate indirect water withdrawal and water consumption avoidance. In 2010, PNNL has revisited the methodology and revised the coefficients that yield indirect water impacts from energy use. PNNL exercised this model for the most recent federal budget submission and has developed estimates of the water impacts. This presentation will discuss our methodology and convey the results.</p>
125	<p style="text-align: center;">Stormwater: Benefit or Detriment to Groundwater?</p> <p>Barbara Adkins, UIC Program Manager, City of Portland Environmental Services <i>Fifteen years of experience developing and implementing municipal UIC and MS4 stormwater management and water quality programs.</i></p> <p>Contributing Authors: Joel Bowker, R.G., UIC Program Hydrogeologist, City of Portland Environmental Services</p> <p>Some consider stormwater as a source of contamination. The City of Portland (Oregon) owns approximately 9,000 UICs that collect stormwater from public rights-of-way for discharge to the subsurface. UICs are a part of the comprehensive watershed management plan, and in some areas, are the only available form of stormwater disposal. In 2005, the City received the first permit in the nation for stormwater discharge to UICs. Representative monitoring is required by the permit to demonstrate groundwater protection. Five years of stormwater data will be presented from over 100 UICs from a range of constituents including total metals, phthalates, and pentachlorophenol.</p>
126	<p style="text-align: center;">Demonstrating Stormwater Infiltration is Protective of Groundwater Quality</p> <p>Heidi Blischke, Principal Hydrogeologist, GSI Water Solutions, Inc. <i>Heidi Blischke specializes in environmental evaluations and remediation projects. Her expertise includes hydrogeology, chemical fate and transport, stormwater, and sediments.</i></p> <p>Contributing Authors: Barb Adkins, Bureau of Environmental Services, City of Portland, Oregon; Rod Struck, Bureau of Environmental Services, City of Portland, Oregon</p> <p>Presentation Synopsis: The City of Portland Oregon discharges stormwater from public rights-of-way to approximately 9,000 shallow Underground Injection Control systems (UICs) under the first regional UIC permit in the nation. The City developed a Framework for determining whether groundwater is protected as a drinking water resource using a solute transport spreadsheet model. The Framework was used to demonstrate and obtain No Further Action determinations, as a corrective action, for more than 300 UICs not meeting permit required discharge limits, setbacks from drinking water wells, and inadequate vertical separation distances.</p>
127	<p style="text-align: center;">Developing Sustainable New Water Supplies for Natural Gas Development</p> <p>Kenneth E. Nichols, P.E. Senior Engineer CH2M HILL; <i>Ken is a senior engineer and operations lead for the CH2M HILL Water Business Group in Austin, Texas.</i></p> <p>Matthew E. Mantell, P.E., Corporate Environmental Engineer, Chesapeake Energy Corporation <i>Matt is responsible for produced water management, water treatment and reclamation, environmental issues with hydraulic fracturing, and water sourcing and supply development.</i></p> <p>Bruce Thomas-Benke, P.E., Client Service Manager, CH2M HILL <i>Bruce is technical lead for CH2M HILL's Upstream Water Management Initiative, with related O&G experience throughout N. America and internationally.</i></p> <p>This presentation summarizes the steps to identify and develop new, sustainable sources of water to support development of natural gas resources. The steps are scalable and can be applied to a wide range of water resource challenges. The basic program includes determining needed volumes and quality, identification of supply options, desktop feasibility studies and cost analysis, field investigations and data collection, and final design and implementation. Examples of evaluations performed for other industries and municipal water users will be provided to give additional insight and potential “out of the box” solutions that might be applied in the natural gas industry.</p>

128	<p style="text-align: center;">Produced Water Treatment and Use as a Water Resource</p> <p>Dr. David R. Stewart, PhD, PE, CTO and Forbes Guthrie, Produced Water Development, LLC <i>Bio: PhD - Environmental Engineering MBA MS/BS - Environmental Engineering. Over 30 years of experience in the water treatment field with an emphasis in membrane treatment.</i> Contributing Authors: Lynn Takaichi, PE This paper will discuss our combined experience in the beneficial use of produced water along the Colorado River system. We have two produced water projects (CBM and Oil) that will be discussed. We will discuss the treatment process and the beneficial use of the produced water within the Colorado River system. We are in the process of completing the design/build/own/operate these two treatment facilities and sells the produced water to water agencies. This paper will discuss the process on how produced water can become a valuable by-product to the energy companies</p>
129	<p style="text-align: center;">Pilot-Scale Constructed Wetland Systems for Treating Energy-Produced Waters</p> <p>James W. Castle, Professor, Environmental Engineering & Earth Sciences, Clemson University, Clemson, South Carolina <i>Dr. Castle's experience in energy and environment includes 15 years at Clemson and 17 years with Cabot O&G and Chevron.</i> Contributing Authors: John H. Rodgers, Michael Spacil, and Bethany Alley, Clemson University, Clemson. South Carolina Pilot-scale constructed wetland treatment systems are effectively treating targeted constituents (e.g. Cd, Cu, Ni, Zn, Se, As, oil & grease, ammonia) in simulated oil and gas produced waters. The pilot-scale systems were designed to produce biogeochemical conditions that result in specific treatment pathways (e.g. oxidation, reduction, sorption) for the targeted constituents. Based in fundamental biogeochemistry, the primary goal is to convert constituents of concern to less bioavailable and less toxic forms often sequestering them in sediments. Advantages of this strategy include flexibility in design and application to a wide range of water quality and quantity.</p>
130	<p style="text-align: center;">Finding Funding for Energy Efficiency Improvements at Water Utilities</p> <p>Jonathan Gledhill, President, Policy Navigation Group <i>He has advised water utilities, water trade associations, and companies on energy, regulatory, and water policy issues.</i> Water utilities have enormous opportunities to improve energy efficiency, but often too few resources to carry out these projects. Recently, federal and state funding has increased substantially for energy efficiency. Federal and state energy efficiency grants now are larger than funds available through the Federal water revolving funds. Moreover, EPA's regulation of greenhouse gases next year will incentivize private electric utilities to fund hundreds of millions of dollars in energy efficiency projects. Water utilities are well positioned to capture some of this funding. This presentation will review the energy efficiency funding opportunities available and how water utility managers can capitalize on them.</p>
131	<p style="text-align: center;">Cynthia C. Dougherty</p> <p>Bio: Cynthia C. Dougherty is the Director of the Office of Ground Water and Drinking Water at the U.S. Environmental Protection Agency in Washington., DC. In that capacity, she serves as EPA's national program manager for implementation of the federal Safe Drinking Water Act. Prior to her current position, she served as the Director of the Permits Division in the Office of Wastewater Management. She has a degree from Duke University and is the recipient of three Presidential Meritorious Executive Awards for her federal service.</p>
132	<p style="text-align: center;">GIS and Water Sustainability – A Taunton River Basin Case Study</p> <p>Mark E. Nelson, P.G. Principal, Horsley Witten Group, Inc. <i>Mark Nelson is a Principal with the Horsley Witten Group, Inc. providing integrated water management consulting services to federal, state and local governments.</i> Contributing Authors: Geraldine Camilli The Taunton River is the longest un-dammed coastal river in New England with 108 subwatersheds located in 43 municipalities. A water balance GIS model was developed to evaluate existing and future hydrologic impacts associated with water supply withdrawals, wastewater discharges, and stormwater runoff within the watershed. The model processes data including geology, land use, impervious cover, ground and surface water withdrawal and discharge locations and volumes, population density, sewer and water service areas. Model verification was conducted by comparing modeled and existing baseflow estimates in two subwatersheds using available stream gauge measurements and precipitation records. This automated model combines state and local GIS data layers with other water resource information to compare pre- and post-development water balances at the sub-watershed level. GIS data processing automation through modeling can then enable the evaluation of multiple development scenarios across all 108 subwatersheds, and the optimization of future water withdrawals and discharges to keep water local.</p>
133	<p style="text-align: center;">Beyond the Energy-Water Nexus – Developing Sustainable Water Supply Solutions for the Electric Power Industry</p> <p>James Oliver, R.G., Principal, Schlumberger Water Services <i>Mr. Oliver works out of the Denver, Colorado office and has over 25 years experience in providing water solutions for industrial and municipal clients.</i> Moving beyond the acknowledgement of the nexus between water and thermoelectric energy production will requires an examination of the specific water needs and requirements related to thermoelectric energy production, and what water resource solutions are available to develop a sustainable water supply for energy production. Limitations on water resources, increasing cost of water production and potential detrimental environmental impacts are changing the importance of water in thermoelectric power development. Traditional work flows and water supply development methods can be modified to meet the specific requirements of the thermoelectric power industry to ensure long-term availability of the water supply.</p>

