



# Weatherford®

## Inflatable Packer Technologies for Natural Gas Storage in Salt Caverns



Drilling



Evaluation



Completion



Production



Intervention

### Well construction

- Cementing products
- Drilling tools
- Inflatable packers
  - Accessory equipment
  - Annulus casing packers
  - Injection production packers
  - Service equipment
  - Straddles
- Liner systems
- Mechanized rig systems
- Solid expandable systems
- Swellable products
- Tubular running services

### Sealed to perfection

Providing a reliable annular seal to isolate, protect and secure your long-term investment in a salt cavern, natural gas storage facility



# When it comes to creating a reliable annular seal, nothing beats a bulldog.

One of the world's largest oilfield services companies, Weatherford has been providing inflatable packer technologies to petroleum sector clients for more than three decades. Our diversified portfolio includes the highly reliable **BULLDOG™ ACP™ annulus casing packer**—ideally suited for the unique demands of natural gas storage in salt caverns.



## *The opportunity:* Effectively meet demand

Storing natural gas in underground facilities helps ensure dependable, long-term access to the commodity, whether imported or locally produced. Like depleted gas reservoirs and aquifers, salt caverns can be converted to natural gas storage facilities cost-effectively with the addition of a well that permits injection and periodic withdrawal of the product.

## *The challenge:* Prevent gas migration, during and after construction

Converting a salt cavern into a natural gas storage facility necessitates running casing into a well connected to the cavern and cementing it in place. As it hardens, the cement is susceptible to the migration of air and gas to the surface; fissures can undermine the structural integrity of a well that must last for decades. Even after it hardens, cement alone does not adequately prevent the injected natural gas, stored under pressure, from circumventing the casing to reach the surface. In short, failure to seal the cement properly where it meets the cavern could lead to costly repairs, loss of product and environmental hazards.

## *The answer:* Create a gas-tight seal with the **BULLDOG ACP** packer

Run into the hole with the casing, our inflatable **BULLDOG ACP** packer seals off air and gas in the cavern, enabling the cement to harden properly during well construction. It also safeguards the facility from the leakage of stored natural gas through the cement for the duration of the well's life cycle. In addition, our **BULLDOG ACP** packer can repair casing damage in previously drilled natural gas storage facilities, providing the same sealing protection as newly drilled wells.

Not all inflatable packers are created equal. With proprietary rubber components, the **BULLDOG ACP** packer is rated for extremely high pressures and temperatures. It has also proven reliable in quality-critical applications throughout the world. Owing to its premium design and track record, the **BULLDOG ACP** packer is the recommended product for salt cavern storage facilities—where packer reliability is critical to success.

