



## New CoreVault® service helped operator confirm 2.5 times more gas in place than expected

**New technology improved targeting, reduced costs, and kept samples under pressure so hydrocarbons could be accurately measured.**

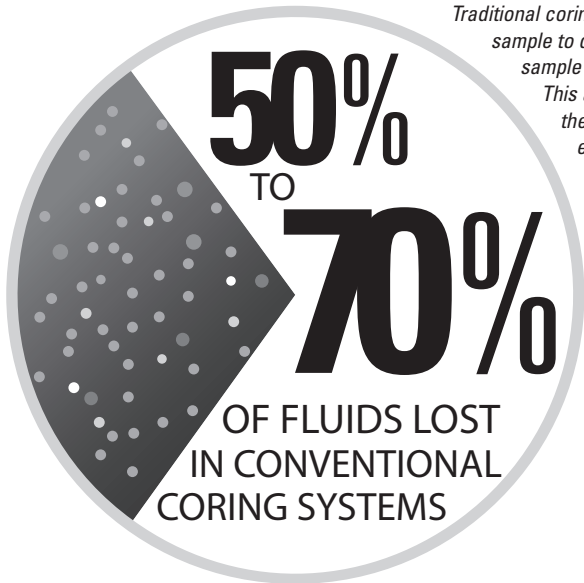


Specialists remove the CoreVault® tool from the wellbore.

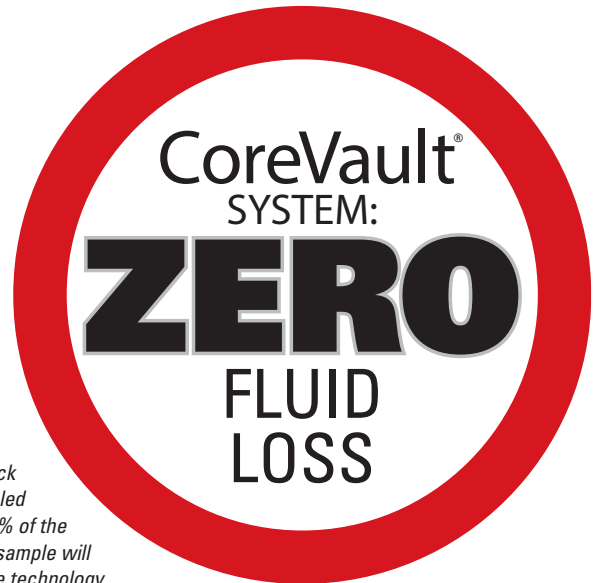
### Overview

Accurate economic evaluation of a shale well previously required drilling and completing it. Traditional coring tools let fluids escape from samples as they depressurized. As a result, analysis had to be based on estimates of fluids lost rather than measurement of fluids in place. Also, tools could take days to retrieve just one core. New Halliburton CoreVault® technology is changing all that, however. Built into the next generation of the proven Xaminer™ Coring Tool, the CoreVault system can capture up to 10 samples in a sealed container – in one run. The container prevents reservoir fluids from escaping during core retrieval and transport. An operator in Ohio and West Virginia used the system to retrieve 150 samples in five wells. Measurements of samples obtained with the CoreVault system showed 2.5 times more oil and gas in place than previously estimated. The operator also found variability in organic content, enabling better targeting and completion efficiency.