134	<p style="text-align: center;">Christopher Smith</p> <p>Bio: Christopher Smith is Deputy Assistant Secretary for Oil and Natural Gas in the Office of Fossil Energy of the U.S. Department of Energy. In this position, Smith is responsible for administering domestic and international oil and gas programs, including research and development, policy analysis, and natural gas import and export licensing. The Oil and Natural Gas Office leads the Department of Energy's LNG program which involves the analysis of safety and other technical issues. Prior to his appointment in October of 2009, Smith served in managerial and analytical positions of increasing responsibility in the private sector. Most recently he spent eleven years with two major international oil companies focused primarily on upstream business development and LNG trading, including three years negotiating production and transportation agreements in Bogotá, Colombia. Smith began his career as an officer in the U. S. Army and served tours in Korea and Hawaii. He subsequently worked for Citibank and JPMorgan in New York City and London in the area of emerging markets and currency derivatives. Smith holds a bachelor's degree in Engineering Management from the United States Military Academy at West Point and an MBA from Cambridge University. Smith is married to Dr. Patricia Smith. They reside in Alexandria with their two children.</p>
135	<p style="text-align: center;">American Water Works Association G-300 Standard (Source Water Protection): Steps to Protect Source Water Quality</p> <p>Chi Ho Sham, Ph.D., Vice President The Cadmus Group, Inc. <i>Currently a Vice President at The Cadmus Group, Inc. and works extensively on source water protection and water quality issues.</i></p> <p>Contributing Authors: Sharon C. Long, Ph.D., Director of Environmental Microbiology, Wisconsin State Laboratory of Hygiene and University of Wisconsin and Richard W. Gullick, Ph.D., Director of Water Resources, Environmental Engineering & Technology</p> <p>Given the importance of source water, American National Standards Institute (ANSI)/American Water Works Association (AWWA) Standard G300, Source Water Protection, was published in 2007. This standard provides a framework to assess the effectiveness of water utilities in source water protection. The minimum requirements for a source water program include: (1) a source water protection program vision; (2) source water characterization; (3) source water protection goals; (4) source water protection action plan; (5) implementation of the action plan; and (6) periodic evaluation and revision of the program. In 2010, an operational guide was published to help implementing the standard.</p>
136	<p style="text-align: center;">Significance of Uncertainty in Water Resources Decisions for Western Pennsylvania's Marcellus Shale</p> <p>Austin Mitchell, PhD Student, Engineering and Public Policy, Carnegie Mellon University <i>BS Mechanical Engineering, University of Dayton</i></p> <p>Contributing Authors: Elizabeth Casman, Engineering and Public Policy, Carnegie Mellon University, Jeanne VanBriesen, Civil and Environmental Engineering, Carnegie Mellon University</p> <p>The PA-DEP requires Water Management Plans (WMP) for hydraulic fracturing operations in the Marcellus Shale. These WMPs rely on deterministic estimates of hydrologic parameters (average daily flow and Q_{7-10}) to determine maximum allowable surface water withdrawals. There is error in these parameter estimates stemming from field measurements, data correction, and stage-discharge regressions. More error is introduced by the use of regional regressions, areal scaling, and extrapolation to ungaged watersheds. This talk explores the significance of regulatory reliance on these deterministic parameter estimates, considering the variability of data inputs, and how this relates to protecting stream quality at low flows.</p>
137	<p style="text-align: center;">Glenn Rider II</p> <p>Bio: Glenn Rider holds a degree in Biology and General Science and is also certified to teach science at the secondary level. He began his environmental career in 1980 as a field inspector for Pennsylvania's DER. In 1983, he accepted a position in the DEP central office in Harrisburg as a Water Pollution Biologist where he conducted stream surveys around the state. Since that time, he has been involved with a variety of water quality and related programs, including managing the DEP Storage Tank division, Watershed Protection division, and Watershed Assistance division. He now serves as the Director of the Bureau of Watershed Management.</p>
138	<p style="text-align: center;">Revised Rhode Island Stormwater Manual Incorporates Ground Water Protection Practices</p> <p>Mark E. Nelson, P.G. Principal, Horsley Witten Group, Inc. <i>Mark Nelson is a Principal with the Horsley Witten Group, Inc. providing integrated water management consulting services to federal, state and local governments.</i></p> <p>Contributing Authors: Michelle West, P.E.</p> <p>The Rhode Island Stormwater Manual, initially drafted in 1993, has been revised and mandates the use of low impact development (LID) strategies in site planning and design for both new development and redevelopment projects in Rhode Island. These new LID standards require the use of stormwater treatment practices that have a proven track record of removing at least 85% of the total suspended solids (TSS), 60% of the bacteria, and 30% of the nitrogen and phosphorous. In addition, predevelopment groundwater recharge must be preserved on-site with appropriate infiltration practices. In addition, recognizing the ongoing changes in rainfall volumes and frequency, the precipitation data used to develop design storm amounts and frequency has been updated, using the full period of recorded data through 2008.</p>

139	<p style="text-align: center;">Preventing Source Water Zone II Impacts on High-Capacity Well Fields from Geothermal Heat Pump Systems</p> <p>Todd Giddings, Ph.D., P.G., President, Todd Giddings and Associates, Inc. <i>Todd is a consulting hydrogeologist and has more than 40 years of experience in ground-water resources development, management, and remediation.</i></p> <p>The new Federal residential and commercial geothermal tax credits are causing a lot of people to install new and retrofitted geothermal heat pump systems right now. Many of these retrofitted geothermal systems are located within the Zone II capture zones (area of direct ground-water flow to the well) of public water-supply wells and well fields supplying drinking water to tens of thousands of people. Proper grouting of the geothermal heat pump system vertical heat-exchanger boreholes is essential to prevent both surface and subsurface contaminants from entering the aquifer and contaminating the groundwater produced by the high-capacity wells and well fields.</p>
140	<p style="text-align: center;">Incidental Recharge in Montana</p> <p>John I. LaFave, Research Hydrogeologist, Montana Ground-Water Assessment Program, Montana Bureau of Mines and Geology <i>For the past 17 years Mr. LaFave has served as a hydrogeologist with Montana Groundwater Assessment Program.</i></p> <p>Incidental recharge occurs when normal irrigation operations result in infiltration of water to an underlying aquifer. Surface-water irrigation in Montana's alluvial valleys has created artificial hydrologic conditions that many consider to be "normal." These conditions include substantial recharge to shallow aquifers, wetlands creation, producing aquifers in arid upland areas, formation of lush riparian areas, and enhanced late season stream flows. As land-use change and irrigation efficiencies change how water is used in Montana, it is important to recognize the hidden significance of incidental recharge. Changes that inadvertently reduce recharge may also cause unforeseen impacts to groundwater storage and late-season stream flows.</p>
141	<p style="text-align: center;">Micro-Hydro Energy Recovery Opportunities in Water Distribution Systems: Impacts of Seasonal and Diurnal Demand Variabilities on Estimating Payback</p> <p>Anna Zaklikowski, PE, HDR Engineering <i>Anna Zaklikowski holds B.S. and M.S. degrees in civil & environmental engineering and is a water project engineer with HDR in Portland, OR.</i></p> <p>Contributing Authors: Brian Hemphill, HDR Engineering</p> <p>In selecting and designing micro- hydropower turbines for use in recovering energy in water distribution systems, it is common to ambitiously estimate the project payback when assumptions for average flow and pressure drop are used. This presentation will provide a basic tutorial on how these micro-turbines operate and how energy recovery potential is affected under different operating conditions. In addition, a case study will be presented to demonstrate the degree to which revenue from these projects can be over-estimated when variabilities in diurnal and seasonal demand are not taken into consideration.</p>
142	<p style="text-align: center;">North American Unconventional Fuel Resources Interactive Map & Digital Repository Project</p> <p>Michelle M. Kline, Institute for Clean and Secure Energy, University of Utah <i>Michelle works in the fields of conventional and unconventional fuels research as a GIS specialist, software developer, and geologist.</i></p> <p>Contributing Authors: Terrance G. Davis, Institute for Clean and Secure Energy, Kirsten A. Uchitel, Esq., Institute for Clean and Secure Energy and S.J. Quinney College of Law, Wendy G. Ajax, Institute for Clean and Secure Energy</p> <p>The Institute for Clean and Secure Energy (ICSE) at the University of Utah has developed an online, interactive map of North American oil shale, oil sands, and heavy oil resources. The map serves two purposes. First, it serves as an interface to the ICSE digital repository (http://repository.icse.utah.edu), which houses a variety of documents relevant to oil shale and oil sands research and development. Second, the map offers a valuable and uniquely accessible means of viewing information about unconventional fuel resources. The map is intended for use by researchers, policymakers, industry, and the general public, and can be accessed at http://map.icse.utah.edu.</p>
143	<p style="text-align: center;">Accounting for the Carbon Costs of Alternative Water Supplies in the Tampa Bay Region</p> <p>M. Jennison Kipp, Resource Economist, University of Florida Program for Resource Efficient Communities <i>Jennison conducts applied outreach and research projects on water, energy, and land-use efficiency, focusing on low impact development in Florida.</i></p> <p>Contributing Authors: Dave Bracciano, Tampa Bay Water; Eleanor Foerste, University of Florida Osceola County Extension; Pierce Jones, University of Florida Program for Resource Efficient Communities</p> <p>Tampa Bay Water serves over 2.4 million customers and relies on a unique supply system that blends groundwater with treated surface water and desalinated seawater. This study calculates and compares the indirect carbon footprints and intensities associated with potable water production from each supply source from 2006-2009. The carbon intensity of desalinated supply is estimated at 12.9 tons CO₂ equivalent per million gallons produced: 18 times greater than that of groundwater supply. Results support the argument for cost-avoidance through aggressive end-use conservation strategies, and utilities can apply the accounting approach itself to evaluate alternative future supply scenarios.</p>