### Operational Sequence

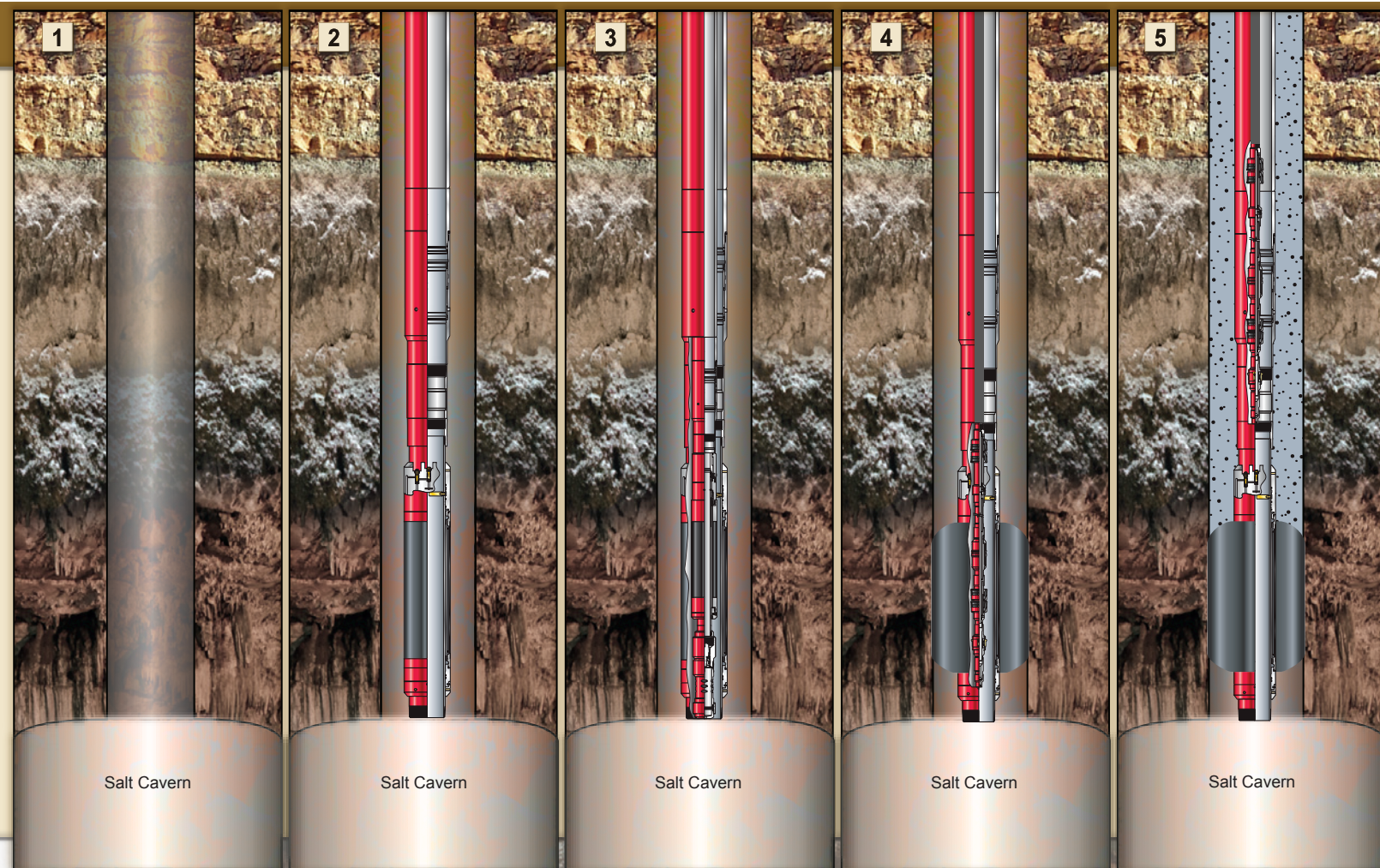
#### Placement and Activation of the Packer

- 1 Drill a well into an existing salt cavern.
- 2 Run the casing, packer, cement port collar and other associated accessories into the hole.
- 3 Run the inflatable production packer (IPP) to pressure test the casing. Deflate and pull the IPP from the well.
- 4 Run in the well with the acid wash tool (AWT). Pump cement or fluid into the drillpipe string through the AWT and inflate the packer to create a reliable seal between the external diameter of the casing and the borehole wall in the annulus.
- 5 Once the packer is inflated, open the shifting sleeve on the port collar and cement the annulus to surface above the packer. Close the port collar and pull out the assembly.

Weatherford's **BULLDOG ACP** packer is run with our model 761 mechanical cementing port collar on the casing string, enabling the cementing of the well without the need to drillout the equipment.



# al in a salt cavern storage facility for natural gas,



## The Pivotal Role of the Packer

- Keeps cement from entering the cavern during well construction
- Prevents the migration of gas and air through wet cement, protecting the well's structural integrity
- Safeguards the facility from the leakage of stored natural gas

## Middelwhich, UK

### Weatherford Overcomes Challenging Hole Condition to Cement Casing, Prepare Salt Cavern for Natural Gas Storage

Our client turned to us for assistance after another service provider refused to cement a 9 5/8-in. casing string in a severely washed out 19-in. OD hole, a key to ensuring the salt cavern below could be used for future natural gas storage. Using the field-proven *BULLDOG ACP* annulus casing packer, model 761 mechanical port collar, and acid wash tool, Weatherford successfully planned and executed the operation, despite the difficult hole conditions.



## Inflatable Packer Technologies for Natural Gas Storage in Salt Caverns

**Sealed to perfection**

To learn more about the benefits of using our inflatable packer technologies to create a reliable annular seal in your salt cavern, natural gas storage facility, contact an authorized Weatherford representative or visit **[weatherford.com](http://weatherford.com)**.



**Weatherford**<sup>®</sup>

**[weatherford.com](http://weatherford.com)**

© 2011 Weatherford. All rights reserved. **8418.00**

Weatherford products and services are subject to the Company's standard terms and conditions, available on request or at [weatherford.com](http://weatherford.com). For more information contact an authorized Weatherford representative. Unless noted otherwise, trademarks and service marks herein are the property of Weatherford and may be registered in the United States and/or other countries. Weatherford products named herein may be protected by one or more U.S. and/or foreign patents. For more information, contact [patents@weatherford.com](mailto:patents@weatherford.com). Specifications are subject to change without notice. Weatherford sells its products and services in accordance with the terms and conditions set forth in the applicable contract between Weatherford and the client.