

**Case study:** The Netherlands

# 100% electric P&A unit key to onshore rigless well abandonment, reduced emissions, smell, noise contour

NAM, an operator in The Netherlands, needed to select the most economical method to abandon more than 60 wells on 23 different onshore locations drilled over a 60-year period.

The first batch of ten wells included those with a complex scope of work, requiring annular remediation. Because of the complexity of the wells, engineered and bespoke solutions such as section milling (SM), perf wash and cement (PWC), and perforate, circulate, and cement (PCC) were required to complete the work. Additionally, well abandonment barriers required a specific cement slurry design. Most of the wells were classified as hydrogen sulfide (H<sub>2</sub>S) and had radioactive material with Low Specific Activity (LSA), benzene, and condensate.

Complicating the entire process was the proximity of the wells to housing and multiple non-technical risks (NTR), so the solution required a reduction in emission, smell, and noise. The operator required no health, safety and environmental (HSE) incidents, lower total abandonment costs, no residual liabilities, and to maintain the overall plug and abandonment (P&A) schedule. The solution must sustain the operator's license to operate in the country and serve as a blueprint for future P&A projects.

## Coordinating the well plan

The scope of work required significant engineering and planning of multiple contingencies. Selection of the optimal solution and downhole equipment (SM, PWC, PCC, fluids and cement slurries)

became apparent after detailed well screening, engineering, and modeling.

Baker Hughes collaborated with WellGear and Mammoet to create a unique, low-impact, fully integrated well abandonment project solution for onshore P&A in The Netherlands including well P&A services, hydraulic workover (HWO), logistics, and site preparation. Project management and detailed engineering ensured efficient planning, and close collaboration and interface with the operator project team drove efficiencies in executing the work. Outstanding project management ensured close cross-product line and third-party collaboration and continuous interaction with the operator.

## Strategizing the solution

A fit-for-purpose, modular 600,000-lb hydraulic workover P&A unit with a high performance rotary table complemented Baker Hughes's downhole technologies and enabled full P&A of complex wells without the need for a drilling rig. The bespoke rigless P&A unit was 100% electric, enabling low noise, smell, and emissions during the on-site operations, mitigating NTR. This was the first electrified P&A unit in the operator's history, and ran on grid power.

## Executing predictable performance

The first 20 wells were completed within the schedule, planned budget, and in compliance with local mining and environmental regulations with no remaining liabilities while limiting the

## Challenges

- Determine the most economical way to abandon 60+ onshore wells, most of which were classified as H<sub>2</sub>S wells with LSA, benzene, and condensate
- Design detailed engineering and bespoke solutions including rigless P&A; section milling; perf wash and cement; perforate, circulate and cement; and specific gas tight cement slurries
- Reduce emission, smell, and noise to account for close proximity to housing

## Results

- Incurred zero lost time incidents (LTI) over 130,000 man-hours
- Completed rigless well abandonment scope within planned schedule and budget
- Reduced CO<sub>2</sub> emissions, smell, and noise contour by using a 100 % electric P&A unit, incurring zero NTR
- Experienced no HSE issues or nonproductive time (NPT)
- "I am very pleased that we are on the right track." – Operator CEO

total project costs. The supply chain stepped up providing a cost-effective solution through collaboration, multi-skilling, technology innovation, and logistical solutions, despite operating during the COVID-19 pandemic.

The P&A work was successfully executed, and a total of 14,655 bbl (2330 m<sup>3</sup>) of cement was pumped to place 26 cement plugs. The annular integrity was re-established in multiple complex wells which included 4 PCC, 4 PWC, and 4 SM jobs. In the process, 35 casing cuts were made and a total of 200 miles (320 km) of pipe was tripped. A total of 40,883 bbl (6500 m<sup>3</sup>)

of mud was delivered and 12,580 bbl (2000 m<sup>3</sup>) was recycled to the mud plant. There was a total of 1,900 truckloads for these 20 wells which included moving the HWO unit, tanks, pumps, cement bulk, fluids, waste, pipe, tools, and offices from site to site. All logistical movements were conducted safely without affecting the nearby neighborhoods.

Because the operation used the all-electric P&A HWO unit, 160 t of carbon dioxide (CO<sub>2</sub>) was saved. The entire operation incurred zero LTI and the NTR was carefully managed.

“The P&A unit places several cement plugs at various depths in a well,” reported NAM’s CEO in Nexstep’s Re-use and Decommissioning Report. “The well is safely and permanently closed this way.”

He went on to add, “I am very pleased that we are on the right track. At the moment, we have already decommissioned 22 wells. Our ambition is indeed to decommission those 70 wells, and I expect that we will achieve this within the agreed term. So, we had a very good start.”



This is the first fully integrated well abandonment approach which included a 100% electric P&A unit that significantly reduced CO<sub>2</sub> emissions, smell, and noise contour.