

WATER USE IN NIOBRARA DEEP SHALE GAS EXPLORATION



FACT SHEET

MAY 2012

Niobrara Shale Water Use

Water is an essential component of Chesapeake Energy Corporation's deep shale development. During the drilling process, Chesapeake uses a mixture of clay and water to carry rock cuttings to the surface, as well as to cool and lubricate the drillbit. Drilling a typical Chesapeake Niobrara deep shale well requires approximately 300,000 gallons of water in the DJ Basin and 840,000 gallons of water in the Powder River Basin. Water is also used in hydraulic fracturing, where a mixture of water and sand is injected into the formation at a high pressure to create small cracks in the rock which allows oil and natural gas to flow more freely. Fracturing a single Chesapeake Niobrara deep shale well requires an average of 4 million gallons of water.

Water Use Consumption

The volume of water needed to drill and frack Niobrara deep shale wells represents a very small percentage of the total water resources used in the area. This region is comprised of a 17-county area, including 10 counties in Wyoming and seven counties in Colorado. According to

How much is 4.3 million gallons?

The 4.3 million gallons of water needed to drill and hydraulically fracture a Niobrara Shale well is equivalent to the amount of water consumed by:

- The **City of Denver** in approximately **26 minutes**
- A 1,000 megawatt coal-fired **power plant** in **approximately 10.5 hours**
- Irrigating a typical Colorado **golf course** for **21.5 days**
- Irrigating **6.5 acres of Wyoming wheat** for a season

While these represent continuing consumption, the water used to produce oil and natural gas from a deep shale well is a one-time use.

KEY POINTS

- Water resources are protected through stringent federal, state and local permitting processes.
- Water is essential for Niobrara deep shale oil and natural gas development.
- Drilling and fracking use a small amount of water compared to other uses within the area, and do not represent a long-term commitment of the resource.

the U.S. Geological Survey, 2005 water use report for Colorado and Wyoming, the total water used in this Niobrara Shale area was approximately 1.28 trillion gallons. Chesapeake's water use is expected to increase the amount used by less than 0.01%, and is well within available resources in the region. This volume is very small in terms of the overall water budget for the area. The largest water users in the Niobrara Shale are irrigation and livestock (approximately 82%), municipal/public water supply (approximately 8%), power generation (approximately 6%) and industry and mining (approximately 4%). Water used in Chesapeake's Niobrara Shale operations differs most notably from other uses because it is temporary, occurring only once during the drilling and completion phases of each well. Use of this water does not represent a long-term commitment of the resource.

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*Chesapeake is continuously
reviewing the use of a variety of
water sources.*
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Water Requirements for Various Energy Sources

Energy Resource ¹	Range of Gallons of Water Used per MMBTU of Energy Produced
Niobrara Shale Natural Gas	1.25 ²
Conventional Natural Gas	1-3
Coal (no slurry transport)	2 – 8
Coal (with slurry transport)	13 – 32
Nuclear (uranium ready to use in a power plant)	8 – 14
Chesapeake Deep Shale Oil	7.96 – 19.25 ³
Conventional Oil	8 – 20 ³
Synfuel - Coal Gasification	11 – 26
Oil Shale Petroleum	22 – 56
Oil Sands Petroleum	27 – 68
Synfuel - Fisher Tropsch (from coal)	41 – 60
Enhanced Oil Recovery (EOR)	21 – 2,500
Biofuels (Irrigated Corn Ethanol, Irrigated Soy Biodiesel)	> 2,500

¹Source: "Deep Shale Natural Gas: Abundant, Affordable, and Still Water Efficient", GWPC, 2010.

²The transport of natural gas can add up to two gallons per MMBTU.

³Includes refining which consumes a major portion (90%) of the water needed (7-18 gal per MMBtu).

Water Sources

Chesapeake utilizes several sources of water in Niobrara Shale exploration, including municipalities, regional water districts, rivers, ponds, lakes and groundwater wells. Chesapeake also considers a variety of other water resources such as discharge water from industrial or city wastewater treatment plants, power plant cooling water, marginal (saline) groundwater and reuse of frack water. Chesapeake works directly with local officials to arrange water purchases from a municipality when drilling inside city limits. Water is typically transported to a drilling location by truck or through temporary pipelines. The water is then stored in tanks or impoundments prior to use. Due to the diverse geographic area overlying the Niobrara Shale, the overall mix of water sources used depends on the region and the availability of sources near drilling sites.

Water Regulations

Regardless of the source, water used in Chesapeake's drilling and fracturing process is purchased and, as required, properly permitted. This ensures that water used for drilling and fracking does not interfere with the available supply for other users.

In the Niobrara Shale area, Chesapeake works closely with entities such as the Wyoming State Engineer's Office, Colorado Division of Water Resources, Bureau of Reclamation, U.S. Army Corps of Engineers, the Colorado and Wyoming Oil and Gas Conservation Commissions, other area water conservation and control districts, local municipalities and landowners on its proposed water use.

Given its relatively small water use, Chesapeake's deep shale development is consistent with the nation's energy/water strategy by making a positive energy and economic contribution at a relatively low cost to the overall water supply. Chesapeake's deep shale exploration has the potential to supply decades of oil and natural gas for the U.S., while using less water than other currently available viable energy sources.

Information Sources

- Argonne National Laboratory
- Colorado Division of Water Resources
- Colorado Water Conservation Board
- Denver Water
- Ground Water Protection Council (GWPC)
- Oilshalegas.com
- Oil Technology Institute
- Sandia National Laboratory
- Society of Petroleum Engineers
- U.S. Department of Energy (DOE)
- U.S. Geological Survey
- Wyoming State Engineer's Office
- Wyoming Water Development Commission

About Chesapeake

Chesapeake Energy Corporation is the second-largest producer of natural gas, a Top 15 producer of oil and natural gas liquids and the most active driller of new wells in the U.S. Headquartered in Oklahoma City, the company's operations are focused on discovering and developing unconventional natural gas and oil fields onshore in the U.S. Chesapeake owns leading positions in the Barnett, Haynesville, Bossier and Marcellus natural gas shale plays and in the Granite Wash, Cleveland, Tonkawa, Mississippi Lime, Bone Spring, Avalon, Wolfcamp, Wolfberry, Eagle Ford, Niobrara, Three Forks/Bakken and Utica unconventional liquids plays. The company has also vertically integrated its operations and owns substantial midstream, compression, drilling, trucking, pressure pumping and other oilfield service assets. For more information on Chesapeake environment initiatives, visit the environment section of CHK.com, HydraulicFracturing.com, NaturalGasAirEmissions.com, NaturalGasWaterUsage.com, AskChesapeake.com or FracFocus.com.