

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



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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
 - Burket



Generalized Stratigraphic Section for Oil and Gas Regio



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Map of the net thickness of organic-rich shale in the Marcellus Formation (modified from Harper, J. A., 2008, The Marcellus shale – An old "new" gas reservoir in Pennsylvania: Pennsylvania Geology, v. 38, no. 1, p. 2-13. This map and other information related to Devonian shales can be accessed from the Survey's website at http://www.dcm.state.pa.us/topogeo/oilandgas/.





DEVONIAN SEDIMENTS THICKENED TO THE EAST AS THE BASIN SUBSIDED



Modified from Harper, 1999



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The fate of residual treatment water in gas shale

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A R T I C L E I N F O

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



Counter Current Imbibition

















Produced Fluids v Time



Emerging Issues

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



Northwest PA Earthquakes & UIC Wells



Southwest PA Earthquakes & UIC Wells



Northwest 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



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