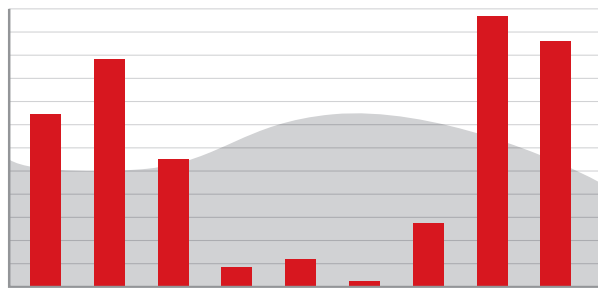
CHALLENGE	SOLUTION
<p><b>Returning samples to surface without losing fluids</b> As traditional samples move from a high-pressure reservoir to the surface, hydrocarbons escape from the sample cores. This can lead to uncertainty during analysis and inaccurate estimates of the type and volume of hydrocarbons in the reservoir, leading to uncertainty in economic evaluation.</p>	<p><b>System captures and retains core and reservoir fluids</b> The new CoreVault system sealed samples in pressurized containers before bringing them to surface. This kept the fluids in place and enabled accurate measurements instead of estimates, resulting in better information for making critical decisions about the field.</p>
<p><b>Acquiring samples in a cost-effective way</b> Traditionally, full-diameter pressure cores are expensive and time-consuming. It can take days to get one sample, with no guarantee that the sample collected is actually representative of the formation.</p>	<p><b>The CoreVault tool returns multiple samples in hours</b> The CoreVault tool was designed for fast, efficient operation. It took just minutes for the tool to take each sample, and the tool gathered up to 10 cores per trip. This allowed the operator to take samples from multiple points in the well, improving accuracy and efficiency.</p>
<p><b>Improving operational safety</b> Acquiring samples with pressure coring tools introduces several safety concerns. Because it is a drilling operation, many personnel are required to operate complicated surface equipment and handle potentially dangerous overpressured containers.</p>	<p><b>Wireline tools feature simple operation</b> The CoreVault system ran on wireline that was lowered into the well with a minimal crew on the surface. And because there was less equipment in the wellbore, there was less potential for equipment failure.</p>



*Traditional coring systems allow the sample to depressurize as the sample is brought to surface. This allows 50-70% of the fluids in the core to escape before they can be analyzed.*



*The CoreVault system keeps rock samples in a sealed container so 100% of the fluid in the core sample will remain within the technology.*



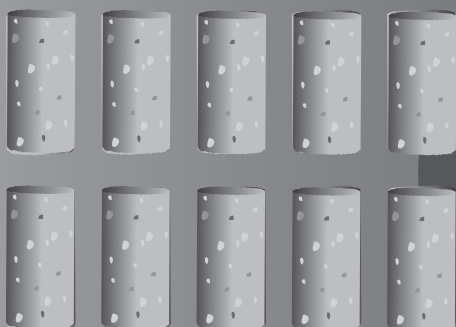
**MEASUREMENT**  
VS. *ESTIMATED*

*Most coring systems require labs to estimate the amount of fluid in the reservoir. With the CoreVault system, labs can actually measure it. This helps operators avoid fracturing dry holes.*



**MORE GAS IN PLACE**  
THAN  
PREVIOUSLY *ESTIMATED*

*The CoreVault system helped one operator in Ohio and West Virginia accurately measure 2.5 times more hydrocarbons than previously estimated.*



**UP TO 10 SAMPLES  
CORED IN 1 HOUR**

*The CoreVault system can retrieve up to 10 samples, giving operators the ability to efficiently target the most profitable zones in a well.*

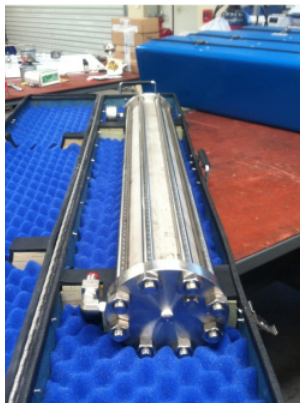
## New CoreVault® service technology from Halliburton helped operator target profitable zones through accurate analysis from core samples.



At surface, gas bubbles out of a conventional core.



Gas escaping from same core in water 24 hours later.



DOT-approved overpack for safe transportation.

### Knowing volume of hydrocarbons is critical for decision-making

Unconventional wells vary widely in their performance – even when the wells are in the same field. Historically, one third of perforation clusters fail to produce any oil or gas, while another third of the wells account for 75% of the total production. To improve drilling efficiency and reduce costs, operators need to gather more accurate information about the location and volume of hydrocarbons so they can avoid spending millions of dollars fracturing a well that may be a dry hole.

