

HYDRAULIC FRACTURING of SHALE

Releasing natural gas from shale formations dating back to before the dinosaurs

Water used in the

ydraulic fracturing is a well completion process that releases natural gas from shale rock formations that are found thousands of feet below the surface of the Earth. This fossil fuel is formed from the remains of prehistoric plant and animal life that has been subjected to high temperatures and pressure for millions of years. A large portion of this

thermogenic natural gas, which is trapped in shale formations, had been inaccessible until hydraulic fracturing was developed in the late 1940's. Technological advances, including the use of horizontal drilling, allows the modern driller to more economically develop this resource.

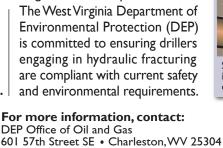
Natural gas is trapped in the **Marcellus Shale** rock formation. dating back 400 million years.

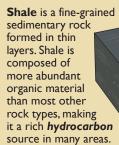
To release natural gas trapped in a formation, a hole is drilled into the ground vertically to the needed depth and then as much as two miles horizontally. This "bore hole" is lined with steel casing and cemented in to a depth adequate to protect freshwater aguifers, coal seams, etc. A mixture of water, sand, and chemicals (to improve flow) is then injected under high pressure to break apart the shale. The fracturing fluid flows away and the sand (called proppant) stays behind - holding the fractures apart so gas can escape. The released natural gas then flows up the casing to the surface.

Fracturing fluid that is not left underground, having returned to the surface with the gas, is called *flowback*. Flowback is treated and reused in other wells. Its ultimate disposal is currently through a Class II disposal well.

Water is used for fracking because it will not compress. Environmental Protection (DEP) is committed to ensuring drillers engaging in hydraulic fracturing are compliant with current safety

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Fluid is pumped under high pressure through a perforated casing fracturing the shale which holds natural cas Flure is pumped under night pressure through a period of the shale which holds natural gas. casing, fracturing the shale which holds natural gas.

Sand or ceramic proppant pumped into the shale fractures hold them

open so the natural gas can escape.

Natural gas is a hydrocarbon gas mixture composed primarily of methane and used for heating, cooking, and electricity generation.

Steel casings are cemented stored in tanks, then trucked fracturing process is transported by out. Natural gas is piped out. in through tanker trucks or freshwater aquifers and pipelines. coal zones. Soil Aquifers ions of gallons of 1.000 ft Silts and Clays 2,000 ft. use A slick water hydraulic fracturing operation can 3,000 ft. Limestone 4.000 ft. Sandstone 5,000 ft.

Kick-Off Point

Drilling levels off in

the direction of the

shale formation.

Crude oil or condensate is

Marcellus Shale Formation The gas-rich

Marcellus, Utica and Rogersville shale rock formations in the Appalachian area are found 5,000 to 14,000 feet below the surface.

6,000 ft

7.000 ft