Cuttings reinjection in the North Sea: A case study

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IN 1997, OILTOOLS (Europe) Ltd, a wholly owned subsidiary of **Oiltools International Ltd** was awarded a contract by a major North Sea operator to design, manufacture, install and operate drilled cuttings injection (DCI) systems on a total of 4 North Sea platforms. In July 1997 Oiltools Engineers formally took over the operation of the first platform.

This report covers the successful operation of the first DCI system (Rig B) after the first 3-well, 5-section phase of a planned multi-well operation and highlights the operational costs and parameters of the injection process.

INTRODUCTION

The slurrification, conveying and injection systems onboard Rig B were installed before Oiltools were awarded a contract to operate the equipment having been supplied by another injection services company in 1996. A full system audit was performed in order to determine the level of maintenance required and also to allow engineering personnel to familiarise themselves with the specific system design. Little or no operating, maintenance or safety procedures were available or third party data for spare parts traceability. As a corrective action of the audit, these documents were generated and necessary maintenance carried out to ensure the operational integrity and safety of the system.

The maintenance workload was successfully completed and the first well commenced during November 1997.

The DCI System for Rig B is designed to receive the drilled cuttings from the Solids Control Equipment, and waste water from the drainage system.

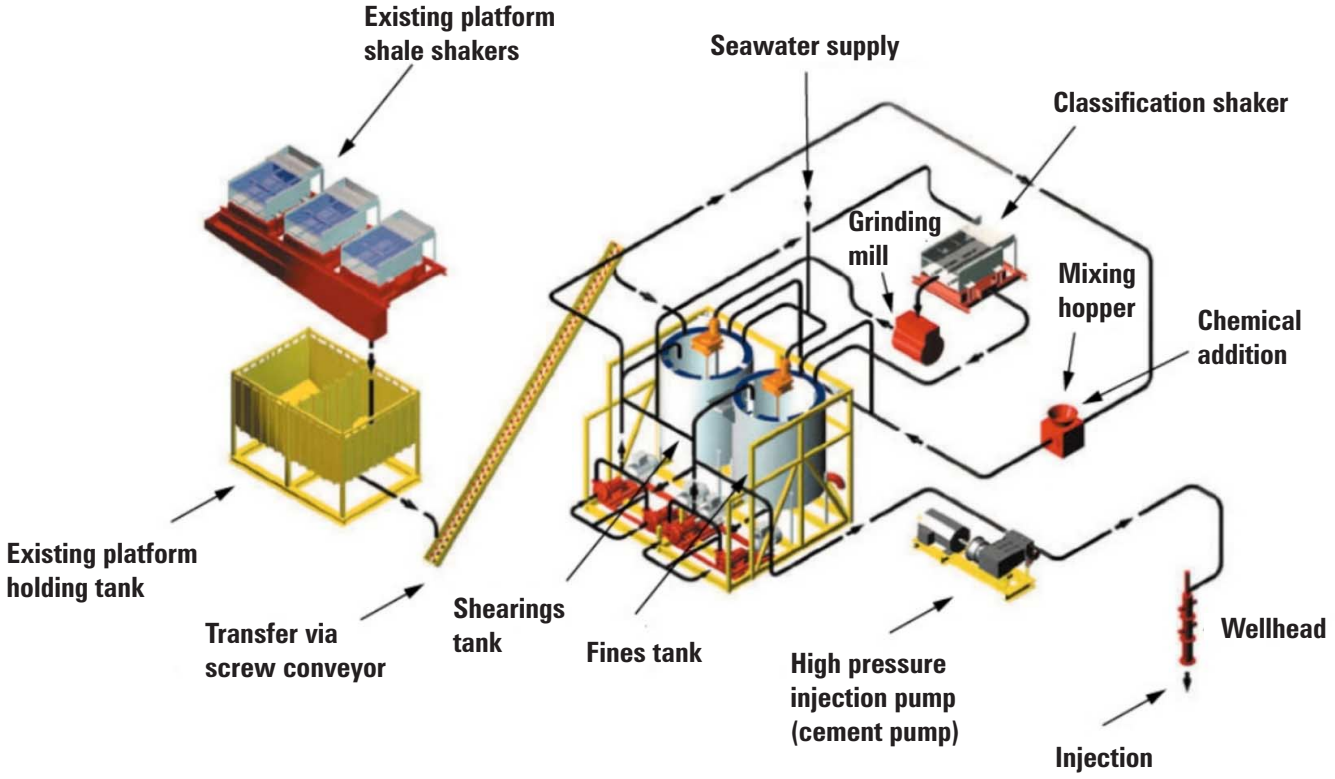
Drilled cuttings are transported to the slurrification system, via screw conveyors, where they are mixed with water (and chemicals if required) and via a combination of special mix tank screw agitator, grinding pumps, grinding mill and classification shaker, provide a pumpable slurry with predetermined particle distribution for transfer to a Batch Holding Tank. The slurry is then pumped via a conventional centrifugal pump from the Batch Holding Tank to a variable speed Triplex Injection Pump, which injects the slurry at a pre-determined rate and pressure via the casing annulus into the appropriate injection zone. In this case the injection zone was located in one of either two different disposal wells. These wells were chosen due to various factors, including well location, depth and injection pressure.

