

# Firma Plug and Abandonment Solutions

## Reduced CO<sub>2</sub> Emissions by 91% in Lump Sum Turnkey Well Decommissioning and Restoration Project

### Objectives

- Decommission 2 impaired wells which presented risks to the environment, restoring the wellsite to its pre-explored condition.
- Deliver all wells, interface, and facility engineering to enable safe, regulatory compliant, and cost-effective operations.
- Engineer the basis of isolation to eliminate the requirement for a drilling rig and use a lower specification and lower carbon footprint solution to execute operations.
- Provide integrated wellsite management of services including duty holding, supervision, permit holding, and multi-skilled crewing to safely execute operations.

### Our Approach

- The operator sought an approach to decommission aging and impaired wells and then restore the well sites through a single-source contracting approach. With limited well data and history, conventional contracting approaches would not be successful.
- The Firma Plug and Abandonment Solutions team appraised the well data, wellsite condition, well integrity, and conventionally used rigs. The team proposed a lump-sum turnkey contract with an engineering, procurement, and services management (EPSm) approach. This enabled the team to select alternative surface equipment to safely decommission the wells with a high degree of cost certainty and lower the carbon footprint associated with drilling rig operations.
- The well engineering team developed several basis of isolation systems and evaluated the most effective well barriers and techniques that were compliant to the operator's standards and allowed lower specification surface equipment to be used.
- The detailed basis of designs encompassed planned operations and contingency preparation and remediation techniques to enable coverage for a variety of wellbore scenarios. This allowed the appropriate level of equipment and materials to be ready for use, reducing the cost of unplanned call off and ensured the operations could progress.
- A workover unit and appropriate surface fluids system were specified and procured for the scope, which consumed 91% less diesel per day than a drilling rig and fluids system.



Firma solutions use a single, integrated contract structure to complete projects more efficiently and effectively

#### LOCATION

Oman

#### WELL TYPE

Onshore

#### CASING SIZE AND TYPE

9.625-in. surface casing  
7-in. production casing  
4.5-in. liner and screens  
3.5-in. tubing  
1.5-in. sucker rod with pump lift

#### MEASURED DEPTH

Production casing: 5,800 ft (1,767 m)  
Liner and screens: 6,200 ft (1,889 m)

#### PRODUCTS/SERVICES

- Project management
- Well engineering
- Facility engineering
- Commissioning and interface engineering
- Wellsite management
- Workover unit
- Slickline and wireline services
- Cement evaluation services
- Perforation services
- Pressure pumping services
- Cement and fluids
- Wellbore cleanup services
- Casing recovery services
- Testing plugs and packers
- Cased-hole fishing services
- Wellhead removal services
- Site preparation and restoration services



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### Our Approach (continued)

- Slickline, wireline, and cement evaluation logging systems were developed as well as contingency perforation and plug setting operations in the event remediation of the B and C annuli was required.
- Multiple contingency levels were planned and developed in a robust well delivery plan—with optimization of well barrier placements and shale interval coverage planned—along with contingency remedial operations. The fluids program was sodium chloride (NaCl) based and options for polymer-based mud were developed should section milling be required as a remediation technique.
- The team planned the surface wellsite pre-operations and laid the groundwork for restoration after the wellhead and all tubulars were removed. This eliminated lost time due to site readiness and handover acceptance. Moreover, these plans ensured the wellsite was left in a pre-explored state, compliant with regulations at the cessation of operations.

### Value to Customer

- The wells were successfully and safely decommissioned and well sites restored without any environmental or personnel injuries. The EPSm approach enabled lump-sum commercials with a high degree of cost certainty for the customer, and significantly reduced the carbon footprint as compared with conventional rig-based approaches.
- Well 1 was executed safely and with a 91% reduction in carbon dioxide (CO<sub>2</sub>) emissions compared to a conventional rig. The wellbore had 38,040 lb of steel removed from the wellsite for recycling, including 4,538 ft (1,383 m) of sucker rod, 4,533 ft (1,381 m) of tubing, and a unitized wellhead. Contingency fluid program and preparation operations were required due to unexpected losses into the formation which was safely mitigated through the management of change process. A combined primary and secondary well barrier was successfully installed and qualified, with a multi-annuli surface well barrier installed and qualified.
- Well 2 was executed safely and with a 90% reduction in CO<sub>2</sub> emissions compared to a conventional rig. The wellbore had 38,040 lb of steel removed from the wellsite for recycling, including 2,864 ft (872 m) of sucker rod, 2,860 ft (871 m) of tubing, and a unitized wellhead. During operations contingency, tubing conveyed perforation was required due to tubular collapse. A combined primary and secondary well barrier was successfully installed and qualified, with a multi-annuli surface well barrier installed and qualified.



Well abandonment experts collaborate to find the right business model within a customer's broader company strategy by evaluating all the options, defining a plan, and managing the operation safely and successfully.