144	<p align="center">Panel: UIC National Database -- Building Data Quality For More Effective Use</p> <p>Beth Hall, Prevention Branch, Drinking Water Protection Division, U.S. EPA. <i>Ms Hall's primary focus is National UIC database implementation and UIC program evaluation. She has degree in biology from Smith College. She has been with OGWDW since 1987.</i></p> <p>Trang Le, Infrastructure Branch, Drinking Water Protection Division, U.S. EPA. <i>Ms. Le is a technical member of UIC database team. She has been working in the National UIC database project since she joined EPA. She earned her Master's degree in Information Technology from the University of Maryland.</i></p> <p>Kurt Hildebrandt, UIC Program Coordinator for IA Program, Region 7, U.S. EPA. <i>Mr. Hildebrandt has been working with the US EPA in the UIC program since 1988. In 1985, he worked in the UIC program for the State of Missouri where he wrote their portion of the Class 5 Report to Congress and developed the state's original PC based UIC data management system. Mr. Hildebrandt currently also serves as the Chairman of the UIC Data Management Steering Committee. A native of St. Louis, Missouri, Mr. Hildebrandt has a Bachelor's degree in Geology from the University of Missouri-Rolla.</i></p> <p>EPA's national UIC DB has been in operation since 2008. As of Sept, 2010, 42 of the 69 UIC programs are mapping their data for submission to EPA. Currently, 20 programs submit data quarterly. To ensure only high quality data flows to EPA's UIC DB, EPA screens the incoming data against an extensive set of business rules. This step brings in very high quality, useable data to meet EPA needs. It also provides feedback to the submitting UIC programs to improve their data. The mutual benefits and challenges of building high quality data transfer is best illustrated by sharing the experience of EPA and the UIC program data submitters.</p>
145	<p align="center">The Energy and Water Efficiency Benefits of Distributed Recycled Water Production Delivery</p> <p>Trevor Hill, President and CEO, Global Water Resources <i>Mr. Hill is President and CEO of Global Water Resources, an Investor Owned Utility Company headquartered in Arizona.</i></p> <p>Contributing Authors: Graham Symmonds, CTO & SVP Regulatory Affairs and Compliance, Global Water Resources</p> <p>Water scarcity and the energy intensity of water are placing extreme pressure on natural resources and power systems throughout the world. The link between power and water demands that the most power efficient systems be deployed first. That most efficient water resource is recycled water. When deployed as an element of a regional planning initiative, the resultant cumulative energy savings are in the order to 11% of the entire energy budget for the community. This reinforces the water savings of water recycling which can reduce the community water consumption by as much as 60%.</p>
146	<p align="center">Water Vulnerabilities for Existing Coal-fired Power Plants</p> <p>Deborah Elcock, Policy Analyst, Argonne National Laboratory <i>MBA, Amos Tuck School, Dartmouth College; BA, Mathematics, Connecticut College; more than 20 years experience in energy and environmental policy analysis.</i></p> <p>Contributing Authors: James A. Kuiper, Argonne National Laboratory</p> <p>Synopsis: The high projected demand for water by coal-fired power plants, combined with decreasing freshwater supplies in many areas, suggests that certain plants may be particularly vulnerable to potential water demand-supply conflicts in the future. If not addressed, these concerns could cause power disruptions and increase consumer costs. The study identified 347 plants in 43 states that are subject to water demand and/or water supply concerns. By analyzing the characteristics of these plants, recommendations were made regarding research and development efforts to help coal-fired power plants meet electricity generation demands in a cost-effective and environmentally sustainable manner.</p>
147	<p align="center">Standing Column Wells at Villanova University</p> <p>Albert A. Koenig, Ph.D., VP, ARB/Geowell, Conshohocken PA <i>35 yrs work experience in advanced energy development with GE, Chloride Silent Power, American Refining & Biochemical including solar, wind, advanced battery and geothermal technologies.</i></p> <p>Since 2006, ARB/Geowell has worked with faculty, students and facilities personnel at Villanova University for the adoption of geothermal technology to reduce energy footprint of campus buildings. The initial project, funded by ARB, was designed to test & verify a new pump string open loop design approach that offered to reduce installed cost. Recently, two 800' wells were drilled in front of Fedigan Hall, adjacent to the CEER engineering building, to provide 25-30% of the heating & cooling of the 60 room refurbished dormitory. The design of the geothermal wells and their interface to the building HVAC system is the subject of this presentation. Thermal test results were utilized in a model of well field performance, coupled with simulation of anticipated seasonal load and water source heat pump performance to develop a complete picture of performance of the hybrid system.</p>
148	<p align="center">Making WaterSense – EPA Activities to Address the Energy/Water Nexus</p> <p>Maura Browning, MS, Office of Ground Water and Drinking Water Maura Browning works in the Drinking Water Protection Division helping utilities to improve water/energy efficiency and customer communication.</p> <p>Contributing Author: Veronica Blette, USEPA WaterSense Program</p> <p>EPA's Office of Water is engaged in many activities to help water utilities and consumers use water efficiently. Many of these activities have the added benefit of avoiding energy costs associated with treating and distributing water, which can represent a significant proportion of operational costs for many utilities. Just as it makes sense for a consumer to lower their water use in order to save on water and energy bills, it makes sense for utilities to use water efficiently on the supply side. This presentation will provide an update on EPA's WaterSense program and other activities to provide for water (and energy) savings on the supply side.</p>

