Waste Fluid Production Rates from Unconventional Oil & Gas Wells and Implications for Disposal Capacity and Reuse

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Joseph J. Lee, Jr., P.G

Lee Geologic
jos.lee@leegeologic.com
717.991.5620
Pennsylvania Unconventional Gas Well Waste Fluids Production

Geology & geologic structures

Areas of oil & gas development

Nature of unconventional formations in retention of waste fluids

Waste fluid production over time

Oil and gas wastewater disposal by deep well injection

Implications for waste fluid disposal
Once Upon a Time in 1859
Black Shale Formations

- Marcellus
- Utica
- Rhinestreet
- Huron

- Upper Devonian
  - Dunkirk
  - Pipe Creek
  - Middlesex
  - Geneseo
  - Burkett
DEVONIAN SEDIMENTS THICKENED TO THE EAST AS THE BASIN SUBSIDED
The fate of residual treatment water in gas shale

Terry Engelder a, *, Lawrence M. Cathles b, L. Taras Bryndzia c

a Department of Geosciences, The Pennsylvania State University, University Park, PA 16801, United States
b Department of Earth and Atmospheric Sciences, Cornell University, Ithaca, NY 14853, United States
c Shell International Exploration and Production Inc., Houston, TX 77082, United States

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Water is the wetting phase: Capillary forces drive water into pore throat.

This is the mechanism for imbibition.
Counter Current Imbibition

- **0 min**: $d = 8.3$ mm, $h = 3.0$ mm
- **17 min**: $d + 4\%$, $h - 26\%$
- **1 min**: $d = 8.3$ mm
- **37 min**: $d + 4\%$
- **3 min**: $d = 8.3$ mm
- **61 min**: $d = 8.3$ mm
- **7 min**: $d = 8.3$ mm
- **85 min**: $d = 8.3$ mm
Produced Fluids from Select PA Unconventional Gas Wells

Produced Fluids v Time

- 125-23638
- 019-21686
- 015-20113
Long Term Waste Management Planning

- Oil and Gas Program has utilized existing produced fluid/flowback data trends to develop a predictive model for waste generation in association with the Marcellus shale play: one mechanism for disposal of this waste is through deep well injection.
UIC Program in Pennsylvania

Distribution of Active Class IID Wells
Southwest PA Earthquakes & UIC Wells
Implications for Waste Fluids Disposal for the Dry Gas Plays

• Production of waste fluids from unconventional oil and gas development in the Appalachian basin dry shales is limited by fluids used in hydraulic fracturing

• Not all of those fluids will be returned over the life of the well

• Increased interest in expansion of the number of Class II wells for disposal in the future in some areas

• Low potential for induced seismicity from Class II disposal well operations as presently occurring