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**Mastering the Subsurface through Technology
Innovation and Collaboration: Carbon Storage and
Oil and Natural Gas Technologies Review Meeting**

U.S. Department of Energy

Fossil Energy and National Energy Technology Laboratory

August 16–18, 2016

Sheraton Station Square, Pittsburgh, Pennsylvania

TUESDAY, AUGUST 16, 2016 – GRAND STATION BALLROOM

7:00 a.m. **Meeting Registration/Continental Breakfast**

WELCOME - PLENARY SESSION

Moderator: Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory

8:00 a.m. **Introductions**
Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory

8:05 a.m. **Welcoming Remarks and NETL Overview**
TBD

8:40 a.m. **Subsurface Technology and Engineering Research, Development, and
Demonstration (SubTER) Crosscut initiative**
TBD

9:15 a.m. **DOE's Clean Coal R&D Program**
Mark Ackiewicz, Office of Fossil Energy, U.S. Department of Energy

9:35 a.m. **BREAK – Grand Station III – IV**

PLENARY SESSION

Moderator:

9:50 a.m. **DOE's Oil and Natural Gas R&D Program**
Shareen Yawanarajah, Office of Fossil Energy, U.S. Department of Energy

10:10 a.m. **International Offshore Carbon Storage Panel Discussion**
Panel: **TBD**

10:55 a.m. **Associated Storage Panel Discussion**
Panel: **TBD**

11:40 a.m. **LUNCH – Reflections and Waterfront**

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PARALLEL SESSIONS – TUESDAY, AUGUST 16, 2016

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | |
|-------------------|----------------|---|----------------|--|---------------|--|
| Session Moderator | Geomechanics 1 | | SubTER 1 | | Monitoring 1 | |
| 12:40 PM | P1 | Geomechanical Properties of Mesozoic Rift Basins: Applications for Geosequestration - Geostock Sandia LLC - Daniel Collins | P1 | Novel 3D Acoustic Borehole Integrity Monitoring - LANL - Cristian Pantea | P1 | Methods for Monitoring Migration of CO ₂ /Brine Plumes and Groundwater Impacts - National Energy Technology Laboratory - Christina Lopano |
| 1:05 PM | P2 | Development of Geomechanical Screening Tools to Identify Risk: An Experimental and Modeling Approach - University of Texas at Austin - Mary Wheeler | P2 | Ultrasonic Phased Arrays and Interactive Reflectivity Tomography - Oak Ridge National Laboratory - Hector Santos-Villalobos | P2 | Monitoring of Geological CO ₂ Sequestration using Isotopes and PF Tracers - Oak Ridge National Laboratory - David Graham |
| 1:30 PM | P3 | Integrated Characterization of CO ₂ Storage Reservoirs on the Rock Springs Uplift Combining Geomechanics, Geochemistry, and Flow Modeling - University of Wyoming - John Kaszuba | P3 | Imaging Fracture Networks using Joint Seismic and Electrical Change Detection - Sandia National Laboratory - Hunter Knox | P3 | Science of CO ₂ Sequestration - Los Alamos National Laboratory - Rajesh Pawar |
| 1:55 PM | P4 | A Probabilistic Assessment of the Geomechanical Response to CO ₂ Injections in Large Igneous Provinces - Virginia Polytechnic Institute and State University - Ryan Pollyea | P4 | Multi Variate Examination of the Cause of Increasing Induced Seismicity - National Energy Technology Laboratory – Kelly Rose | P4 | Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO ₂ -Enhanced Oil Recovery Pilot, Anadarko Basin, Texas - Oklahoma State University - Peter Clark |