149	<p style="text-align: center;">Evaluating Green Energy Options at Water and Wastewater Treatment Facilities</p> <p>F. Bloetscher, Ph.D., P.E., LEED-AP, Florida Atlantic University, Boca Raton, FL 33431 <i>Dr. Bloetscher is an Assistant Professor at Florida Atlantic University and President of Public Utility Management and Planning Services, Inc., He has worked for local governments in utility management for 20 years.</i></p> <p>FAU's Department of Civil Engineering undertook an effort to evaluate what would be needed to make two treatment plant projects "green." The first was a proposed nanofiltration water plant in Dania Beach, FL. The second was the existing North District Wastewater Treatment Plant in Pompano Beach, FL. Why design green? Environmental benefits, governmental incentives, community pride and long term savings in costs. Major areas of concern are energy and atmosphere, innovation, sustainable sites, air quality and water management. Major benefits can be gained using green power. The evaluations centered on applying the concepts of "green power" to the site - no additional power purchased from Florida Power and Light, and no on-site fossil fuel generators could supply the additional power needed. This effort was intended to support efforts to migrate water and wastewater utilities off the power grid.</p>
150	<p style="text-align: center;">Physico-Chemical Treatments for Flue-Gas Derived Water from Oxy-Fuel Power-Production with CO₂-Capture</p> <p>Danylo Oryshchyn, Mechanical Engineer, NETL, <i>Researching CO₂-capture with energy-recovery.</i></p> <p>Contributing Authors: Harendra, S. NETL; Ochs, T. NETL; Gerdemann, S. NETL</p> <p>Integrated Pollutant Removal (IPR ©) is a NETL patented process that consists of several stages of compression and intercooling resulting in a relatively pure CO₂ stream suitable for sequestration. As part of this work an IPR system was built to process approximately 100 lb/hr of flue gas (a slip stream from a test boiler). Flocculation/coagulation experiments were performed on water condensed out of this system. Results from ASTM standard method D 2035 for coagulation-flocculation jar tests show ferric chloride as an effective treatment. Anion capture remains to be fully addressed through reverse osmosis testing.</p>
151	<p style="text-align: center;">Louisiana Haynesville Shale Model: Finding Success through Development of Flexible Institutions and Balanced Adaptive Water/Energy Management</p> <p>Gary M. Hanson, Director, Red River Watershed Management Institute LSU Shreveport <i>M.S. Earth Sciences, University of New Hampshire. Extensive industry experience including district exploration manager/partner and Tetra Tech office manager. Director since 2001.</i></p> <p>The massive natural gas shale resource plays that are currently under development throughout the U.S. need relatively large volumes of water for well drilling and completion operations. Two of the larger plays are the Haynesville and the Marcellus. The Institute, partnering with a proactive Louisiana Department of Natural Resources and Office of Conservation, has worked with local and federal entities to develop flexible institutions to address water quality/supply issues. A non-statutory water resources committee and working group, whose members include representatives from waterway authorities, state/federal regulatory agencies and gas companies, is solving water resource problems by applying adaptive management tools.</p>
152	<p style="text-align: center;">A Program to Promote Responsible Unconventional Natural Gas Development</p> <p>Richard Ward, Energy Future Coalition <i>Shell Group, EHS Strategy and Plan Manager (The Netherlands); Environmental Manager / Hydrologist (Saudi Arabia); Contaminant Hydrologist (San Francisco); Exploration Geologist (Houston); BS Stanford Univ. (Geology); MS Stanford Univ. (Petroleum Geology)</i></p> <p>The past decade has spawned dozens of initiatives aimed at responsibly producing unconventional natural gas. To date, these initiatives have not been successful in assuring the public. Indeed as the development has progressed, public concern about the environmental impact has swelled to civic outrage leading to drilling moratoria in many basins. This talk describes a multi-lateral initiative bringing together industry, NGOs and government leaders as a force for change. The aim is consolidate initiatives and lead key stakeholders in a collaborative effort to promote improved standards by codifying the best in class processes and procedures for unconventional natural gas development.</p>
153	<p style="text-align: center;">Recycling Conserves Water AND Energy</p> <p>David Reardon, PE, BCEE, National Director Water Sustainability HDR Engineering <i>BS Civil Engineering, MS Environmental Engineering, UC Davis. 8 years with LA County Sanitation Districts, 30 years with HDR</i></p> <p>Contributing Authors: Peter Newell, HDR</p> <p>Major portions of the country a beset by drought and virtually the entire country suffers from negative impacts of high energy cost. In the West and elsewhere, water supplies are at a premium and virtually all new water sources must now come from sources that are becoming energy intensive to deliver to the customer. It is common to extract well water from depths of 600 ft or more and to construct water delivery systems that span hundreds of miles with significant lifts. All this leads to delivered water that has significant "energy intensity". It is not uncommon to have energy intensities of 5,000 kWh/million gallons or more prior to treatment and distribution. Recycled water offers an attractive option to our energy intensive water sources. This presentation shows how recycled water energy intensity compares to other water sources. It also shows how the energy imparted to water in the home dwarfs the energy associated with water delivery, water treatment, distribution and wastewater treatment</p>

154	<p style="text-align: center;">Design and Development of the Alternative Water Source Information System (AWSIS)</p> <p>Roy Arthur, Internet and Technology Services, - ALL Consulting, LLC <i>Over 10 years experience in creating data management and technology applications for private clients, state oil and gas agencies, EPA, and the U.S. Department of Energy.</i> Contributing Authors: Roy Arthur; J. Daniel Arthur, P.E., SPEC; David Alleman; Nathan Alleman; ALL Consulting, LLC As part of the NETL Program to reduce fresh water usage at coal-fired power plants, ALL Consulting has developed an internet-based GIS Catalog of Alternative Sources of Cooling Water. The Catalog compiles publicly available data on alternative (or non-traditional) sources of water, such as mine discharge water, oil and gas produced water, saline aquifers, and publicly owned treatment works (POTWs) that could be used to supplement or replace existing surface water sources. This presentation will provide an overview of the Catalog, the data sources used, the data management approaches used to create the Catalog, and the expected benefits.</p>
155	<p style="text-align: center;">Robert F. Kennedy, Jr</p> <p>Bio: Robert F. Kennedy, Jr.'s reputation as a resolute defender of the environment stems from a litany of successful legal actions. Mr. Kennedy was named one of Time magazine's "Heroes for the Planet" for his success helping Riverkeeper lead the fight to restore the Hudson River. The group's achievement helped spawn the almost 200 Waterkeeper organizations that today span the globe. Mr. Kennedy serves as Chief Prosecuting Attorney for the Hudson Riverkeeper and President of Waterkeeper Alliance. He is also a Clinical Professor and Supervising Attorney at Pace University School of Law's Environmental Litigation Clinic, and is co-host of Ring of Fire on Air America Radio. Earlier in his career he served as Assistant District Attorney in New York City. He has worked on several political campaigns, including the presidential campaigns of Edward M. Kennedy in 1980, Al Gore in 2000, and John Kerry in 2004. Mr. Kennedy is also a venture partner in and senior advisor to VantagePoint Venture Partners, one of the world's premiere cleantech venture capital firms.</p> <p>He has worked on environmental issues across the Americas and has assisted several indigenous tribes in Latin America and Canada in successfully negotiating treaties protecting traditional homelands. He is credited with leading the fight to protect New York City's water supply. The New York City watershed agreement, which he negotiated on behalf of environmentalists and New York City watershed consumers, is regarded as an international model in stakeholder consensus negotiations and sustainable development. He helped lead the fight to turn back the anti-environmental legislation during the 104th Congress.</p> <p>Among Mr. Kennedy's published books are the New York Times' bestseller Crimes Against Nature (2004), St. Francis of Assisi: A Life of Joy (2005), The Riverkeepers (1997), and Judge Frank M. Johnson, Jr: A Biography (1977). His articles have appeared in The New York Times, The Washington Post, Los Angeles Times, The Wall Street Journal, Newsweek, Rolling Stone, Atlantic Monthly, Esquire, The Nation, Outside Magazine, The Village Voice, and many other publications. His award winning articles have been included in anthologies of America's Best Crime Writing, Best Political Writing, and Best Science Writing.</p> <p>Mr. Kennedy is a graduate of Harvard University. He studied at the London School of Economics and received his law degree from the University of Virginia Law School. Following graduation he attended Pace University School of Law, where he was awarded a Masters Degree in Environmental Law.</p> <p>He is a licensed master falconer, and as often as possible, he pursues a life-long enthusiasm for white-water paddling. He has organized and led several expeditions in Canada and Latin America, including first descents on three little known rivers in Peru, Colombia, and Venezuela.</p>
156	<p style="text-align: center;">State Regulatory Oversight of Geothermal Heat Pump Installations: A National Survey</p> <p>Kevin B. McCray, CAE, Executive Director, National Ground Water Association Nationally, installations of geothermal heat pump systems are estimated to have increased more than 33 percent in each of the last two year, as reported by the federal government. In the interest of protecting ground water, the Geothermal Heat Pump Consortium, Ground Water Protection Council, and the National Ground Water Association conducting a comprehensive survey of current regulatory practices regarding geothermal heating and cooling systems among the various states.</p>
157	<p style="text-align: center;">Water Quality Considerations in Aquifer Storage & Recovery Systems: A Safe Drinking Water Act Perspective</p> <p>Anna Zaklikowski, PE, HDR Engineering <i>Anna Zaklikowski holds B.S. and M.S. degrees in civil & environmental engineering and is a water project engineer with HDR in Portland, OR.</i> Contributing Authors: Bryan Black, HDR Engineering In this presentation, water quality considerations and treatment requirements for ASR projects will be discussed in general and in the context of two case studies. ASR water quality is typically regulated by multiple regulatory agencies in each state, oftentimes with overlapping and conflicting requirements. The regulatory requirements for permitting and/or licensing ASR wells in two states will be compared, with specific attention given to the challenges in simultaneously complying with each agency's requirements. The case studies will provide specific examples of water quality issues that need to be addressed and present solutions that were developed to guarantee the success of these projects.</p>

