

## What happens after Drilling?

Once drilling is complete, drill cuttings and drilling fluids gathered during the drilling operation are analyzed to help determine if the well has producing potential. If the samples yield acceptable results, the well will proceed to the next phase of operations.

Steel pipe (casing) is used to isolate the well bore from surrounding rock; the casing is further isolated using cement, which is pumped into the subsurface between the casing and the surrounding rock. When the well is ready for a third operational phase, known as Completions. The drilling rig and the associated equipment will be moved off the location.

## Preparing the well for Completion

A small truck mounted rig (known as a completions rig or service rig) is moved onto the location along with pumps and storage tanks.

The completion operation is designed to test the well's capability. The service rig first installs a pressure control device on the well, to ensure it can be tested safely. The rig then runs a small 3 inch diameter pipe (tubing) into the well bore. Using this tubing, the inside of the casing is cleaned and prepared for testing.

During the completion phase, Fortuna applies the same high environmental and safety standards used during all other phases of our operations. Specialized high pressure vessels are used to capture all drilling fluids during the well flowback period to prevent any environmental contamination; drilling fluids captured are then removed from the site for either disposal or reuse.

## Stimulation

In many cases, the well is prepared for testing by stimulating it using a mild solution of hydrochloric acid. Gas is usually found in underground formations of limestone and/or dolomites, which are altered limestone. These rock formations react with the acid solution which helps connect the pores and fractures where the gas resides.

Specialized pump trucks are used to stimulate the well. These trucks are operated by personnel trained in handling chemicals and pressure equipment. If greater chemical placement accuracy is required, another piece of equipment known as a coiled tubing unit is used. The coiled tubing unit uses approximately 1 inch diameter pipe that's spooled on a coil and transported to site. This small pipe runs inside 3 inch tubing, into the potentially productive zone. A pressure control device is installed at the surface, and the chemical is pumped directly into the formation. Flow rates and pressure measurements are recorded during the operation.

## Flow and Pressure Buildup

After the stimulation, the well is tested to determine productivity. At this time, the tubing is full of fluid, and needs to be removed to allow the formation pressure to bring any available gas to surface. In some cases, the well pressure may be sufficient to remove the fluid and flow; if the well has sufficient reservoir pressure, it will eventually flow gas and liquids without assistance. In other cases, the well needs help to remove the fluid and allow it to flow. To remove the fluid, the service rig runs rubber cups (called swab cups) inside the tubing on a braided steel line. The fluid is lifted out of the hole by "swabbing" the well.



*Crew monitoring completions rig*



*Flow and pressure testing*

Once the liquid has been removed from the well, pressure recorders are run into the well using a wire line truck. During this time, the well is shut in for 24 to 72 hours, allowing the well to naturally build reservoir pressure. This pressure reading is vital when predicting the potential lifespan and reservoir potential of a well.

### **Flow Test**

After the well pressure has built up, it must be flowed to determine whether it is capable of commercial production. The flow period generally lasts for 24 to 72 hours. During the flow period, pressure recorders measure downhole pressure drops in the reservoir, and flow and pressure measurements are taken at the surface. To ensure a high level of efficiency, specialized equipment and trained personnel are brought in for the flow period of a well.

### **The Flare**

Because the well is not connected to a gathering line, gas collected during the flow testing is burned at the surface through a flare stack. This controlled burn is known as a flare, and may be visible far away from the well site. A large flare does not necessarily indicate that the well is capable of commercial production. After evaluating the results of the flow test and the effect of the flow on the reservoir pressure, it is decided whether a well should be put on production.

A flare permit must be obtained from the New York Department of Environmental Conservation before a well is flared. To alleviate possible concern about flares that are often highly visible, local emergency service centers and traffic departments are notified of upcoming flares.

In the great majority of cases, the gas burned during flaring is more than 98% methane (the same gas that is burned in many homes.) The flared gas also contains a small amount of water, which is captured in separator vessels. In a few cases, flared gas may also contain small amounts of other substances that are incinerated in

the flare. Fortuna carefully follows the best industry practices and monitors flaring closely to ensure the safety of employees, neighbors and the public.

The combustion process produces water and carbon dioxide. Occasionally, incomplete combustion may produce some slight visible smoke. On some tests, the flares will produce noise as high-velocity gas moves through the flare stack and passes rapidly through the nozzle tip at the base of the flame. The test will typically run for no more than 72 hours.

The amount of gas burned off during flaring varies from well to well, but is usually equal to about one day's production. Royalties are not paid on the gas needed for testing. Fortuna's goal is to minimize the amount of gas flared during testing in order to maximize the amount of gas sales.

Profits from all marketable gas are shared with well leaseholders. Each leaseholder receives detailed statements that show total production volume, market derived gas price, royalty share, and individual unit percentage.

### **Next Steps**

After the flaring phase, test results are reviewed to determine if a well will be economically viable for production. If test results confirm a well is viable, preparations are made to put the well on production. Site preparation includes construction of the well site facilities and building a gathering line to transport the gas to market.

If the flare test results are not favorable, the well is suspended for further geological testing or it may be plugged. A well may be temporarily suspended and additional work put on hold, but new information or other factors such as a change in gas prices could result in reversing the decision.

Constructing a new gathering line past a suspended well might make it possible to begin production, as could new technologies, the well's re-drill potential or the stimulation of a suspended well. These factors are continually reviewed.

Fortuna employees regularly visit all shut-in wells to check on their condition and status. All temporarily abandoned or suspended wells are reported to the New York state Department of Environmental Conservation, which regulates time limits and renewals of this status. When a well is determined to be non productive or commercially uneconomic, the well will be sealed and the surface area restored.

For further information, please access our website at [www.fortunaenergy.com](http://www.fortunaenergy.com) or contact our information desk at 607-795-2780 (Toll free 866-566-4747)