Environmental Protection and Unconventional Shale Well Development in the Commonwealth of Pennsylvania

Potomac Drinking Water Source Protection Partnership will hold its 2014 Annual Meeting

November 20, 2014
Roadmap

• Background
• Exploration, Production and Economic Impacts
• Structure of PA DEP
• Environmental Protection
• Available Information
• Unconventional Shale Gas in the Potomac Basin in PA
PENNSYLVANIA OIL AND GAS
HISTORICAL DEVELOPMENT
Once Upon a Time in 1859
PENNSYLVANIA
SHALE GEOLOGY
Black Shale Formations

- Marcellus
- Utica
- Rhinestreet
- Huron

- Upper Devonian
  - Dunkirk
  - Pipe Creek
  - Middlesex
  - Genesee
  - Burket
CURRENT DATA – WELL PERMITTING, DRILLING AND PRODUCTION
Unconventional Well Applications Received

5/6/2014

Year


21 61 208 775 1,992 3,759 3,597 2,596 3,037 1,158

Pennsylvania Department of Environmental Protection
Conventional Well Applications Received

5/6/2014

Year


6,232 7,368 7,392 7,787 3,913 3,343 2,391 1,431 1,744 361

Pennsylvania Department of Environmental Protection
Department of Environmental Protection
Office of Oil and Gas Management
Unconventional Wells Drilled in 2013
2014 Top NG Producers
(through June, 2014)

<table>
<thead>
<tr>
<th>State</th>
<th>Production</th>
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</thead>
<tbody>
<tr>
<td>TX</td>
<td>3.8</td>
</tr>
<tr>
<td>PA</td>
<td>2.0</td>
</tr>
<tr>
<td>OK</td>
<td>1.1</td>
</tr>
<tr>
<td>LA</td>
<td>1.0</td>
</tr>
<tr>
<td>WY</td>
<td>0.9</td>
</tr>
</tbody>
</table>
PROGRAM IMPLEMENTATION
Laws and Regulations

- 2012 Oil and Gas Act
  - 25 Pa. Code Chapter 78 (relating to Oil and Gas Wells)
- Oil and Gas Conservation Law
- Coal and Gas Resource Coordination Act
- Clean Streams Law
  - 25 Pa. Code Chapter 91 (relating to General Provisions)
  - 25 Pa. Code Chapter 93 (relating to Water Quality Standards)
  - 25 Pa. Code Chapter 95 (relating to Wastewater Treatment Requirements)
  - 25 Pa. Code Chapter 102 (relating to Erosion and Sediment Control)
Laws and Regulations Continued

- Dam Safety and Encroachments Act
  - 25 Pa. Code Chapter 105 (relating to Dam Safety and Waterway Management)

- Solid Waste Management Act

- Air Pollution Control Act

- Land Recycling and Environmental Remediation Standards Act

- Environmental Laboratory Accreditation Act
Oil and Gas Statutory, Regulatory and Policy Changes

- Marcellus Shale Advisory Commission (2011)
- Act 13 of 2012 (Feb 2012)
- PUC Spud Well List – Act 13 Impact Fees (2011)
- Act 9 – Emergency Response for Well Sites (Feb 2012)
  - Reg: Emergency Response Planning at Unconventional Well Sites (Jan 2013)
- Well Permit Fee Increase (Proposed July 2013, Final June 2014)
- Spills/Release Policy at Oil & Gas Wells and Access Roads (Sept 2013)
Oil and Gas Statutory, Regulatory and Policy Changes

- Chapter 78 Subchapter D (Feb 2011)
  - Casing and Cementing and Well Construction Standards
- Chapter 78 Subchapter C (Proposed Dec 2013)
- Erosion and Sedimentation Controls: Chapter 102 (Dec 2012)
  - Stormwater Policy
  - Erosion and Sedimentation Control GP 2
- Total Dissolved Solids Rule: Chapter 95 (Aug 2010)
  - Wastewater Recycling Call (April 2011)
Constant Analysis