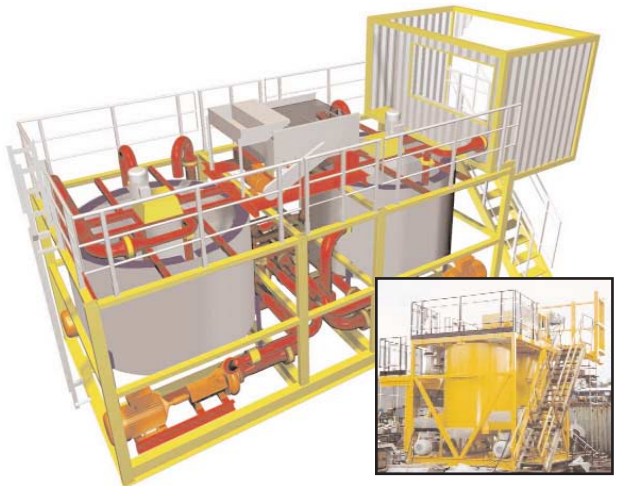
RESULTS

Of the 3 wells and 5 sections drilled to date, a total of 15,732 ft was drilled over a period of 125 days. During this time the DCI system was operational for 2,185 hrs. A total of 20,784 bbl of waste were injected over this period at an average viscosity of 77 sec and average density of 641.2 lb/K ft.

A planned maintenance schedule was in operation and included ultrasonic inspection of the pipe work at the end of the sec-

Schematic of cuttings reinjection system





Slurrification: Once transported to the slurrification system via screw conveyors, cuttings are mixed with water and sometimes chemicals. Through a combination of special mix-tank screw agitator, grinding pumps, grinding mill and classification shaker, the cuttings are transformed into a pumpable slurry with a predetermined particle distribution.

ond section. Some pipe work experienced excessive wear and was replaced as a precautionary measure.

Oiltools personnel regularly monitored all equipment from the shakers through to the injection pump to ensure optimum system efficiency. The reduction of waste at source was a prime objective and an average Shale Shaker Oil on Cuttings figure of 136.6 g/kg. was recorded.

During the course of the 12 ½-in. section, a total of 4 engineers was employed to operate the equipment. As the drilling rates were much smaller, and thus the injection requirements, 2 or 3 engineers were utilised during the 8 ½-in., 6-in. and 3 ⅞-in., sections, depending upon anticipated drilling rates. Total personnel costs equated to US $154,700.00.

Preventative maintenance required the use of approximately US $19,608.00 worth of spares over the 5 sections. Viscosifiers were used where required to maintain solids suspension and this equated to a total of US $38,049.00 for the same period.

The average steady injection pressure required varied and was dependent upon the disposal well being utilised. For Disposal Well 1, the average pressure for all 5 sections was 1,242 psi whereas the Disposal Well 2 recorded a value of 1,054 psi. Some formation plugging was experienced during initial injection operations and pressure had to be briefly increased to 2,800 psi to enable the injection zone to receive the slurrified waste.

CONCLUSIONS

This case history has shown that after the completion of the first 3-well, 5-section phase, a total of 20,784 bbl had been successfully injected with zero equipment downtime.

The costs for this type operation were consistent with similar DCI projects. In relation to the slurry injected the cost per barrel of rock drilled was US $176.15/bbl This appears to be very high, but only accounts for the theoretical amount of rock drilled. When the actual amount of slurry, which includes dilution water, and wastewater is factored, the actual cost equates to only US $10.22/bbl. DCI remains the only in-situ solution to drilled cuttings disposal for an offshore platform.

Using ultrasonic inspection contributed to the zero downtime record. As more ultrasonic information becomes available it is hoped to be able to predict the life cycle of key components thus improving the planned maintenance programme.

A major project objective was to minimise overboard discharges. At the time of writing, Oiltools had experienced no unplanned overboard discharge of drilling waste due to any reason.

Since this report was completed, Oiltools has continued to fulfill its contractual obligations for the North Sea operator. At the time of writing, drilled-cuttings handling and injections systems had been installed on Rig A. Oiltools continues to successfully operate the system on Rig B.

ABOUT THE AUTHORS

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