One operator working in Ohio and West Virginia used new CoreVault technology from Halliburton to gain accurate sampling results that revealed dramatically more oil and gas in place than previous estimates indicated.

### 50-70% of fluid lost in transit prior to analysis

Most traditional sampling tools lose pressure in core samples, so as samples are brought to the surface, much of the fluid escapes. On average, 50-70% of the hydrocarbons in a core sample are lost before they can be analyzed.

To compensate, operators must use a mathematical calculation that estimates fluid loss based on experience from other wells in the area. But because natural variances occur between wells and between zones in a single well, this estimate can be inaccurate. That often leads to incorrect assumptions about the reservoir and makes it impossible to target the most profitable zones. Thus when using traditional coring systems, operators had to fracture and complete the entire well to learn how much oil and gas they actually had.

### CoreVault system allows for accurate measurement before completion

An operator in Ohio and West Virginia chose to use CoreVault technology from Halliburton. It seals core samples into a pressure vessel at depth. Using this the new system ensured that core samples remained sealed, preventing fluids from escaping. This gave the operator the ability to take a true measurement of the fluid volume in the reservoir instead of relying on inaccurate estimates.

### Overpack system keeps high-pressure samples safe for transport

Halliburton has also developed an overpack transportation solution that allows safe handling of the pressurized cylinders. Despite the high pressure inside the cylinder, once packed appropriately, the operator was able to safely ship the samples by air to remote laboratories for analysis.

## New CoreVault technology from Halliburton helped operator target profitable zones through accurate analysis from core samples.



CoreVault assembly is built on proven Xaminer™ Coring Tool technology.



Unique design ensures oil and gas remain sealed in samples.



Large-volume coring tool being prepped for run.



Disassembled CoreVault tubes after lab analysis is complete.

Traditional coring systems are also very time-consuming. It can often take days of rig time just to get one sample. There is no way to verify that the coring system has actually retrieved a sample until the tool has been brought to the surface. And, there is no guarantee that the sample will reveal accurate information about the volume of hydrocarbons in place.

### **The Xaminer™ Coring Tool with CoreVault system acquires samples quickly, efficiently**

The CoreVault system is built into the latest generation of the field-proven Xaminer Coring Tool. This tool takes just minutes to retrieve each sample, and can take up to 10 samples in just a few hours. This enabled the operator to take cores from multiple points in each well and to see where the most profitable zones were – without having to fracture the entire well.

Unlike conventional coring tools, which use hollow bits on drillpipe, the Xaminer Coring Tool runs on wireline. This allowed the operator to reduce the number of personnel needed on the surface, and eliminated any question about being able to control pressure while the circulation of mud was restricted. Real-time connectivity also enabled the operator to verify that each core was successfully retrieved before bringing the tool to the surface.

### **Designed for high-pressure environments**

Both the CoreVault system and the Xaminer Coring Tool are designed to operate in extreme environments. Rated to 400°F and 25 kpsi, these tools can handle even the most extreme unconventional plays.

### **CoreVault system reveals 2.5 times as much oil and gas in field**

The operator ran the CoreVault system in five wells, gathering a total of 150 core samples. Previously, the operator estimated fluid loss from depressurized samples. Calculations, based on the faulty estimates, indicated an average of 78.2 scf/ton of hydrocarbons in the reservoir.

Samples retrieved by the CoreVault system revealed an average of 196.2 scf/ton. That meant the operator had 2.5 times more gas than expected. Thus, the CoreVault system enabled much more accurate valuation of gas in place. It also enabled better targeting because it retrieved multiple samples from different places along the wellbore.

Using conventional tools, the operator could have concluded that these wells would not be economic. But thanks to CoreVault technology, the company knew the precise volume of oil and gas in the reservoir. The operator also obtained better information about where the most profitable zones were. That enabled the company to complete wells more efficiently and avoid fracturing non-profitable zones and dry holes. Thus, CoreVault technology contributed to more efficient use of capital.