158	<p style="text-align: center;">US DOE Efforts to Broaden the Understanding of the Energy-Water-Climate Nexus</p> <p>Craig Zamuda, Ph.D., Senior Policy Advisor, Office of Climate Change Policy and Technology, Office of Policy and International Affairs U.S. Department of Energy <i>Senior policy advisor with more than 30 years of experience in the areas of energy security, energy technologies and environment/climate policy.</i></p> <p>Presentation Synopsis: The discussion will provide an overview of efforts within US Department of Energy to explore water implications of energy technologies and energy-climate policy. Challenges to effectively integrate energy-water interdependency into policy and energy technology development and deployment activities on a domestic and international basis will be discussed. Finally, a high-level summary of DOE water-energy activities will include efforts within the DOE's Office of Policy and International Affairs and DOE National Laboratories to characterize the water demands of existing and alternative energy production technologies, as well as strategies for reducing the use of fresh water through improving energy-water use efficiency, and use of non-traditional water sources.</p>
159	<p style="text-align: center;">NF-co-doped TiO₂ for Visible/Solar Treatment and Disinfection of Water Including Applications in Developing Countries</p> <p>Miguel Pelaez, Ph.D. Student, University of Cincinnati <i>B.S. Chemical Engineering, Universidad de las Americas, Puebla, Mexico.</i></p> <p>Contributing Authors: Erick R. Bandala, Universidad de Las Américas, Puebla, Patrick S.M. Dunlop, University of Ulster, Dionysios D. Dionysiou, University of Cincinnati</p> <p>The development of a novel chemistry method to synthesize nitrogen and fluorine co-doped TiO₂ (NF-TiO₂) photocatalytic nanoparticles and films active under visible/solar light was explored. The material exhibited high surface area and porosity, narrow pore size distribution and an improvement on the visible light absorption showing a slight red-shift in light absorbance. These NF-TiO₂ materials were proven efficient for the destruction of pesticides (Amitrole), biological toxins (microcystin-LR) and the inactivation of Escherichia coli (<i>E.coli</i>) under visible and/or solar light. This technology can have a significant impact on the purification of water for developing countries or for emergency aid situations worldwide.</p>
160	<p style="text-align: center;">UV/H₂O₂ Process for Treatment of β-lactam Antibiotics in Water</p> <p>Xuexiang He, Department of Civil and Environmental Engineering, University of Cincinnati <i>A Ph.D. student from UC with research focus on the degradation of emerging contaminants by advanced oxidation processes.</i></p> <p>Contributing Authors: Kimberly A. Rickman, Chemistry and Biochemistry Department, California State University; Stephen Mezyk, Chemistry and Biochemistry Department, California State University; Dionysios D. Dionysiou, Department of Civil and Environmental Engineering, University of Cincinnati</p> <p>Antibiotics have been playing a significant role in pharmaceutical industry; however, their presence in water resources could create undesired environmental problems. The destruction of such emerging contaminants by UV/H₂O₂ advanced oxidation process has been investigated. Different β-lactam antibiotics (i.e., ampicillin and cephalothin) were selected as model contaminants. It was found that the degradation of these antibiotics increased with increasing of UV dose, following pseudo-first-order kinetics. The presence of certain inorganic species was examined with respect to degradation kinetics and extent of mineralization. A competition study was also conducted to determine the second order rate constant.</p>
161	<p style="text-align: center;">Development of CNT-based Sensors for Detecting Cyanotoxins in Water</p> <p>Changseok Han, Ph.D Student, University of Cincinnati <i>BS, School of Civil and Environmental Engineering, Yeungnam University, Korea, MS, Environmental Engineering, Graduate school of Yeungnam University, Korea</i></p> <p>Contributing Authors: Amos Doepke, University of Cincinnati, Wondong Cho, University of Cincinnati, Dionysios D. Dionysiou, University of Cincinnati</p> <p>To develop Carbon nanotube(CNT)-based sensor for detecting cyanotoxins in water, multi-wall CNTs arrays were grown on SiO₂/Si wafer deposited with Fe film by a water-assisted thermal CVD method. C₂H₄ (carbon source), H₂, Ar and water vapor (reactant gases) were used at 750 °C in Easytube furnace. To improve graphitization of CNTs, CNTs arrays grown on the substrate were heat-treated in Ar atmosphere at 2500 °C. CNTs were functionalized by electrochemical method in alkaline solutions. Antibodies were conjugated on CNTs by modified PIERCE EDC/NHS method and electrochemical impedance spectroscopy was applied to measure the impedance change for CNT-based sensors.</p>
162	<p style="text-align: center;">State Investigations of Oilfield ground Water contamination Incidents and Their Role in Advancing Regulatory Reforms</p> <p>Scott R. Kell, Consulting Geologist Bio: Scott Kell was a geologist and Administrator over the Ohio oil and gas regulatory program and is past president of the GWPC. Synopsis: The GWPC is completing a two-state study of documented ground water contamination incidents caused by oilfield activities. Based upon a review of records in Ohio and Texas, the author has concluded that State determinations regarding causation have played a major role in advancing regulatory reforms that enhance protection of ground water resources.</p>
163	<p style="text-align: center;">The Water-Energy Nexus: The Role of Global Change Science</p> <p>Charles Vörösmarty (Presenter), Balázs Fekete, Pamela A. Green (City University of New York) and Eric F. Wood (Princeton University)</p> <p>This paper will present perspectives of two Earth System Science Partnership (ESSP) elements -- the Global Water System Project (GWSP) and Global Energy and Water Experiment (GEWEX). Through examples we describe how interdisciplinary approaches can be used to better articulate issues associated with the energy-water nexus and how the data and tools can help craft solutions. One issue that arises immediately is that of tradeoffs, which will accompany planning for water allocations in the future. We highlight the potential of existing technological assets, exemplified by these two ESSP projects and how these can be used to address the strategic imperatives.</p>