- TENORM Study
- Long-Term Air Quality Monitoring Study
- Barto Compressor Station Monitoring
- Mine Influenced Water (MIW) for Hydraulic Fracturing
- State Review of Oil and Natural Gas Environmental Regulations (STRONGER)
- Independent Laboratory Review
Continuous Regulatory Improvement

- Air Quality Exemption No. 38
- Air GP5 (Natural Gas Compression Facilities)
- Beneficial Use of Liquid Waste from Oil and Gas (WMGR123)
- Mechanical Integrity Assessment
Permitting

- Well Permit
- Erosion and Sediment Control
- Stream and Wetland Encroachment
- Commercial Waste Processing
- Centralized Wastewater Impoundment
- Alternative Waste Management at Well Sites
Effective and Efficient Permitting

- Assessment philosophy
  - Site-specific vs. standard approach
- Clear standards applied consistently
- Properly staffed, trained properly
- Documentation
  - Frequently Asked Questions (external)
  - Standard Operating Procedures (internal)
  - Technical guidance/statements of policy (both)
• Biologists – Surface Disturbances

• Geologists/Engineers Former Drillers – Subsurface Disturbances

• Inspection Trends
Violations 2008-2013

Total Unconventional Violations

- 2008: 237
- 2009: 682
- 2010: 1,281
- 2011: 1,225
- 2012: 707
- 2013: 512

Pennsylvania Department of Environmental Protection
Complaints 2009-2013

- DEP complaints
- Oil and Gas related complaints

Year | DEP Complaints | Oil and Gas Complaints
--- | --- | ---
2009 | 7,781 | 730
2010 | 7,670 | 888
2011 | 8,702 | 1,147
2012 | 7,925 | 934
2013 | 7,633 | 774
Spud date (commencement of drilling)
- Resumption of drilling
  - 30-day (or longer) break in drilling
- Cementing of all casing strings
- Conducting pressure tests of the production casing
- Stimulation of a well
- Abandoning or plugging of a well
Types of Inspections

Well Pad Inspections (Surface)
- Water Quality Specialists
  - Erosion and Sedimentation Controls (mandatory; before drilling)
  - Inspect waste containment

Well Drilling Inspections (Sub-surface)
- Oil and Gas Inspectors
  - Perform inspections when well drilling commences and ongoing drilling activities
  - (setting casings, cementing jobs, etc.)
  - Inspect well fracturing operations

Other DEP Inspections
- Air Quality
- Waste Management
- Water Management (Water Quality)
• Pre-Hydraulic Fracturing Review
• Promote Recycling of Flowback Water
• Spill Prevention, Reporting and Clean Up
• Freshwater Impoundments
• Rock Pits
• Temporary Pipelines
• Horizontal Directional Drilling for Gathering Lines
Environmental Protection
EXHIBIT 30: CASING ZONES AND CEMENT PROGRAMS

- Conductor Casing
- Aquifer
- Surface Casing
- Drilling Mud
- Intermediate Casing
- Cement
- Production Casing
- Production Tubing

Deepest Fresh Groundwater
Approximate contact of "circulating fresh water and connate brine"

From: Carter, 2011
Unconventional Well Waste Summary

2008 – 2011

Injection Disposal Well
- 6.0%

Municipal Sewage Treatment PLT
- 6.5%
- 6.5%

Centralized Treatment PLT For Recycle
- 19.7%
- 30.3%
- 31.0%

Reuse Other than Road Spreading

Brine or Industrial Waste Treatment PLT

Other

Total Waste: 44,347,869 bbl
Unconventional Well Waste Summary

2012

Other (1.5%)

Centralized Treatment
PLT For Recycle

12.4%

16.3%

69.8%

Injection Disposal Well

Reuse Other than
Road Spreading

Total Waste: 29,124,485 bbl
Disposal Locations for Oil & Gas Waste
Available Information
Growing Greener Grant Awards