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|----------------|----|--|----|--|----|--|
| 2:20 PM | P5 | A Coupled Geomechanical, Acoustic, Transport and Sorption Study of Caprock Integrity in Carbon Dioxide (CO ₂) Sequestration - Colorado School of Mines - Manika Prasad | P5 | SLAC National Accelerator Laboratory Coupling of Geochemical and Geomechanical Processes in the Manipulation of Fracture Systems in Subsurface Formations used for Carbon Sequestration - SLAC National Accelerator Laboratory - Andrew Kiss | P5 | Field Testing of Emerging Technologies – The Otway Project - Lawrence Berkeley National Laboratory – Barry Freifeld |
| 2:45 PM | P6 | Quantitative Characterization of Impacts of Coupled Geomechanics and Flow on Safe Permanent Geological Storage of Carbon Dioxide (CO ₂) in Fractured Reservoirs - Colorado School of Mines - Yu-Shu Wu | P6 | Borehole Muon Detector for 4D Density Tomography - Pacific Northwest National Laboratory - Alain Bonneville | P6 | Nonlinear Acoustic Methods for the Detection and Monitoring of CO ₂ /Brine Leakage Pathways in Wellbore Systems - Los Alamos National Laboratory- Pierre-Yves LeBas |

3:10 p.m. **BREAK – Grand Station III – IV**

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | |
|-------------------|------------------------|--|----------------|---|--------------------|---|
| Session Moderator | Hydraulic Fracturing 1 | | SubTER 2 | | Geologic Storage 1 | |
| 3:25 PM | P1 | Laboratory and Numerical Investigations of Hydraulic Fracture Propagation and Permeability Evolution in Heterogeneous and Anisotropic Shale - Lawrence Berkeley National Laboratory - Seiji Nakagawa | P1 | Luminescence Spect Stress Sensor In Situ Measurement - Oak Ridge National Laboratory - Yarom Polsky | P1 | Small-Scale Field Test Demonstrating CO ₂ Sequestration in Arbuckle Saline Aquifer and by CO ₂ -EOR at Wellington Field, Sumner County, Kansas - University of Kansas Center for Research - Lynn Watney |
| 3:50 PM | P2 | Understanding Water Controls on Shale Gas Mobilization into Fractures - Lawrence Berkeley National Laboratory - Tetsu Tokunaga | P2 | Evaluating the State of Stress Beyond the Borehole - Los Alamos National Laboratory - David Coblenz | P2 | CO ₂ Utilization in Unconventional Reservoirs - Pacific Northwest National Laboratory - Peter McGrail |
| 4:15 PM | P3 | Development of Nanoparticle-stabilized Foams To Improve Performance of Waterless Hydraulic Fracturing - University of Texas at Austin - Masa Prodanovic | P3 | Hydraulic Fracture and Stimulation in a Deep Mine Investigation - Lawrence Berkeley National Laboratory - Curtis Oldenburg/Patrick Dobson | P3 | Sequestration in Basalt Formations - Pacific Northwest National Laboratory - Peter McGrail |

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| 4:40 PM | P4 | Advanced Hydraulic Fracturing - Gas Technology Institute - Jordan Ciezobka | P4 | Development of microBayesloc Location Method - Lawrence Livermore National Laboratory - Steve Myer | P4 | Exploring the Behavior of Shales as Seals and Storage Reservoirs for CO ₂ - National Energy Technology Laboratory - Ernest Lindner |
| | | | | Offshore Systems | | |
| 5:05 PM | P5 | A Geomechanical Analysis of Gas Shale Fracturing and its Containment - Texas A&M - George Moridis | P1 | Risk Assessment for Offshore Systems – National Energy Technology Laboratory – Kelly Rose | P5 | Central Appalachian Basin Unconventional (Coal/Organic Shale) Reservoir Small Scale CO ₂ Injection Test - Virginia Tech - Mike Karmis |
| 5:30 PM | P6 | Fracture Design, Placement, and Sequencing In Horizontal Wells - University of Texas at Austin - Mukul Sharma | P2 | Metal-based systems in Extreme Environments – National Energy Technology Laboratory – Jeff Hawk | | |

6:15 p.m. **Poster Session – Grand Station III–V**

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WEDNESDAY, AUGUST 17, 2016 – GRAND STATION BALLROOM

7:00 a.m. **Meeting Registration/Continental Breakfast**

8:00 a.m. **WELCOME – OPENING PLENARY SESSION**

Moderator:

8:05 a.m. **IEAGHG Monitoring Network Panel Discussion**
Panel Chair: Tim Dixon, Manager Technical Program, and CCS and Regulatory Affairs
Panel: **TBD**

8:50 a.m. **National Risk Assessment Partnership Panel Discussion**
Panel: **TBD**

9:30 a.m. **Microseismicity Panel Discussion**
Panel: **TBD**

10:10 a.m. **Water Nexus – Water Treatment Technologies**
Jessica Mullen, National Energy Technology Laboratory

10:30 a.m. **BREAK – Grand Station III – IV**

PLENARY SESSION – RESEARCH UPDATES

Moderator:

10:45 a.m. **Oil and Natural Gas Program Update**
Jared Ciferno, U.S. Department of Energy, National Energy Technology Laboratory

11:05 a.m. **Overview of NETL Subsurface Intramural Research**
Grant Bromhal, U.S. Department of Energy, National Energy Technology Laboratory

PLENARY SESSION – REGIONAL CARBON SEQUESTRATION PARTNERSHIP LARGE-SCALE FIELD PROJECTS

11:25 a.m. **Kevin Dome, Big Sky Regional Carbon Sequestration Partnership**

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12:00 p.m. **LUNCH – Reflections and Waterfront**

PARALLEL SESSIONS – WEDNESDAY, AUGUST 17, 2016

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | | | |
|-------------------|----------------|---|----------------------|--|------------------------------------|--|-------------------------------|--|
| Session Moderator | Monitoring 2 | | Fracture Diagnostics | | Pressure Management | | Offshore Resource Assessments | |
| 1:00 PM | P1 | MVA Field Activities - National Energy Technology Laboratory - Hank Edenborn | P1 | Fracture Diagnostics Using Low Frequency Electromagnetic Induction And Electrically Conductive Properties - University of Texas at Austin - Mukul Sharma | P1 | Phase II Field Demonstration at Plant Smith Generating Station: Assessment of Opportunities for Optimal Reservoir Pressure Control, Plume Management and Produced Water Strategies - Electric Power Research Institute - Robert Trautz | P1 | Offshore CO ₂ Storage Resource Assessment of the Northern Gulf of Mexico - University of Texas at Austin - Tip Meckel |
| 1:25 PM | P2 | Field Testing of Emerging Technologies – The Aquistore Project - Lawrence Berkeley National Laboratory – Tom Daley | P2 | Injection and Tracking of Micro Seismic Emitters to Optimize UOG Development - Paulsson Inc. - Bjorn Paulsson | P2 | Developing and Validating Pressure Management and Plume Control Strategies in the Williston Basin Through a Brine Extraction and Storage Test (BEST) - Phase II - University of North Dakota Energy & Environmental Research Center - John Hamling | P2 | Mid-Atlantic U.S. Offshore Carbon Storage Resource Assessment Project - Battelle Memorial Institute - Neeraj Gupta |
| | | | Geophysics 1 | | Capacity/Storage Efficiency | | | |
| 1:50 PM | P3 | Pressure-Based Inversion and Data Assimilation System (PIDAS) for CO ₂ Leakage Detection - University of Texas at Austin - Alexander Sun | P1 | Relationship between Microseismicity and Rock Properties: Not all Marcellus is the Same – National Energy Technology Laboratory - Erich Zorn | P1 | Enhanced Analytical Simulation Tool for CO ₂ Storage Capacity Estimation and Uncertainty Quantification - University of Texas at Austin - Seyyed Hosseini | P3 | Assessment of CO ₂ Storage Resources in Depleted Oil and Gas Fields in the Ship Shoal Area, Gulf of Mexico - Geomechanics Technologies, Inc. - Jean Young |