164	<p style="text-align: center;">The Future of Water Quality</p> <p>Jacqueline Daoust, Vermont Law School <i>A graduate from Johnson State College with a B.S. in Environmental Science and Vermont Law School with a Master's in environmental law and policy.</i> Here the future of water quality will be discussed, as well as the latest case decisions that effecting the future and functions of water suppliers and other water agencies. Due to the new Water Transfer Rule promulgated by the EPA, the CWA is now read differently due to this decision and serious exemptions from NPDES permitting have been upheld. While this may be helpful to water agencies, could this decision cause a significant increase of pollution to our navigable waters?</p>
165	<p style="text-align: center;">An Integrated Water Treatment Solution for Sustainable Water Resource Management in the Marcellus Shale</p> <p>Matthew J. Bruff, Chief Development Officer and General Counsel, Altela, Inc. <i>Matthew has over 15 years experience in water and natural resource law leading Altela's business development and environmental permitting activities.</i> The project aims to demonstrate that the recently-patented AltelaRain® technology can be successfully deployed in the Marcellus Shale Basin operating within regulatory requirements, be cost effective and provide unique benefits to industry, common water resource and environmental stakeholders. The three Phase approach will outline and address the regulatory steps and reuse the clean water following treatment, demonstrating that water quality, economic and regulatory requirements can be met. In addition, a life-cycle approach will highlight the benefits of adopting such an integrated technology for sustainable water resource management.</p>
166	<p style="text-align: center;">Energy & Water: Potential Futures</p> <p>C. Andrew (Andy) Miller is Chief of the Atmospheric Protection Branch with EPA's National Risk Management Research Laboratory (NRMRL). <i>Andy has been with EPA since 1991, and for much of that time conducted research on the formation and control of combustion-generated air pollutants. He currently leads a group of researchers evaluating the environmental implications – including GHG emissions – of changes in the U.S. energy system resulting from changes in technology and policy.</i> Energy production and use are likely to change in response to policies developed in response to climate change, energy security, economic demands, and technological development. Because water is a critical factor in energy production, these changes will impact, and will be impacted by, the demand for water. A model of the U.S. energy system (the MARKAL model) is employed to evaluate several scenarios of future energy production and use, and the results of those scenarios are used to gain insights into the impacts on water consumption. The scenarios evaluated include a business as usual case, several scenarios in which greenhouse gas emissions are controlled to levels similar to those stated in proposed legislation, and a GHG control scenario that includes significant increases in electric-capable light-duty vehicles. Scenarios that emphasize thermal electricity generation show considerable increases in water consumption, while those with a renewable energy approach indicate significant reductions in water demand. Water consumption for production of biofuel feedstocks overwhelms water requirements to power electric-capable vehicles. The presentation closes with a brief discussion of future directions for research and analysis.</p>
167	<p style="text-align: center;">RBDMS Water A NEW Regulatory Tool for Water Data Management</p> <p>Gregg Miller, Ohio DNR RBDMS Water is web based system that is accessible with different permission levels. RBDMS Water has many internal users including: Coal Regulatory, Oil and Gas, Industrial Minerals, and Abandon Mine Lands. External users include: OSM and other federal and state agencies, the public, Watershed organizations, and Universities. RBDMS Water accepts electronic data submissions from laboratories. RBDMS water tracks compliance monitoring and evaluates monitoring trends: pre-/post-mining; bond releases; oil & gas, coal, and IM – Complaint and other investigations. RBDMS Water includes alerts that contain compliance information such as permit exceedance. Other examples include, self-designed “red flags” and percent deviation from baseline figures, SMCL or MCL violations, effluent standards, and flags for delinquent reports. RBDMSW also includes a fully interactive GIS Component that displays all located sample locations, and allows for selection of samples through the map interfaces, and the presenting of sample locations selected from the database.</p>
168	<p style="text-align: center;">Marcellus Shale Water Management</p> <p>Tony Gaudlip, Water Operations Manager, Range Resources <i>Tony Gaudlip joined Range Resources in January 2008 following various industry positions in South Texas, Wyoming, the Middle East, Europe and Asia.</i> Contributing Authors: Pete Miller, P.E., Range Resources The management of water resources poses considerable challenges to natural gas operators seeking to develop the Marcellus shale in Pennsylvania. Although the play overlies a seemingly water-rich region the sourcing, storage, transfer and disposal of water for drilling and completions operations are far from straight forward. One approach uses the fundamental characteristics of the Marcellus shale to challenge the conventional rules of thumb for water quality. This unconventional approach to water management has lead to innovative solutions which serve to both protect the water resources of the Commonwealth and to provide maximum flexibility to operations.</p>

169	<p style="text-align: center;">THE INTEGRITY OF GROUND WATER SUPPLIES IN AREAS OF OIL AND GAS DEVELOPMENT</p> <p>Andrew Stone, Executive Director, American Ground Water Trust <i>Andrew Stone is a hydrogeologist with experience as a consultant, educator and ground water advocate</i> Thirty two states have producing gas wells, 31 states produce crude oil and 22 states have active coal mining operations. The management of produce water and the effects on wells and ground water from the fracking processes used for coal bed methane and shale gas are of prime concern to citizens. The challenge for communities and their elected officials is to find protocols and procedures that will facilitate energy development without jeopardy to water resources. This presentation proposes a template for informed debate at the local level to identify realistic and achievable controls for areas where energy development may impact water.</p>
170	<p style="text-align: center;">The Environmental Costs of Energy: A Discussion of the Trade-offs Involved in Energy Choices</p> <p>J. Daniel Arthur, P.E., SPEC, Executive Director, - American Energy and Environmental Research Foundation <i>Over 25 years experience in conventional and unconventional energy resource development and environmental compliance and planning. He has recently been appointed to serve on a National Petroleum Council Study and a DOE Federal Advisory Committee.</i> The success of the U.S. economy over the last 50 years is the direct result of an abundant, reliable and affordable supply of energy from sources such as coal, oil, and natural gas. With rising concerns over global climate change and our dependence on foreign oil, however, many questions concerning the future direction of energy development in the United States are being raised. Renewable energy sources are becoming more popular because they are domestically produced and are viewed as a way to reduce harmful emissions and establish a sustainable energy supply. The transition to a more sustainable energy future, however, will require that decision makers, as well as the public, understand both the near- and long-term implications of their energy choices.</p>
171	<p style="text-align: center;">Easing the Water Constraints on Power Plant Cooling with Treated Municipal Wastewater: Insights from Pilot-scale Cooling Tower Tests</p> <p>Radisav D. Vidic, Ph.D., P.E., Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA 15261 <i>Dr. Vidic is a William Kepler Whiteford Professor and Chairman of the Department of Civil and Environmental Engineering at the Swanson School of Engineering, University of Pittsburgh, where he has been working since 1992. He holds a BS in Civil Engineering from the University of Belgrade (1987), M.S. and Ph.D. in Civil and Environmental Engineering from the University of Illinois (1989) and University of Cincinnati (1992), respectively.</i> Contributing Authors: Heng Li and Shih-Hsiang Chien, Department of Civil and Environmental Engineering, University of Pittsburgh, Ming-Kai Hsieh and David A. Dzombak, Department of Civil and Environmental Engineering, Carnegie Mellon University This presentation evaluates the feasibility of using treated municipal wastewater as a source of cooling water makeup in thermoelectric power generation. Municipal wastewater can pose several technical difficulties in cooling systems because of its lower quality compared to typical freshwater sources. Corrosion, scaling, and biofouling are the major challenges. The feasibility of using chemical inhibitors in combination with advanced treatment to manage cooling water quality was examined in both lab- and pilot-scale studies. The results indicate that corrosion, scaling and biofouling can be managed adequately in cooling systems using treated municipal wastewater to replace freshwater as makeup water, but with higher doses and additional treatment, which translates into higher costs relative to the use of freshwater.</p>
172	<p style="text-align: center;">Evaluation of Abandoned Mine Drainage as a water supply for hydraulic fracturing in the Marcellus Shale</p> <p>Elise Barbot, Ph.D., Postdoctoral researcher, University of Pittsburgh, Department of Civil and Environmental Engineering <i>M.S. in Process Engineering and Physical-Chemistry, Aix-Marseille University, Ph.D. in Process Engineering, Aix-Marseille University.</i> Contributing Authors: M.K. Henrikson, K., and, Department of Civil and Environmental Engineering, University of Pittsburgh; R. Vidic Gregory, Department of Civil and Environmental Engineering, Carnegie Mellon University Ongoing development of horizontal drilling and hydraulic fracturing in the Marcellus shale raises major concerns about water use and treatment: primarily, supplying the well site with millions of gallons of fresh water for hydrofracturing, secondarily, finding an appropriate way to treat or utilize flowback water that returns to the surface contaminated with both inorganic and organic components after hydrofracturing. The approach developed in this presentation relies on blending flowback water with abandoned mine drainage allowing for the mixture to be reused for hydrofracturing. Determining potential mine drainage waters is based on water quality and the need for additional treatment processes.</p>
173	<p style="text-align: center;">Nutrient Problems in the U.S. Call for Urgent Action</p> <p>Jim Taft; Executive Director; Association of State Drinking Water Administrators <i>Mr. Taft oversees the activities of the Association which include information and knowledge transfer among states in support of effective implementation of the SDWA.</i> Presentation Synopsis: Despite our collective best efforts, the national nutrients problem is not getting better. As the U.S. population expands, nutrient pollution from a variety of sources is expected to grow. Increased public health risks and treatment costs from contamination of drinking water are major concerns. In October 2008, state and EPA water quality and drinking water directors and national program managers formed a State-EPA Nutrient Innovations Task Group to review past nutrient control efforts and evaluate the potential for creating a new combination of existing tools and innovative approaches for addressing nutrient pollution. The Task Group believes that a coordinated and innovative synthesis of existing regulatory authorities and voluntary tools must be used across all sources and sectors of nutrient pollution.</p>