Each year, DEP invests millions of dollars in watershed protection projects to improve watersheds, reduce stormwater runoff and acid mine drainage (AMD), and support educational programs, among other environmental efforts through its annual Growing Greener Grants. These projects will reduce nonpoint source pollution in impaired streams by implementing agricultural and stormwater best management practices; developing, repairing or installing passive systems to treat AMD; and supporting the establishment of riparian buffers, among other methods.
Understanding the geology of the Marcellus Formation helps us predict where it is most likely to be developed.
Interactive Map

- Oil and Gas Mapping

Interactive Reports

- Permits Issued Detail Report
- Monthly – Permits Issued by County and Well Type Report
- Year to Date – Permits Issued by County and Well Type Report
- Permitted Well Inventory
- Oil and Gas Compliance Report
- SPUD Data Report
- Wells Drilled By County
- Wells Drilled By Operator
- All Abandoned and Orphan Wells
- Oil and Gas Well Formations Report
- Oil and Gas Well Pad Report
- Oil and Gas Production Reports
- Well Permit Workload Report (PDF)
- Interactive Reports Modifications (PDF)

Operator Electronic Registration – Oil and Gas Reporting
- Applications & Authorization Forms
- FAQ
- Abandoned & Orphan Well Program
- Marcellus Shale Advisory Commission
- Oil and Gas Technical Advisory Board
- Laws, Regulations & Guidelines
The Department of Environmental Protection is committed to providing information in an accessible and user-friendly format. In order to do so more effectively, the department has created interactive reports that allow the user to select specific criteria for the desired information. In addition, the report data can easily be downloaded for further analysis. The report links on this page provide oil and gas production information, permits issued, drilling commence date (SPUD date), county data, operator specific data, as well as inspections, violations and enforcement actions. For questions or problems with any of these reports, contact the Office of Oil and Gas Management, Bureau of Compliance and Data Administration at 717-772-2199 or by email at RA.EP-OGMOGRE@pa.gov

Interactive Map
Oil and Gas Mapping

Interactive Reports
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# Oil & Gas Mapping Tool

## Identify Results: 1 result returned.

<table>
<thead>
<tr>
<th>Permit Number</th>
<th>015-21743</th>
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</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>BURKE BRA 5H</td>
</tr>
<tr>
<td>Operator</td>
<td>CHESAPEAKE APPALACHIA LLC</td>
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<tr>
<td>Operator No.</td>
<td>OGO-65420</td>
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<tr>
<td>Well Type</td>
<td>GAS</td>
</tr>
<tr>
<td>Well Status</td>
<td>Active</td>
</tr>
<tr>
<td>Permit Date</td>
<td>8/11/2011</td>
</tr>
<tr>
<td>SPU Date</td>
<td>9/19/2011</td>
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<tr>
<td>Conservation Well</td>
<td>N</td>
</tr>
<tr>
<td>Well Configuration</td>
<td>Horizontal Well</td>
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</tbody>
</table>

[Screen shot of the Oil & Gas Mapping Tool]
FracFocus 2.0
HUNDREDS OF COMPANIES. THOUSANDS OF WELLS.

Welcome to FracFocus 2.0! We're excited about our latest upgrades designed to dramatically enhance the site's functionality for the public, state regulatory agencies and industry users. Our user-friendly Find A Well chemical disclosure registry now includes more extensive search options.

FracFocus continues to evolve and expand, adding more participating companies and reported wells from across the country. Our continued success is the result of nationally recognized organizations working with state governments and the oil and natural gas industry to provide public transparency.

Looking for information about a well site near you?
Search for nearby well sites that have been hydraulically fractured to see what chemicals were used in the process.