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| 2:15 PM | P4 | Optical Spectroscopy and Microseismicity tools for EOR and Coal Bed MVA Analyses - Los Alamos National Laboratory - Sam Clegg | P2 | 4D Integrated Study Using Geology, Geophysics, Reservoir Modeling & Rock Mechanics to Develop Assessment Models for Potential Induced Seismicity Risk – University of Oklahoma - Jeremy Boak | P2 | Optimizing and Quantifying CO ₂ Storage Resource in Saline Formations and Hydrocarbon Reservoirs - University of North Dakota - Charles Gorecki | P4 | Offshore Storage Resource Assessment - NITEC LLC - Chet Ozgen |
| 2:40 PM | P5 | Real-Time In-Situ Carbon Dioxide Monitoring Network for Sensitive Subsurface Areas in Carbon Capture and Storage - Intelligent Optical Systems Inc. - Jesus Delgado-Alonso | P3 | Scalable Automated, Semipermanent Seismic Method for Detecting CO ₂ Plume Extent During Geological CO ₂ Injection - University of North Dakota - John Hamling | P3 | Commercial Scale CO ₂ Injection and Optimization of Storage Capacity in the Southeastern United States - Advanced Resources International, Inc. - George Koperna | P5 | Southeast Offshore Storage Resource Assessment - Southern States Energy Board - Ken Nemeth |
| 3:05 PM | P6 | Understanding Impacts to Air Quality from Unconventional Natural Gas Development – National Energy Technology Laboratory - Natalie Pekney | P4 | Improved Microseismic Monitoring - Lawrence Livermore National Laboratory - Metzel/White | P4 | Resource Assessment - National Energy Technology Laboratory - Angela Goodman | | |

3:30 p.m.

BREAK – Grand Station III – IV

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | | | |
|-------------------|----------------|--|----------------|---|--------------------|--|--------------------|--|
| Session Moderator | Mitigation | | Geomechanics 2 | | Associated Storage | | Wellbore Integrity | |
| 3:45 PM | P1 | Programmable Sealant-Loaded Mesoporous Nanoparticles for Gas/Liquid Leakage Mitigation - C-Crete Technologies, LLC - Rouzbah Shasavari | P1 | Pressure Management and Geomechanical Behavior at Industrial Partner Projects - Lawrence Livermore National Laboratory - Josh White | P1 | Improved Characterization and Modeling of Tight Oil Formations for CO ₂ Enhanced Oil Recovery Potential and Storage Capacity Estimation - University of North Dakota - James Sorensen | P1 | Integrated Wellbore Integrity Analysis Program for CO ₂ Storage Applications - Battelle Memorial Institute - Mark Moody |

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| 4:10 PM | P2 | Wellbore Leakage Mitigation using Advanced Mineral Precipitation Strategies - Montana State University - Adrienne Phillips | P2 | Characterizing and Interpreting the In Situ Strain Tensor During CO ₂ Injection - Clemson University - Larry Murdoch | P2 | Liquid-rich Shale Potential of Utah's Uinta and Paradox Basins: Reservoir Characterization and Development - Utah Geological Survey - Michael Vandenberg | P2 | Wellbore and Seal Integrity - Los Alamos National Laboratory – Bill Carey |
| 4:35 PM | P3 | Methods to Enhance Wellbore Cement Integrity with Microbially-induced Calcite Precipitation (micp) - Montana State University - Adrienne Phillips | P3 | Impact of Thermal Stress on Wellbore Integrity - Lawrence Livermore National Laboratory - Joe Morris/Pratanu Roy | P3 | Optimizing CO ₂ Sweep Based on Geochemical and Reservoir Characterization of the Residual Oil Zone of Hess Seminole Unit - University of Texas at Austin - Ian Duncan | P3 | Improving Science-Base for Wellbore Integrity, Barrier Interface Performance – National Energy Technology Laboratory - Nick Huerta |
| 5:00 PM | P4 | Targeted Mineral Carbonation to Enhance Wellbore Integrity - University of Virginia - Andres Clarens | P4 | Geomechanics of CO ₂ Reservoir Seals - University of Texas at Austin - Peter Eichhubl | P4 | Identification of Residual Oil Zones in the Williston and Powder River Basins - University of North Dakota - Wesley Peck | P4 | Development of Methods to Prohibit and Remediate Loss of Annular Isolation in Shale Gas Wells: Prevention and Remediation of Sustained Casing Pressure and Other Isolation Breaches - CSI Technologies, LLC - Jeff Watters/Kyle Comb |
| | | | | | Improved Recovery | | | |
| 5:25 PM | P5 | Nanoparticle Injection Technology for Remediating Leaks of CO ₂ Storage Formation - University of Colorado - Yunping Xi | P5 | Geophysical and Mineralogical Controls on the Rheology of Fracture Slip and Seal Breaching - Pennsylvania State University - Derek Elsworth | P1 | Simulation of the Shale Oil System: from Molecular Fluid Dynamics to Reservoir Scale - Lawrence Berkeley National Laboratory - George Moridis | P5 | Nxis Well Integrity Inspection in Unconventional Gas Wells - General Electric Company - Matthias Kasten |