174	<p style="text-align: center;">Deficiencies in Methodologies for Assessing Induced Seismicity</p> <p>Dr. Chet Miller , Independent Consultant for E. I. DuPont De Nemours Inc. <i>Chet Miller retired from DuPont in 2002 after 35 years service. He currently consults with them on underground injection well issues.</i> Contributing Authors: James E. Clark, Diane K. Sparks, Richard W. Nopper, E. I. DuPont De Nemours Inc. We demonstrate that past diagnostic studies of induced seismicity at underground injection sites (e.g., Wesson and Nicholson, 1988) were both inaccurate and fundamentally flawed, and, in our judgment, failed to confirm the basic theoretical mechanism of static frictional slip failure. We recommend that new work be initiated to revisit the earlier studies in order to address these deficiencies and to arrive at improvements to the current overly-stringent siting methodology.</p>
175	<p style="text-align: center;">The North Carolina Groundwater Resource Evaluation Program - A Decade of Characterization of the Fractured Bedrock Aquifers of the Piedmont and Mountains</p> <p>Evan Kane, Groundwater Planning Supervisor, NCDENR Division of Water Quality <i>Evan Kane oversees North Carolina's groundwater quality monitoring program and development of classifications and other regulations for groundwater protection.</i> Contributing Authors: Rick Bolich, NCDENR Division of Water Quality The results of a 10 year cooperative study on the groundwater resources of the North Carolina piedmont and mountain regions have enhanced our knowledge base on groundwater movement and groundwater quality in fractured rock environments. This increased knowledge base will assist North Carolina regulators with their goals of protecting this valuable resource from pollution and enhancing water quality for the future.</p>
176	<p style="text-align: center;">ASR Application in Climate Adaptation: The need, issues and research focus</p> <p>Dr. Y. Jeffrey Yang, PE, D.WRE., Physical Scientist, USEPA, Office of Research and Development, MS690, 26W Martin Luther King Dr., Cincinnati, Ohio 45268 <i>Dr. Yang leads R&D activities in water resources and infrastructure adaptation to climate and socioeconomic changes with focus on water-energy sustainability</i> <i>Angela Restivo, USEPA, Region 6</i> Aquifer storage and recovery (ASR) is a technique used to store excessive water and smooth temporal water supply variations. Its function for mitigation of water flow imbalance finds new applications in water resource adaptation to climate changes and socioeconomic developments. This paper describes a holistic research and development program on ASR, from the need assessment in contiguous US, mechanistic study of arsenic remobilization, fate and transport of emerging contaminants in reclaimed water, to engineering controls of ASR operations. Experimental data and engineering models are expected outcomes to assist end users in sustainable ASR developments.</p>
177	<p style="text-align: center;">Proposed CO2 Rules and the National UIC Program: A Multi-Stakeholder Perspective</p> <p>Bob Van Voorhees, Manager, Carbon Sequestration Council <i>Bob has addressed underground injection control, energy and environmental issues as a lawyer and consultant for companies and other organizations for over thirty years. With Scott Anderson he has coordinated the geologic sequestration multi-stakeholder discussions and development of recommendations.</i> <i>Scott Anderson, Senior Policy Advisor, Climate and Air Program, Environmental Defense Fund</i> Through multi-stakeholder discussions (MSDs), environmental non-governmental organizations (ENGOS); industry organizations and companies representing the electric utility, petroleum and mining industries; and government regulators are developing specific regulatory proposals on issues relating to the geologic emplacement and containment of carbon dioxide for both enhanced recovery of hydrocarbons and for storage. These recommendations provide a template for addressing siting criteria, defining the GS project area, permitting, financial assurance, well construction requirements, logging and testing, operating requirements, testing and monitoring, reporting, post-injection site care, closure, and post-closure care.</p>
178	<p style="text-align: center;">Recovery Act Financing for Ground Water Systems</p> <p>Chuck Job, Chief, Infrastructure Branch Two billion dollars in Recovery Act funding were in water system contracts by February 17, 2010, the statutory deadline, to address immediate capital needs defined by the act. As of mid-July, approximately 45 percent of the funds had been spent providing jobs and responding to public health and environmental objectives. A significant amount of this funding and resultant expenditure were for infrastructure of ground water supplied public water systems.</p>
179	<p style="text-align: center;">Contaminants in Groundwater Sources Used for Public Supply</p> <p>Patricia L. Toccalino, Hydrologist, U.S. Geological Survey, Sacramento, CA <i>Dr. Toccalino leads an interagency effort to communicate the potential relevance of USGS water-quality findings in a human-health context.</i> Contributing Authors: Jessica A. Hopple, Hydrologist, U.S. Geological Survey, West Trenton, NJ About one-third of the Nation's population obtains drinking water from public wells. The U.S. Geological Survey assessed water-quality conditions in source (untreated) water from 932 public wells in 41 states, and in source and finished (treated) water from a subset of 94 wells. More chemical contaminants (as many as 337) were assessed in this study than in any previous national study of public wells. Study objectives were to evaluate contaminant occurrence in source water and its potential significance to human health, whether contaminants that occur in source water also occur in finished water, and the occurrence of contaminant mixtures.</p>

180	<p style="text-align: center;">Evaluating Sustainability of Projected Water Demands under Future Climate Change Scenarios</p> <p>Sujoy B. Roy, Principal Engineer, Tetra Tech, Inc., Lafayette, California <i>Environmental engineer focused on evaluating water use and water quality impacts relating to power, agricultural, and municipal sectors.</i> Contributing Authors: Limin Chen, Tetra Tech, Inc., Lafayette, California; Evan Girvetz, University of Washington, Seattle, Washington, and The Nature Conservancy; Edwin P. Maurer, Santa Clara University, Santa Clara, California This study presents an integration of water withdrawal projections and future estimates of renewable water supply across the United States to assess future water availability in the face of a changing climate. The water demand projections in this work are based on business-as-usual trends in growth, particularly of population and energy demand, and renewable water supply projections are based on the average results of an ensemble of sixteen established climate models. The analysis is performed using annual water use data at the U.S. county level, and using global climate model outputs for temperature and precipitation.</p>
181	<p style="text-align: center;">U.S. Geological Survey National Water Census Groundwater Resources Program</p> <p>Susan S. Hutson, Hydrologist, U.S. Geological Survey Susan has a Bachelor of Science from the University of Tennessee, and a Master of Science from the University of Memphis Contributing Authors: Eric J. Evenson, Water Census Coordinator, U.S. Geological Survey The Water Availability and Water Use Assessment proposed in the Department of Interior 2011 budget is part of WaterSMART and the National Water Census Initiative. Funding will be used to assess groundwater's role in water availability by expanding the USGS work through the Groundwater Resources Program. The USGS will concentrate on those aquifer systems that account for the greatest groundwater use. From these studies, USGS will obtain information about recharge, yields, and changes in storage. Additionally, some of the resources of the initiative, will be used to continue and complete and analysis of the Nation's brackish aquifer systems.</p>
182	<p style="text-align: center;">The Carbon Footprint of Water</p> <p>Wendy Wilson, National Program Director, River Network <i>Wendy Wilson is a national program director with River Network, a technical support organization for local river and watershed groups.</i> Contributing Authors: Bevan Griffiths-Sattenspiel, River Network This paper explores water-related energy use in the United States and the potential to reduce greenhouse gas emissions through water management strategies. The authors show how, at a minimum, pumping, treating and heating water in the United States consumes over 520 million Megawatt hours per year - equivalent to 13% of the country's electricity consumption. This session will explore the connections between climate change, municipal water use and energy conservation and how grassroots groups can promote policies and programs in water conservation, efficiency, reuse and Low Impact Development.</p>
183	<p style="text-align: center;">Well Stimulation 101</p> <p>Bob Garland, Universal Well Services Hydraulic Fracturing has been used for the past 62 years to increase the production from oil and gas reservoirs throughout the U.S. and the world. The process and the chemicals used to facilitate the processes are not new, secret, or mysterious. Hydraulic Fracturing 101 will cover the process from start (pre-job preparation) to the stimulation to the finish (flow-back). When we plan a job, how much water is used, certain additives are used in order to: more efficiently pump the job, protect the formation, and ultimately produce more natural gas. This presentation will go over the general chemicals used and why they are used. The typical Marcellus stimulation will contain the following additives: Friction Reducer, Dilute HCL Acid, scale inhibitor, biocide, surfactant, iron stabilizer, and acid inhibitor. These additives will be compared to the chemicals we use on a daily basis and we will also discuss the delusion and why this is so important to the process.</p>
184	<p style="text-align: center;">Interdependent Water, Energy and Carbon Management Issues and Assessment Models for Basin-Scale Energy Development</p> <p>Andrew Wolfsberg, Computational Earth Science Group Leader, Los Alamos National Laboratory <i>Ph.D. and M.S. in Civil Engineering from Stanford University, B.S. in Hydrology from University of Arizona, LANL since 1994.</i> Contributing Authors: Donatella Pasqualini, Gordon Keating, Richard Middleton, and Daniel Levitt (Computational Earth Science, LANL) This poster highlights LANL's recently completed Western Energy Corridor Initiative study of oil-shale development in Colorado, where substantial new electric power generation would be necessary to develop the fuel resource. We have developed a multi-scale framework that integrates a dynamic energy assessment model (<i>CLEAR</i>) with spatially aware hydrologic (<i>WARMF</i>) and carbon management (<i>SimCCS</i>) models at the basin scale. With these capabilities, we are able to model multiple energy development scenarios taking into account critical basin-wide processes including regional climate impacts on surface hydrology, reservoir and diverted water management, land use change, and CO₂ transport and storage.</p>

