Source Control Operations Achieve Success on Offshore Drilling Platform

OVERVIEW

During drilling operations on a platform, a kick occurred after encountering an unexpected abnormal pressure formation. While circulating out the kick, a leak developed on the blowout preventer (BOP) stack, which then ignited. The platform was safely evacuated without any injuries, but the fire eventually degraded the structural integrity of the platform, causing it to partially collapse. Bottomhole pressure was approximately 18,000 psi, and the bottomhole temperature was near 215°F (102°C). The operator called Boots & Coots for its extensive experience on safe and efficient source control practices. Details of this case study are published as part of OTC-26975-MS.

CHALLENGES

- Compromised offshore drilling platform, following a fire
- High flow rate and multiple leaks through the wellhead seals
- Severe weather conditions
- Station keeping of non-dynamically positioned firefighting boats

SOLUTIONS

- Detailed operational and safety procedures
- Rapid deployment of source control operations
- Water deluge system
- Debris removal and source control

RESULTS

- The wellhead was cut, capped, and contained safely
- Source control operations helped operator avoid cost of drilling a relief well

A fire engulfs an offshore platform in the Caspian Sea. The heat and fire degraded the integrity of the platform structure and caused part of the platform to collapse.

CHALLENGES

On closer inspection of the platform, multiple leaks had developed from the flanges below the BOP due to the collapse of the platform onto the stack. The height of the flame reached 320 feet (98 meters). The heat-affected superstructure had collapsed and scattered debris all over the platform. The spontaneous decision was to drill a relief well; however, severe weather conditions imposed a six month delay on mobilizing an appropriate rig for drilling a relief well. A subsequent risk analysis was performed to evaluate the feasibility of performing source control to cap and contain the well on the platform.

A detailed analysis indicated severe damage to 25–30 percent of the platform structure. Considering the structure of the platform, multiple safe routes for boarding the platform and emergency evacuation plans were established. Major safety and health hazards were identified by the health, safety, and environment (HSE) team, and proper procedures were developed to eliminate or mitigate risks.

SOLUTIONS

In order to mitigate heat damage to the structure of the platform and to the equipment, two firefighting boats continuously sprayed water on the platform and equipment. Several firefighting pumps and fire monitors were positioned on the platform to support the source control operation. Had the platform been lost altogether, the only option would have been...
to drill a relief well. Therefore, it was absolutely crucial to prevent further damage to the structural integrity of the platform while properly removing debris.

Following all safety precautions and protocols, the well control crew boarded the platform to clear debris and gain access to the wellhead. The primary objective of the daily operation was to eliminate or mitigate safety hazards to as low a degree as practically possible.

The platform clearing operation was supported by a barge crane to lift and collect debris. The position of firefighting boats and fire monitors on the platform were adjusted based on the ongoing activity to provide support for the operation. The presence of high salt content in the water and winds necessitated special considerations for protecting pumps, electronics, and control panels to ensure reliable and continuous operation.

After removing debris and gaining access to the wellhead, the damaged sections were replaced and decking was erected for the jet-cutting and capping operations. A practice jet-cutting operation was performed onshore on a similar 18-3/4-inch, 10,000-psi wellhead with 8-1/2-inch-thick forged steel. Well control experts carefully examined the progress of the jet-cutting operation for the cut on the platform wellheads. The jet-cutting operation on the platform was performed flawlessly and the stack was removed, resulting in a vertical flow of hydrocarbons over which a Venturi tube was lowered as added protection.

After the jet-cutting operation, damaged spools and flanges were removed from the remainder of the stack and the well was capped with a custom configuration tree. There was a concern that heat and flow damage could occur to the sealing elements, and, therefore, the wells were not shut in. Instead, the flow from the well was diverted to a pipeline while other efforts for securing the well were under way.

In the absence of an immediate option for drilling a relief well, source control provided the only viable option for containing the well safely for the operator. Detailed safety and hazard analysis significantly reduced the risks associated with source control operations on the platform, and, after capping and diverting the flow to a pipeline, the environmental hazards and pollution were eliminated, providing a safe environment for continuing source control operations on the platform.

RESULTS

The total length of the source control operations from the start to the capping operation lasted 49 days, with 40 percent nonproductive time attributed to severe weather conditions. Notwithstanding these delays, the Boots & Coots team was able to successfully complete these operations, saving the customer loss of production and the cost of drilling a relief well.