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| 5:50 PM | P6 | Statistical Analysis of CO ₂ Exposed Wells to Predict Long Term Leakage through the Development of an Integrated Neural-Genetic Algorithm - University of Louisiana at Lafayette - Boyan Guo | P6 | Geomechanical Framework for Secure Carbon Dioxide CO ₂ Storage in Fractured Reservoirs and Caprocks for Sedimentary Basins in the Midwest United States - Battelle Memorial Institute - Joel Sminchak | P2 | Maximize Liquid Oil Production from Shale Oil and Gas Condensate Reservoirs by Cyclic Gas Injection - Texas Tech University System - James Sheng | P6 | Wellbore Integrity and Mitigation - National Energy Technology Laboratory - Barbara Kutchko |
| 6:15 PM | P7 | Wellbore Seal Repair Using Nanocomposite Materials - University of New Mexico - John Stormont | P3 | Results from the In Situ Fault Slip Experiment at Mont Terri – Lawrence Berkeley National Laboratory – Jens Birkholzer | P3 | Nano-scale and Laboratory-scale Investigations of Shale Oil Systems - Lawrence Berkeley National Laboratory - George Moridis | P7 | Nanite For Better Wellbore Integrity and Zonal Isolation - Oceanit Laboratories - Vinod Veedu |

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THURSDAY, AUGUST 18, 2016 – GRAND STATION BALLROOM

- 7:00 a.m. **Meeting Registration/Continental Breakfast**
- 8:00 a.m. **WELCOME – PLENARY SESSION – REGIONAL CARBON SEQUESTRATION PARTNERSHIP LARGE-SCALE FIELD PROJECTS**
- Moderator:**
- 8:05 a.m. **Farnsworth Unit, Southwest Regional Partnership on Carbon Sequestration**
- 8:40 a.m. **Michigan Basin, Midwest Regional Carbon Sequestration Partnership**
- 9:15 a.m. **Citronelle Project, Southeast Regional Carbon Sequestration Partnership**
- 9:50 a.m. **Cranfield Project, Southeast Regional Carbon Sequestration Partnership**
- 10:25 a.m. **BREAK – Grand Station III – IV**
- 10:40 a.m. **Bell Creek Field Project, Plains CO₂ Reduction Partnership**
- 11:15 a.m. **Illinois Basin - Decatur Project, Midwest Geological Sequestration Consortium**
- 11:50 a.m. **Carbon Storage Program Future Direction**
Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory
- 12:00 p.m. **LUNCH – Reflections and Waterfront**

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PARALLEL SESSIONS – THURSDAY, AUGUST 18, 2016

