Environmentally Friendly Drilling Systems Program

Reducing environmental footprints by providing unbiased science for policy and cost effective operations

Ground Water Protection Council
January 24, 2012

www.efdsystems.org
www.facebook.com/EFDSystems
The Environmentally Friendly Drilling (EFD) program, managed by the Houston Advanced Research Center (HARC), integrates advanced technologies into systems that significantly reduce the footprint of petroleum drilling and production in environmentally sensitive areas. The objective is to identify, develop and transfer critical, cost effective, new technologies that can provide policy makers and industry with the ability to develop reserves in a safe and environmentally friendly manner.

Our bottom-line is to impact our sponsor’s bottom line:

- Reduce the environmental footprint
- Measure public perception, allowing us to prioritize our efforts and engaging all stakeholders
- Identify and aid in the application and development of cost effective technologies
EFD Program History

• Formed Team in 2005 (7 years)
  – Texas A&M University took lead to obtain U.S. Department of Energy Funding

• Engaged Stakeholders
  – Formed Joint Industry Partnership to guide and co-fund program
  – Engaged Environmental Organizations
  – Formed University/National Lab Alliance
  – Initiated International outreach program including EFD-EU

• Expanded Effort
  – Phase 2 led by HARC with RPSEA funding
  – Phase 3, Technology Integration Program co-funded by RPSEA & Industry
  – Initiated complementary program funded by Coastal Impact Assistance Program (CIAP) managed by the Texas General Land Office
Thank you Sponsors!
The EFD Team

Co-funded by RPSEA, US Fish and Wildlife, Industry, Environmental Organizations
Working to Reduce Impacts

For more Info see:

www.oilandgasbmps.org
www.strongerinc.org/p
www.efdsystems.org
www.fracfocus.org
From the Past
(single wells at multiple sites)

To the Present
(multiple wells at single sites)
Opposition to O&G Activities

NO DRILLING! NO COMPROMISE!

EARTH FIRST!
No Compromise in Defense of Mother Earth

The land and water cannot depend on the hollow promises of politicians and corporations. Over and over, regulations fail to protect the land and water that gives us life. Counting on the government to protect us is no safer than counting on the oil and gas companies to drill safely. That's why we started Finger Lakes Earth First! To make space in the gas drilling debate for those of us that are ready to take action to defend our home.

www.FingerLakesEarthFirst.org
Energy Company’s License to Operate

Technology is available, but it will be the environmental issues and society’s acceptance that slow the development of shale gas resources.
EFD Alliance responding to local issues

North American shale plays (as of May 2011)
Program Highlights
Energy Water Production Industry

- 60 Million BBls/Day (20x salt of seawater, various chemicals)

- Average oil well: 7.6 bbls water per bbl of oil
  - On avg: 88% of material brought to surface is water
  - 98% towards end of production life

- Average gas well: 260 bbls of water per million cubic feet of natural gas

- In 2007, average daily output in the US:
  - 4.8 million bbls of crude oil
  - 66 billion cubic feet of natural gas
  - 58 million bbls of waste water
    - Total of 150,000 disposal wells
      - 29 million bbls re-injected into oil/gas formations
      - 20 million barrels injected into non-hydrocarbon zones
    - Less than 2 million bbls per day discharged on surface – mostly offshore (380,000 bbls onshore).
Water World

• Life Cycle
  – Use of non-potable water
  – Produced water management
  – Reuse, reinjection
  – De-watering of wells
  – Cost-effectiveness

• Regulations/Policy
  – Offshore discharges
  – Clean Water Act
Membrane Treatment Options to Allow Re-Use of Frac Flowback and Produced Brine for Gas Shale Resource Development

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Texas A&M University

Co Investigators
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Gene Theodori, - Sam Houston State University
James (Chip) Kilduff - Rensselaer Polytechnic Institute
Abby Kinchy - Rensselaer Polytechnic Institute
E.J. (Jeri) Sullivan Los Alamos National Laboratory
Rich Haut – HARC
Membrane Desalination Projects

- Marcellus Shale NY, PA, WV (pre-treatment)
- Central Texas (Luling) - Desalination
- Coastal Texas (Geothermal Desalination)
- South Texas (Eagle Ford Shale) – ground water aquifer protection
A&M GPRI Designs™ Advanced Water Treatment Technologies for re-use of brine for fracturing and desalination for private and public use.