TOTAL WELL SITES REGISTERED

5 5 9 7 8

FAQs
Q. How do the search forms work?
A. There are two search forms available in FracFocus: Map Search and Standard Search. The data available to be searched upon (e.g.,

www.fracfocus.org
### Hydraulic Fracturing Chemical Registry

#### Hydraulic Fracturing Fluid Product Component Information Disclosure

**Job Start Date**: 5/11/2013  
**Job End Date**: 5/16/2013  
**State**: Pennsylvania  
**County**: Bradford  
**API Number**: 37-015-22083-00-00  
**Operator Name**: Chesapeake Operating, Inc  
**Well Name and Number**: KNAPP BRA 5H  
**Longitude**: -76.85136000  
**Latitude**: 41.79445100  
**Datum**: NAD27  
**Total Base Water Volume (gal)**: 6,119,862  
**Total Base Non Water Volume**: 357,211

#### Hydraulic Fracturing Fluid Composition:

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Ingredients</th>
<th>Chemical Abstract Service Number (CAS #)</th>
<th>Maximum Ingredient Concentration in Additive (% by mass)**</th>
<th>Maximum Ingredient Concentration in HF Fluid (% by mass)**</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Fresh Water</td>
<td>CHEAPEAKE ENERGY</td>
<td>Carrier/Base Fluid</td>
<td>Water</td>
<td>007732-18-5</td>
<td>100.00000</td>
<td>80.02383</td>
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<td>Northern White Sand</td>
<td>FTS INTERNATIONAL</td>
<td>Proppant - Natural</td>
<td>Crystalline Silica (Quartz Sand, Silicon Dioxide)</td>
<td>014808-60-7</td>
<td>100.00000</td>
<td>10.82102</td>
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<td>Recycled Produced Water</td>
<td>CHEAPEAKE ENERGY</td>
<td>Carrier/Base Fluid</td>
<td>Water</td>
<td>007732-18-5</td>
<td>100.00000</td>
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<td>100 Mesh Sand</td>
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<td>10-15 HCL</td>
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<td>Acid</td>
<td>Water</td>
<td>007732-18-5</td>
<td>95.00000</td>
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<tr>
<td>FRW-600</td>
<td>FTS INTERNATIONAL</td>
<td>Friction Reducer</td>
<td>Hydrochloric Acid</td>
<td>007647-01-3</td>
<td>15.00000</td>
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<tr>
<td>BBA</td>
<td>X CHEM</td>
<td>Ant-Bacterial Agent</td>
<td>Glutaraldehyde (Pentaneoil)</td>
<td>006111-30-8</td>
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<td></td>
<td></td>
<td></td>
<td>Dioleyl Dimethyl Ammonium Chloride</td>
<td>007173-51-5</td>
<td>8.00000</td>
<td>0.00222</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Quaternary Ammonium Compound</td>
<td>008424-85-1</td>
<td>0.00000</td>
<td>0.00162</td>
<td></td>
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</tbody>
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Unconventional Shale Gas Development in the Potomac River Basin in PA
Potomac - Unconventional Sahle Gas
Potomac - Unconventional Sahle Gas

(1) Unconventional Oil and Gas Wells - SHANNON TODD PAD A 24

- Permit Number: 061-20014
- Well Name: SHANNON TODD PAD A 2458
- Operator: PA GEN ENERGY CO LLC
- Operator No.: OGO-63025

Well Status: Active
- Permit Date: 7/1/2010
- SPUD Date: 11/4/2010
- Date Plugged:

Enforcements for Violation ID 667462:

<table>
<thead>
<tr>
<th>Enforcement Type Description</th>
<th>Date Executed</th>
<th>End Date Final</th>
<th>Enforcement Final Status Description</th>
<th>Penalty Amount</th>
<th>Total Amount</th>
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<tbody>
<tr>
<td>Consent Assessment of Civil Penalty</td>
<td>5/10/2012</td>
<td>5/10/2012</td>
<td>Comply/Closed</td>
<td>$18,079.00</td>
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<tr>
<td>Notice of Violation</td>
<td>3/16/2011</td>
<td>4/13/2012</td>
<td>Administrative Close Out</td>
<td>$0.00</td>
<td>$0.00</td>
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</table>
Questions?

Joseph J. Lee, Jr., P.G.
Director, Division of Plugging and Subsurface Activities
Bureau of Oil and Gas Planning and Program Management

joslee@pa.gov

(717) 772-2199