Boots & Coots Safely Kills Six-Well, Single-Pad Blowout

TEAM SOLVES MAJOR WELL-CONTROL CHALLENGE NEVER SEEN BEFORE IN THE INDUSTRY

CONVERSE COUNTY, WYOMING, USA

CHALLENGES

- Six-well blowout on a single pad
- Wellhead proximity and valve alignment caused a cascade effect complicating source control
- Extreme direct and radiant heat

SOLUTIONS

- Rapid deployment of well control services and detailed risk analysis
- Thorough site containment and safety measurements
- Aggressive well control procedures to kill the blowout well by well

RESULTS

- The blowout was safely killed and all wells were re-headed in 16 days
- Rapid containment prevented environmental damage beyond the site
- Lesson learned: Configure production trees so all valves are perpendicular to the direction of the pad and face away from other wells

OVERVIEW

A client with six wells on a single pad suffered a setback when one well developed a gas leak and ignited, ultimately causing a multiple-well blowout. The heat damaged the neighboring wellheads, causing the other wells to also develop leaks and catch fire. Boots & Coots was called in to contain and kill the blowout, which it did safely in only 16 days.

CHALLENGES

A series of six wells spaced 15 feet (5 meters) apart were drilled on a pad, targeting formations with different pressure and fluid properties. Each well was completed with multistage hydraulic fractures to enhance production. After completion, wells were flowed back to clean fractures and sands prior to production. A production facility was located off the drilling pad to process and measure production from each well. During flowback of the last well, a leak developed in a flowback line and the exiting gas ignited.

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Figure 1. The six-well pad fire, with wells in close proximity and generating extreme heat, was the first blowout of its kind in the industry.

The original production trees had been installed with the casing valves aligned in series and pointing toward adjacent wells. Heat from the first well fire caused the other wellheads and valves to leak and catch fire – a cascade effect that intensified the complexity of controlling the source. The first well caught fire in the evening, and by morning all the wells were burning.

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Figure 2. The fires of three proximate wells feed each other to create a complex fire hazard on the site. The side valve of the well on the right is compromised and is feeding a mixture of gas and condensate to the other two wells.

The main safety challenge was managing both direct and radiant heat. The crossfire from the failed side valves generated unpredictable fire behavior around the pad, creating hazards for approaching the wells and further complicating source control efforts.

The challenge facing Boots & Coots and the operator was the first of its kind in well control history. Pad drilling is a relatively new practice in the petroleum industry. Although there has been some discussion among professionals about the risks associated with well control in pad drilling, the industry had not experienced multiple blowouts of wells in such close proximity.

By Day 16, all the wells were under control, with the damaged wellheads removed and the wells re-headed. The principal lesson learned from this incident is the need to configure production trees so all valves are perpendicular to the direction of the pad and face away from other wells.

SOLUTIONS

The Boots & Coots team responded to the crisis immediately, mobilizing the necessary well control equipment within hours of the call, establishing an incident command center, and assessing the site. Following evaluation and risk analysis, the area around the pad was contained and safety monitors were installed. Site containment included air-quality measurement, fire and heat measurement, and protection and spill-control plans. Barriers were built around the pad to prevent runoff, and all fluids, including condensate and water, were safely collected at the end of the pad for processing.

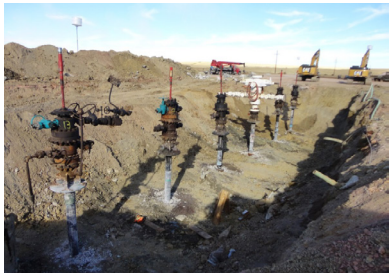

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Figure 3. After all the wells were safely capped, the pad was excavated to install new wellheads.

Water monitors were installed around the pad to create a water curtain and reduce the intensity of radiant heat. Debris around the pad was removed to allow a safe approach for the Boots & Coots team and to position its equipment and tools.

RESULTS

The first three wells were killed by stinging and pumping brine to mitigate formation damage and save the wells for future operations. Halliburton provided sand and pumping units for the operation, and, after sufficient brine was pumped to kill each well, a safety valve was installed in the tubing. Heat shields were built on site and installed on contained wells to protect the wells against further heat damage.

Well 4 had significant heat damage and multiple leak points, and the intensity of its fire blocked access to Wells 5 and 6. The wellhead of Well 4 was severed, using a jet cutter with abrasive sand pumped at 10,000 psi, and a Venturi tube was installed to flare the fire upward and away from the work area. With the fire redirected, Wells 5 and 6 were killed and contained prior to Well 4.

One of the wells was severely damaged with a visible condensate leak, and another had developed a minor leak below the tubing hanger. After completing risk analysis, the team decided to plug these two wells with cement. By Day 16, all the wells were under control, with the damaged wellheads removed and the wells re-headed.

The Boots & Coots team worked with the operator to successfully implement a spill control program, and all fluids from the wells were safely contained and processed. Ultimately, the rapid containment prevented environmental damage beyond the pad.

Today, many operators are turning to pad sites with multiple wells to reduce development costs and environmental footprints. For wells in close proximity, careful consideration must be given to the overall design to minimize the risk associated with well control incidents. All parties involved in the response collaborated to perform a detailed safety and risk analysis without injury. The principal lesson learned from this incident is the need to configure production trees so all valves are perpendicular to the direction of the pad and face away from other wells.

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