**Deliverables**
- Document the cost effectiveness of brine desalination, frac fluid re-use, brackish water desalination.
- Identify optimal treatment techniques
- Provide information to community leaders

**Status**
- **Field Trial in Eagle Ford, February 2011**
- **Current field trials in New York**
- **A&M Separation Sciences pilot testing new technology**
- **Creation of new Analytical Services Roundtable**
- **Collaboration with Texas A&M School of Rural Public Health, McAllen, TX**
Texas A&M Research Goal: Reduced Fracturing Footprints

Use of Non-potable water for drilling, completion, and stimulation

1. Recycle Frac Fluids
2. Use of Brackish Ground water for fracturing
3. Disposal of residue brines in deep geologic formations
All Weather Mobile Unit for Site Treatments (2011)

Mobile testing laboratory in South Texas.
Field Frac Brine after Three Weeks

Treated

Un-Treated
Technology Integration Program

Integrated approach for applying new technologies in unconventional natural gas production

Objectives

• Integrate developing technologies into systems that lower cost and improve performance.
• Bring new technologies to a “proving ground” for evaluation.
• Demonstrate technology to reduce the environmental footprint of operations.
• Disseminate the information.
Technology Integration Program

Field Tests

- **Locating Sites** – allow new knowledge to influence land use.
- **Drilling and Completion Operations** – demonstrate what is possible with new technologies.
- **Community Issues** – perform social impact assessment to identify/address misconceptions.
- **Air Quality/Emissions** – develop/test new sensors/systems.
- **Water Management** – test full-scale prototype systems.

**Technology Transfer/Outreach**

Web site that integrates all RPSEA work being performed.

- Access to valid/accurate data related to new knowledge, technologies, practices.
- Work with all RPSEA funded unconventional gas programs.
Complementary Programs

Coastal Impacts Technology Program (CITP)
- Technology Road Mapping
- Environmental Impact Mitigation
- Inter-State Collaboration
- Workforce Development

Environmental Assessment for Shale Gas Development in Ukraine
- Environmental Scoping Statement
- Special Studies
- Environmental Assessment
- Environmental Mitigation & Monitoring Plan

Legend
- National Capitals
- Eastern Europe Basins
- Assessed Basins
  - Yes
  - No
- Prospective
- Non-Prospective
Texas Coastal Production

2010 Oil and Gas Production

- 508 operating companies reported production in the 18 coastal counties
- Highest Production: Jefferson County
  - 7,874,511 BBL
  - 115,330,648 MCF
Coastal Impacts Technology Program

- Technology Road Mapping
- Environmental Impact Mitigation
  - Studies
  - Field Trials
- Inter-State Collaboration
- Workforce Development
  - Workshops
  - Web Site
  - Outreach efforts
Our big challenge: Core Values

- Companies successfully made **safety** a **core value**.

- Accomplished by corporate leadership, documenting, measuring and training.

- If we are to achieve the same success in environmental performance, it will require the leaders in the industry to also make this a core value.
# Tradeoff Scorecard Development

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<tr>
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<td>Stormwater Management Plan 9</td>
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<tr>
<td>Prerq 2</td>
<td>Integrity Testing of Surface Casing 4</td>
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<tr>
<td>Credit 1</td>
<td>Water Management Plan 9</td>
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<tr>
<td>Credit 2</td>
<td>Setbacks from Streams/Sources 4</td>
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<tr>
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<td>Reduce Water Usage 2</td>
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<tr>
<td>Credit 5</td>
<td>Reuse of Water/Fluids 1</td>
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<table>
<thead>
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<th>Max</th>
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![Environmental Drilling Scorecard](image)
Summary

• **EFD Program** – an award winning program focused on *reducing environmental footprint* associated with oil and gas operations.

• **Technologies are available** to *reduce footprint* *(water)* and new technologies are being developed and tested.

• The **EFD Technology Integration Program** is *performing field tests* concerning emissions and have additional work planned to *test new technologies* and *develop monitoring technologies*. 
Where to find information

[Image of EFD logo]

- Facebook: https://www.facebook.com/EFDSystems
- Website: http://www.efdsystems.org/

**Environmentally Friendly Exploration & Production**

**What's New**

JIP aims to minimize environmental risks, coastal impact through technology

Dr. Gene Theodori discusses public perception at expo in East Texas.

AADE-11-NTCE-61 The Impact of Rig Design and Drilling Methods on the Environmental Impact of Drilling Operations

Download presentations from the latest EFD workshop - Managing...
Free-access, searchable, database and website for best management practices (BMPs).

www.oilandgasbmps.org
Hydraulic Fracturing Chemical Registry

- Developed/managed by GWPC
- Provide Transparency
- Protect Groundwater
- Engage Public
  - Explain frac process
  - Provide well information
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