EPA’s National Enforcement Initiative for Energy Extraction Sector Compliance with Environmental Laws

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Overview

• Shale gas and the environment
• Energy Extraction Enforcement Initiative
• Other aspects of EPA’s approach
  – Scientific study
  – Regulation and policy development
  – Best design and management practices
• Marcellus Shale Activities
US Shale Gas Extraction

Advances in hydraulic fracturing and horizontal drilling have opened new areas for oil and gas development.
US Shale Gas Extraction

- According to 2009 US Dept of Energy data:
  - US natural gas **proved** reserves: 8.045 Tm$^3$
  - US “technically recoverable” shale gas: 23.43 Tm$^3$
Shale Gas and the Environment

• Natural gas is *relatively clean burning*
  – About 53 kg of CO₂ for every million Btu equivalent of natural gas

  *versus*
  – About 91 kg of CO₂ for every million Btu of coal, and 73 kg of CO₂ for every million Btu of fuel oil

• But CH₄ is a *potent greenhouse gas*
  – About 25 times more potent than CO₂
  – Some estimates suggest a factor of 72
EPA Energy Extraction Enforcement Initiative

March 2010 EPA announced new enforcement initiative for energy extraction

First focus area is onshore gas production

Two major goals:

• Take action where violations cause air or water impacts that threaten human health
• Secure company-wide relief

Many cases brought to date (including air and drinking water cases), more under investigation
Shale Gas and the Environment

- Natural gas exploration, drilling and production have many environmental impacts
  - Site selection and preparation
  - Staging, transport, water withdrawal and chemical storage
  - Drilling
  - Well completion
  - Air emissions
  - Wastewater handling
  - Well abandonment and plugging

- Advances in drilling and production technologies have positive and negative impacts

- Strict safety regulations and standards are required for natural gas
Shale Gas and the Environment – Site Selection and Preparation

Gas well development in Marcellus Shale in western Pennsylvania.

Gas well field in Green River Basin, near Pinedale, Wyoming.
Shale Gas and the Environment – Site Selection and Preparation

• Impacts and considerations:
  – Avoid sensitive environments, such as surface waters, wetlands and source water protection areas
  – Install physical controls, such as silt fencing, sediment traps and basins, and expanded riparian areas. Use storm water management plan practices
  – Minimize surface water and air impacts from access roads, staging areas, pits, ponds, impoundments, tanks and other equipment
  – Ensure appropriate confining layer between target formation and aquifers
Impacts and considerations:

• Spill and runoff prevention
• Sample water wells in vicinity to determine baseline water quality
• Plan for proper wastewater disposal areas with adequate liners and freeboard
• Consider use of LNG versus diesel trucks and equipment
• Work with local agencies and citizens to determine appropriate water sources
Impacts and considerations:

- Prevention of methane and other contaminant migration
- Adequate well construction and pressure control to prevent explosions
- Limit chemical use to only those required by specific geology
Impacts and considerations:

• Loss of methane and VOCs to atmosphere
  • “Green completions” capture product, while reducing air emissions
  • Use of flares where “green completions” not possible
• Well integrity, monitoring and modeling critical to ensuring fracture in target zone
• Spill prevention
• Occupational hazards
Impacts and considerations:
- Occur throughout lifecycle of well development and production
  - Poses environmental and occupational risks
- Use of flares, no-bleed pneumatics and other control technology to limit emissions
  - Some technologies have rapid return on investment
- Use of remote monitoring to determine and react quickly if something amiss

Forward Looking Infrared (FLIR) image of condensate tank.
Shale Gas and the Environment – Wastewater Handling

Impacts and considerations:

• Wastewater contains chlorides, heavy metals, frack chemicals and radioactive material
• Spills may be lethal to aquatic and terrestrial organisms
• Difficult to treat in typical wastewater plant – ultimate disposal in deep injection wells may be necessary
• Important to maximize recycling for additional fracking or other uses

Truck hauling gas wastewater from Marcellus Shale.
Impacts and considerations:

- Abandoned wells can leak or provide conduits for migration of contaminants
- Utilize proper materials and techniques to ensure proper seal
- Consider institutional controls to prevent access and monitor seals

Leaking 75-year-old, abandoned gas well in NY state.
EPA’s Approach on Shale Gas – Scientific Study

• US Congress asked EPA to study relationship between hydraulic fracturing and drinking water resources
• Peer-reviewed study currently underway, with preliminary results due in late 2012
• Lifecycle approach, use of case studies, with preliminary focus on sources and pathways of potential impacts
• Stakeholder involvement throughout process
EPA Approach on Shale Gas – Best Design and Management Practices

• EPA is developing **Best Design and Management Practices** (BDMPs) to minimize adverse impacts to public health and the environment from shale gas production
• Part of EPA’s role to carry out President Obama’s **Blueprint for a Secure Energy Future** (March 2011)
• Rely on widely-accepted federal, state and industry practices from across the United States
• Recognition that **certain BDMPs may not be applicable in every location**, while other BDMPs may be compulsory
Shale Gas Development in Mid-Atlantic States

• Rapid increase in development activity in one of world’s largest gas plays

• Densely populated areas

• Hydrologic conditions

• Formation containing uranium

• Produced water rich in total dissolved solids
Flowback and Produced Water Treatment & Disposal

• Program Oversight
  – EPA requests for better characterization of discharges & impacts
  – PADEP requests to operators for monitoring at public drinking water systems and WWTP discharge points
  – Determine if discharge permit modifications are needed
Flowback and Produced Water Treatment & Disposal

- Underground Injection Control permits for waste disposal
  - Issued by authorized states with EPA oversight & technical assistance
  - Issued by EPA in “direct implementation” states
  - Inspection of disposal of shale gas development waste via wells

- Emergency and Accident Prevention and Response
Marcellus Shale Approaches

• Underground Injection Control
  – Unpermitted injection of wastes
  – Injection of wastes not in compliance with permit

• Reporting of releases
  – National Response Center 1-800-424-8802

• Clean Air Act general duty clause
Marcellus Shale Approaches

• Unpermitted discharges (spills) to U.S. waters
• Discharge permits for treatment of oil & gas wastewater
• Pass-through or interference at POTWs
• Construction
  – Road crossings, pipeline crossings, well pads, compressor stations
  – Stream diversions
Conclusion

We must ensure that [energy] production is safe, responsible, and efficient.