185	<p style="text-align: center;">Ground Water Classification Approaches: Importance and Applications</p> <p>Kevin D. Frederick, P.G. <i>Kevin Frederick manages the Groundwater Section for the Wyoming Department of Environmental Quality's Water Quality Division in Cheyenne, Wyoming.</i> Many states apply some type of system to classify groundwater according to the type of existing or potential use of the resource, or the type of use(s) for which ground water is suitability for. Some federal regulatory programs establish suitability standards (i.e. MCLs) for a specific type of ground water use (i.e. domestic use) or base protective standards upon a more generalized quality aspect (i.e. Underground Source of Drinking Water (USDW)). Classification systems are described in order to review the advantages and disadvantages of generalized approaches versus more comprehensive classification approaches that consider the suitability of the resource for specific purposes.</p>
186	<p style="text-align: center;">EPA OWOW Storm Water Update</p> <p>Edward W. Lavery, USEPA Region, 1 EPA New England, Environmental Protection Specialist The proposed EPA stormwater rules may have a huge impact on how stormwater will be handled in urban, suburban, rural and in new developed versus existing areas. Under the proposed rules, additional requirements in construction permits to infiltrate stormwater to mimic pre-development hydrology are likely. The talk will include a discussion on EPA's current stormwater policy and program efforts as well as a calendar of activities planned for the upcoming year.</p>
187	<p style="text-align: center;">EPA OGWDW Storm Water Update</p> <p>Roy Simon, EPA Headquarters, Office of Ground Water and Drinking Water This presentation will include an overview of how the proposed stormwater rules may impact permittees in urban, rural and new development. Depending on the designs of many of these stormwater best management practices (BMPs), state UIC programs may be required to review stormwater BMPs to determine if they qualify as Class 5 UIC wells. Similarly, many communities already require low-impact development techniques which also may qualify as Class 5 wells. This presentation will discuss the potential effects on shallow groundwater resources, quality and quantity, and an overview of pollutant removal capabilities.</p>
188	<p style="text-align: center;">Watershed-Based Source Water Protection Programs in Pennsylvania</p> <p>G. Patrick Bowling, P.G., Geologist, Pennsylvania Department of Environmental Protection <i>Patrick Bowling, a senior geologist in the Pennsylvania Department of Environmental Protection's Bureau of Watershed Management, is involved with developing, implementing and coordinating Pennsylvania's Source Water Assessment & Protection Program.</i> Contributing Authors: Joseph J. Lee, Jr., P.G, Geologist Manager, Pennsylvania Department of Environmental Protection During development of Pennsylvania's Source Water Protection (SWP) Program, the complexities of addressing numerous potential sources of contamination for run-of-river surface-water intakes on major rivers challenged the standard model from wellhead protection efforts. Numerous point and non-point sources of contamination in catchments spanning dozens of municipalities made it difficult to develop, let alone implement, a local SWP program. Initially, water suppliers using these sources desired an early warning monitoring network to know what the system needed to treat on a short term and longer basis. Pennsylvania capitalized development of early warning/spill detection networks on the major rivers serving as water sources. Networks are designed and maintained by member systems, and must include a communication network. From these networks, water suppliers, watershed organizations, and governmental agencies organized collaborative, watershed-based SWP programs to provide a coordinated approach by addressing common concerns about potential sources of contamination, and leveraging resources for outreach and implementation of protection measures.</p>
189	<p style="text-align: center;">Joshua Johnson</p> <p>Bio: Joshua Johnson, Professional Staff Member for the US Senate Committee on Energy and Natural Resources Joshua Johnson is a Professional Staff Member on the U.S. Senate Energy and Natural Resources Committee. As a member of the Republican staff, he is responsible for the Water and Power Subcommittee, and energy efficiency. Prior to joining the Senate, Mr. Johnson was the Staff Director of the U.S. House Resources Committee's Subcommittee on Water and Power. Mr. Johnson has a Masters Degree from the London School of Economics and an M.A. in National Security and Strategic Studies from the U.S. Naval War College.</p>

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Water Impacts of a Changing Energy Policy**Michael E. Webber**, UT Austin*Webber is Assistant Professor of Mechanical Engineering, Associate Director of the Center for International Energy and Environmental Policy, and co-Director of the Clean Energy Incubator at UT Austin*Contributing Authors: **Carey W. King**, **Ashlynn S. Stillwell**, and **Kelly M. Twomey**

Abstract/synopsis: Energy and water are precious, global, and interconnected resources. Water provides electric power directly and plays a growing role for irrigation of energy crops. At the same time, the thermoelectric sector is the largest user of water in the U.S., withdrawing 200 billion gallons daily for powerplant cooling. And while the energy sector uses water, the water sector uses energy for moving, pumping, treating, and heating. Given recent trends towards water-intensive fuels and energy-intensive water production (through desalination), the problems might only become worse. However, despite the close relationship of energy and water, the funding, policymaking, and oversight of these resources are typically performed by different people in separate agencies. Energy planners often assume they will have the water they need and water planners often assume they will have the energy they need; if one of these assumptions fails, the consequences will be dramatic. But, by bringing scientific and engineering expertise to bear on this vastly understudied problem, this scenario might be avoided.

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Using RBDMS to Manage Oil and Gas Activities in New York and Display Data Using the RBDMS Wellbore Schematic Utility**Amanda Trotter**, New York DEP

As one of the oldest oil and gas producing states, New York continues to be a player in the nation's domestic program of oil and gas production. New York first implemented RBDMS 10 years ago to track production data, and also uses RBDMS to regulate the development and production of oil and gas within the state. With help from GWPC, some of the recent projects include the capacity to track multi-lateral wells, the creation of an online searchable database, and an electronic permitting system that is currently being deployed. With the advent of high-volume hydraulic fracturing of low-permeability gas reservoirs (such as the Marcellus shale), New York is considering how to track HVHF processes in the database, with potential data elements ranging from chemical usage to source water and/or disposal. GWPC and DOE are funding the development of a wellbore diagram tool that will aid in the visualization of horizontal wells.

The Ground Water Protection Council (GWPC) is a national non-profit organization, founded in 1983. The *GWPC Annual Forum* brings together state, federal, and local agency representatives with the responsibility for ground water/drinking water protection with industry, researchers, and environmental groups in a congenial venue on the latest technology and policy developments. For the last 27 years, the *Annual Forum* has been a major gathering, which brings these groups together to foster communication on safeguarding the nation's ground water supplies.

At the *Water/Energy Symposium* we will explore the complex relationships between water resources, quality, and sustainability, with energy development and generation in the midst of multiple components of change, with the goal of informing policy decisions at state, federal, and local levels and fostering interaction between those in the water and energy communities. The event will highlight various energy sectors and their impacts on water quality and quantity, as well as those water-use-intensive institutions that need and rely on energy, while also addressing emerging challenges associated with climate change adaptation. Partial event funding provided through cooperative agreements from each the USEPA Office of Ground Water & Drinking Water and the USDOE, National Energy Technology Laboratory.

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

Upcoming GWPC Events

Fall RBDMS Training

Hampton Inn & Suites Albany
Downtown
25 Chapel Street, Albany, NY 12210
October 13-14, 2010



Radisson Downtown
1st and Congress

2011 UIC Conference

Underground Injection
Control

THE National Ground
Water Protection
Program

Austin Texas
January 24-26, 2011



*“Dedicated to protecting
the nation’s
Ground Water”*

Ground Water Summit May 1-5, 2011 ~ Baltimore, MD



2011 NGWA Ground Water Summit and
2011 Ground Water Protection Council Spring Meeting

Baltimore, Maryland
May 1-5

2011 Ground Water Protection Council Annual Forum

September 2011
Details ~ COMING SOON!

*Ground Water
Availability
& Sustainability*

*Water Energy
Sustainability*

*Ground Water
Protection*