BAKER HUGHES
a GE company

Plug and abandonment solution streamlined decommissioning job

An operator in Norway needed to permanently plug and abandon (P&A) a large field development with five wells located at 984-ft (300-m) water depth. The scope and difficulty of the project were considerable, so the operator contacted Baker Hughes, a GE company (BHGE), seeking an integrated approach.

The field was developed to provide gas and increase production to another field in the North Sea. The development was eventually closed down and temporarily abandoned. The scope of work for the P&A was to establish a deep well barrier, followed by cut and pull of the $9^{5}/_{8}$-in. and $13^{3}/_{8}$-in. casing, $18^{3}/_{4}$-in. wellhead, 30-in. conductor, 42-in. washout sleeve; all wells needed to be disconnected from subsea template by cuts 16.4 ft (5 m) below the seabed.

After carefully reviewing the job details and developing a detailed plan of execution, we deployed our experienced teams to provide a coordinated effort that included cementing services, fluids, mud logging, milling, cutting, and fishing services.

First, the five wells were temporarily abandoned using a light well intervention (LWI) vessel, and all subsea trees were removed before the rig arrived. Once the rig was in place, the completion was pulled and logging tools were run on wireline to find the correct placement for the barrier and to identify gas below casing hanger. Cement plugs were then placed inside the $9^{5}/_{8}$-in. casing, and the casing was cut and successfully removed using a **Model B™ spear**.

Before the casing hanger could be removed, the seal assembly needed to be milled. To enhance efficiency, BHGE used a specialized $18^{5}/_{8}$-in **METAL MUNCHER™ Advanced Milling Technology (AMT) junk mill**. A cement plug was then set inside the $13^{3}/_{8}$-in. casing, and it was cut and pulled using a Model B spear. The seal assembly was milled using our METAL MUNCHER AMT mill, similar to the way it was used with the $9^{5}/_{8}$-in. seal assembly.

A total of 16 cut-and-pull operations were performed to remove the $9^{5}/_{8}$-in. x 10¾-in. and $13^{3}/_{8}$-in. casing. The spear and motor were combined on eight of the trips to reduce the total number of trips and maximize efficiency.

Challenges

- Offshore Norway P&A operation
- Subsea template with six slots and five wells drilled
- More than 10 years after initial drilling, field was shut down and wells were secured temporarily
- Wells located in 984-ft (300-meter) water depth
- Needed to cut and pull $9^{5}/_{8}$-in. and $13^{3}/_{8}$-in. casing, $18^{3}/_{4}$-in. wellhead, 30-in. conductor, and 42-in. washout sleeve
- Job required nonstandard products such as large-size cement mills, casing cutter, and casing spear

Results

- Enhanced operational efficiency with a fully integrated solution
- Minimized the number of trips needed
- Reached 99.62% uptime

The 18 3/4-in. wellhead was connected to the 30-in. conductor by spring-loaded pins, so more than 136 tons of overpull was applied to shear the pins and pull the wellhead free.

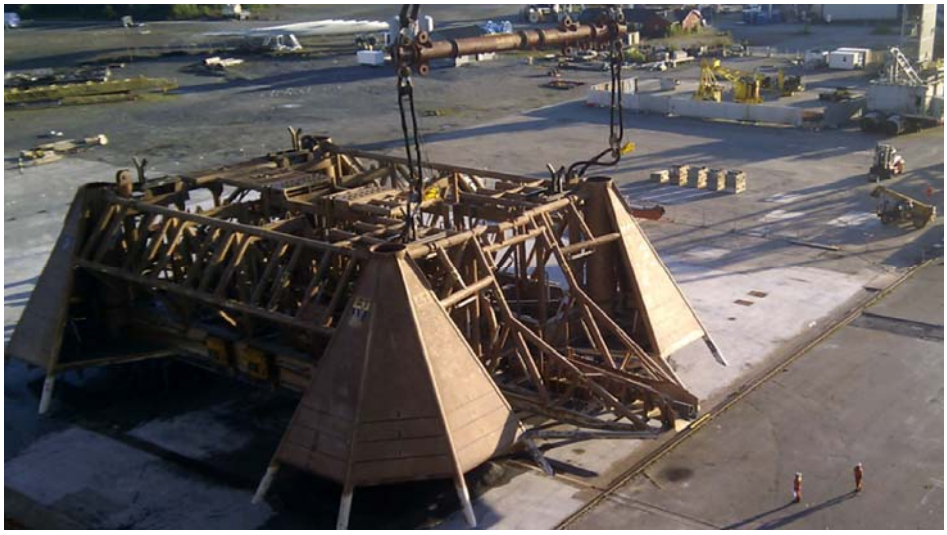
After the 18 3/4-in. wellhead was cut using a **HERCULES™ casing cutter**, a BHGE **Model D™ spear** with jars and accelerator was used to jar the wellhead free.

Next, the spring-loaded pins that attached the 30-in. conductor to the template were sheared, and a dedicated run was made to cut the conductor. Cutting depth was 3.2-ft (1-m) shallower than the cut in the 18 3/4-in. wellhead. The 30-in. conductor was then jarred free using a 20¾-in. Model D spear.

A cement cleanup run using 33 3/8-in. and 45½-in. cement mills was then made down to the top of the conductor cut, and to the top of the 42-in. washout sleeve.

Finally, the 42-in. washout sleeve was cut using a modified BHGE HERCULES cutter, which was centralized inside the washout sleeve. A custom **Model E™ spear** was used to successfully pull the 42-in. washout sleeve free. Only 25 runs were made to cut and pull the wellhead, conductor, and washout sleeve.

At the conclusion of the job, all five wells were permanently plugged, all wellheads and conductors were pulled free from template, and the template was lifted away from the field. The integration of P&A services provided by BHGE ensured maximum efficiency, reduced HSE risk, and resulted in flawless onsite execution with zero downtime.



Subsea template (note scale compared to personnel on the ground at lower right).

A specialized 18 5/8-in METAL MUNCHER AMT junk mill was used to mill the seal assemblies.

A custom Model E spear was used to catch the 42-in. washout sleeve.

The 42-in. washout sleeve on deck after successful removal using a modified HERCULES casing cutter and Model E spear.

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