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | |
|---------------------------|----------------|--|------------------------|---|---------------|---|
| Session Moderator | Geophysics 2 | | Hydraulic Fracturing 2 | | Modeling | |
| 1:00PM | P1 | Deep Controlled Source Electro-Magnetic Sensing: A Cost Effective, Long-Term Tool for Sequestration Monitoring - Multi Phase Technologies LLC - Douglas LaBrecque | P1 | Hydraulic Fracturing Test Sites Institute of Gas Technology - Jordan Ciezobka | P1 | Model Complexity and Choice of Model Approaches for Practical Simulations of CO ₂ Injection, Migration, Leakage, and Long-term Fate - Trustees of Princeton University - Michael Celia |
| 1:25 PM | P2 | Methods for Locating Legacy Wells - National Energy Technology Laboratory – Rick Hammack | P2 | Marcellus Shale Energy and Environment Laboratory (MSEEL) West Virginia University - Tim Carr | P2 | Optimal Model Complexity in Geological Carbon Sequestration: A Response Surface Uncertainty Analysis - University of Wyoming - Ye Zhang |
| 1:50 PM | P3 | Field Testing of Emerging Technologies - The CMC Containment and Monitoring Field Station - Lawrence Berkeley National Laboratory - Tom Daley and Barry Freifeld | P3 | Utica Shale Energy and Environment Laboratory Ohio State University - Jeff Daniels | P3 | Enhanced Simulation Tools to Improve Predictions and Performance of Geologic Storage Coupled Modeling - Massachusetts Institute of Technology - Ruben Juanes |
| 2:15 PM | P4 | Distributed Fiber Optic Arrays: Integrated Temperature and Seismic Sensing for Detection of CO ₂ Flow, Leakage and Subsurface Distribution - Electric Power Research Institute Inc. - Robert Trautz | P4 | Chemical Control of Fluid Flow and Contaminant Release in Shale Microfractures SLAC National Accelerator Laboratory - John Bargar | P4 | Evolution of Carbonate CO ₂ Storage Reservoirs - Lawrence Livermore National Laboratory - Susan Carroll |
| Geologic Storage 2 | | | | | | |
| 2:40 PM | P1 | Reservoir Performance - National Energy Technology Laboratory - Deepak Tapriyal | P5 | Development and Field Testing Novel Natural Gas Surface Process Equipment for Replacement of Water as Primary Hydraulic Fracturing Fluid – Southwest Research Institute - Melissa Poerner | P5 | Multiscale Modeling of Carbon Dioxide Migration and Trapping in Fractured Reservoirs with Validation by Model Comparison and Real-Site Applications - Princeton University - Michael Celia |

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| 3:05 PM | P2 | Impact of Microstructure on the Containment and Migration of CO ₂ in Fractured Basalts - Washington University - Daniel Giammar | P6 | Geochemical Evolution of Hydraulically-Fractured Shales – National Energy Technology Laboratory - Ale Hakala | |
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3:30 p.m. **BREAK – Grand Station III – IV**

| Room | Haselton 1 & 2 | | Brighton 3 & 4 | | Ellwood 1 & 2 | |
|-------------------|--------------------------|--|----------------------|--|--------------------------------|---|
| Session Moderator | Associated Storage (EOR) | | Energy Data eXchange | | Intelligent Monitoring Systems | |
| 3:45 PM | P1 | A Nonconventional CO ₂ -Enhanced Oil Recovery Target in the Illinois Basin: Oil Reservoirs of the Thick Cypress Sandstone - University of Illinois - Nathan Webb | P1 | Advances in Data Discovery, Mining, & Integration for Energy R&D Using the Energy Data eXchange (EDX) - National Energy Technology Laboratory - Kelly Rose | P1 | Development of a Framework for Data Integration, Assimilation, and Learning for Geological Carbon Sequestration - University of Texas at Austin - Alexander Sun |
| 4:10 PM | P2 | Carbon Life Cycle Analysis of CO ₂ -EOR for Net Carbon Negative Oil (NCNO) Classification - University of Texas at Austin - Vanessa Nunez-Lopez | P2 | | P2 | Development of Intelligent Monitoring System (IMS) Modules for the Aquistore CO ₂ Storage Project - University of North Dakota - John Hamling |
| 4:35 PM | P3 | Development of Swelling-Rate-Controllable Particle Gels to Enhance CO ₂ Flooding Sweep Efficiency and Storage Efficiency - Missouri University of Science and Technology - Baojun Bai | P3 | | P3 | Intelligent Monitoring Systems and Advanced Well Integrity and Mitigation - Archer Daniels Midland Corporation - Scott McDonald |

5:00 p.m. **Concluding Remarks – GRAND STATION BALLROOM**
 Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory