EPAct Unconventional Resources Complementary Program Research Overview

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EPAct Unconventional Resources
Complementary Program Research Overview
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NETL EPAct Unconventional Resources Research

  - Section 999: Ultra-Deepwater and natural gas supply R&D program funded at $50 million per year
- NETL-RUA implements a “Complementary” research plan
  - Portfolio of oil/natural gas related research conducted by the NETL-RUA that supports the goals of EPACT
- Consortium administered program elements
  - Research Partnership to Secure Energy for America (RPSEA)
    - Comprised of U.S. energy research universities, industry and independent research organizations
NETL-Regional University Alliance

- NETL’s Office of Research and Development
- URS
  - Carnegie Mellon University
  - Pennsylvania State University
  - University of Pittsburgh
  - Virginia Tech
  - West Virginia University
Risk assessment requires predicting the potential for a deleterious event as well as its consequence.

Risk = probability $\times$ consequence

Focus for FY12 Research:

- **Field Data** to establish baselines and impacts of processes
- **Laboratory Data** for simulations and confirmation of field data
- **Computational Tools** to characterize and predict system baselines and behavior
**EPAct Unconventional Resources FY 2012 Portfolio**

Air quality monitoring to evaluate environmental integrity of sites undergoing oil and gas development
- Characterize baseline environmental signals
- Fugitive air emissions

Evaluating water quality and treatment using established and novel techniques
- Characterize baseline environmental signals
- Produced water composition and treatment
- Naturally-occurring isotope tracers

Integrated modeling and monitoring for predicting fracture growth and induced seismicity
- Characterize baseline environmental signals
- Prediction of fracture propagation
- Coupling microseismic data and geomechanical models

Information-based tools for predicting and evaluating implications of onshore unconventional resource development
- Characterize baseline environmental signals
- Fluid-gas-rock interactions in shale
- Evaluating distribution and provenance of saline fluids and methane in shallow groundwaters
- Predictive tools for risk assessment
Air quality monitoring to evaluate environmental integrity of sites undergoing oil and natural gas development

- **Historical Successes (2005 – 2011)**
  - NETL Air Quality Monitoring Laboratory
    - Designed and fabricated one-of-a-kind mobile ambient air quality monitoring station with remote data collection
    - Preliminary conclusions for Allegheny National Forest show no major difference between sites downwind of oil and gas operations and a control site
Current focus: Baseline air quality monitoring and definition of fugitive methane emissions
Evaluating water quality and treatment using established and novel techniques

- **Historical Successes (2005 – 2011)**
  - Subsurface drip irrigation (SDI) successful reuse strategy for coalbed methane produced waters
    - *NETL’s research established the science-base behind SDI discharge permit requirements by the WY Dept. of Environmental Quality*
  - Strontium isotopes able to distinguish difference between AMD and Marcellus Shale produced waters
    - *Established science base for further development of novel water quality analytical tool*

Multicollector ICP-MS for high-throughput isotope analysis
Current focus: Evaluating surface pond aeration

- Detailed study of the chemistry and microbiology of produced water during surface storage

### Chemistry

![Conductivity Chart]

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sulfide (mg/l) Before Aeration</th>
<th>Sulfide (mg/l) After Aeration</th>
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</table>

### Microbiology

![Microbiology Image]

- Static
- Aerated

### Oxidation Reduction Potential

![Oxidation Reduction Potential Chart]
Current focus: Use of natural isotopic signals to identify geologic source of fluids

Multicollector ICP-MS for high-throughput isotope analysis
Integrated modeling and monitoring to predict fracture growth and induced seismicity

- **Historical Successes (2005 – 2011)**
  - “Intelligent modeling” process for simulating fractured reservoir systems (e.g., the Bakken oil-bearing shale)
    - Improved production and well placement
    - FRACGEN/NFFLOW multi-layer version was released to the public and is being used by small- to mid-size operators to design production operations

- **Current approach**
  - Develop predictive capability for hydraulic fracture growth and microseismic events
  - Back-track the source of regional microseismic events to specific subsurface phenomena (and distinguish signals between natural vs. oil and gas related events)
Information-based tools for subsurface processes in oil and gas development

• **Historical Successes (2005 – 2011)**
  - Airborne magnetic surveys detected the location of unknown wells in an active WY CO₂-EOR field
    - *This information led to solutions to stop for unwanted CO₂ leakage from previously-unknown leaky wellbores*
  - Assemblage of 3-D geologic framework model for the Marcellus Shale using commercial software (EarthVision) –
    - *Used for developing well designs, completion techniques, and efficacy in producing hydrocarbon resources*
    - *Key foundation for risk assessment modeling of shale gas operations*
  - Developed foundation for shale gas regional assessments on gas productivity and potential environmental issues (e.g., sources of metals and contaminants)
Development of information tools for integrated assessment modeling
Questions?

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