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Research and Application of Low Discharge Scheme

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Abstract

With the further development of offshore drilling, the government's demand for energy has gradually transformed into the demand for ecology. The eco-friendly offshore drilling technology has gradually attracted more and more attention. A reasonable solution to marine ecological problems, in turn, can also help the exploration and development of marine oil and gas resources. Therefore, during the drilling process, the drilling platform is required to carry out the adaptive transformation of full recovery, so as to solve the problem of running, emitting, dripping and leakage in the system process of conventional drilling platform, which can not realize the full recovery operation. Limited by the influence of offshore platform space, how to make efficient use of the existing abundant space of platform and deck, build a drilling waste reduction process suitable for offshore oil development, and develop miniaturized and efficient treatment equipment is one of the future development directions, which is of great significance and value.

Keywords

Emissions; Marine Exploration; Drilling Platform; Environmental Protection.

1. Introduction

In recent years, especially after the implementation of the new environmental protection, some sea areas such as offshore oil and gas field ecological protection areas and forestry and fishery are prohibited from being directly discharged into the sea, and the drilling cuttings need to be collected and transported. Therefore, the requirements for the transmission link of drilling cuttings continue to improve. The specific performance is to improve the transmission efficiency, reduce the leakage risk and extend the transmission distance; At the same time, it is required that the transmission device should not be too large to meet the installation in the constructed drilling equipment and reduce the space limit. During the drilling operation of offshore platforms, a large amount of drilling waste will be generated. Timely and effective reduction treatment of drilling waste can avoid the pollution of marine environment due to improper waste treatment. The adaptability transformation of full recovery shall be carried out for the drilling platform to solve the problems of running, emitting, dripping and leakage in the system process of conventional drilling platform, which can not realize full recovery. Limited by the impact of offshore platform space, how to make efficient use of the existing abundant space of platform and deck to build a drilling waste reduction process suitable for offshore oil development. Developing miniaturized and efficient treatment equipment is the best way to solve this problem. The "zero emission" project highlights its value in drilling and completion operations [1-2].

2. Development Difficulties of Oilfield Project

The oilfield is located in the steep slope zone of the western section of shijiutuo uplift, close to the central and Western sub depression of Bozhong, about 20.0km away from Bozhong 2-1 oilfield in the East and about 12.5km away from Nanpu 35-2 oilfield in the northwest. The structure of C oilfield is a fault nose structure developed and complicated by faults attached to the No. 1 boundary fault of

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Shinan, which is spatially composed of steep slope zone and fault step zone. The platform is divided into North and South well areas, with 44 notches and 42 development wells. Bohai C oilfield is located in the ecological red line area, strictly realizing "zero emission" of pollutants [3].

China's law stipulates that water-based drilling fluid (excluding sulfonation system) and drilling cuttings are general wastes, which can be discharged into the sea if they meet the national legal requirements for class I, class II and class III sea areas. With the improvement of national industry's awareness of the harm of drilling wastes, the tightening of marine drilling, especially the inland sea environmental protection policy, and the implementation of the latest requirements of zero emission in the Bohai Sea, zero emission drilling has been implemented in some areas.

Taking Bohai Bay as an example, the water-based drilling fluid system is used for drilling at this stage. On average, more than 1000 m3 of drilling fluid is used for a single well, 400 m3 of drilling cuttings are generated, and 200-300 wells are operated every year. With the tightening of environmental protection policies, all generated wastes are not allowed to be discharged into the sea. The only solution is the reuse of drilling fluid and the harmless and resource treatment of drilling cuttings [4].

3. Research on Non Emission Technology

In view of the difficulties faced by the development of Bohai C oilfield project in the field of environmental protection, this paper designs and develops the mud recovery system, rainwater recovery system and drilling water-based mud treatment system, which not only reduces the floor area of the equipment, but also reduces the operation cost of the equipment, and comprehensively improves the economic benefits of the offshore platform [5][6].

3.1 Mud Recovery System

(1) Renovate the wellhead oil pan, add rubber on the joint surface between the oil pan and the horn pipe to make the oil pan more close to the horn pipe, increase the backflow slope of the oil pan, and fully recover the lost drilling fluid in the wellhead area;

(2) Upgrade the floor drain pipeline on the drill floor, increase the floor drain on the drill floor, fully cover the drill floor area, reduce the risk of blockage, divert the mud on the drill floor to the mud circulation system during drilling operation, and the rainwater and sanitary water enter the sewage tank through the switching process and are uniformly recycled to 3P and 3S sewage collection tanks;

(3) The mud return function of the grit chamber is added, and a tee and butterfly valve are added to the discharge end pipeline of the three removal pump to realize the function of long-distance closed transmission.

3.2 Rainwater Recovery System

Drilling floor sewage collection and discharge: the drilling floor sewage floor drain pipeline is reconstructed to realize the drilling floor floor drain sewage. The sewage collected by the sewage tank next to the rotary table enters the drilling floor sewage tank. Finally, the sewage from the sewage tank is discharged to the mobile sewage tank or connected to the export station through the connecting hose of 3"pneumatic diaphragm pump.

Collection of domestic sewage, bilge water and deck sewage: ①cut off the valve at the sea discharge from the main leakage pipeline of the bulk tank on the port side, add a pipeline in front of the valve, extend the gradient of the main floor drain pipeline, turn the elbow of the floor drain water pipeline at the stairway entrance into a tee, pass through the tank to the side of the sewage treatment device, extend the gradient, and open a hole in the 3P tank to enter the 3P tank. The 3P tank is used to collect the deck water on the port side;②For the black ash water pipeline treated by the port sewage treatment unit, a valve shall be added on the pipeline passing through the bulk bin and cut off. A tee shall be added in front of the valve to lead out a pipeline, which shall be extended to the bulkhead and enter the opening of 3p tank. 3P tank is used to collect domestic sewage of the whole ship;③The bilge

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water pipeline at the sea discharge of the port bulk tank cuts off the valve of the bilge water pipeline at the sea discharge, leads out a branch pipeline in front of the valve, and enters the 3P tank along the upper part of the port bulk tank. 3P tank is used to collect bilge water. Cut off the valve at the sea discharge of the starboard ground leakage main pipeline, add a pipeline in front of the valve, extend the slope of the ground leakage main pipeline, and open a hole in the 3S cabin to enter the 3S cabin. The 3S tank is used to collect the deck water on the starboard side.

All sewage collection and export: all sewage is collected to 3P and 3S tanks, exported to the filling station through newly added electric pump, and finally transmitted to the supply ship through hose. The original bilge water pump can also realize the function from 3S tank to 3p.

4. Field Application of Non Emission Technology

4.1 Full Recovery Operation Mode

(1) Rock debris slurry treatment: EPS engineering ship is mainly used, and the rock debris treatment capacity is 60m3 / h (1400m3 / D); the sorting screen and water washing screw conveyor on the standby platform have a maximum treatment capacity of 30m3 / h, and the filtrate treated by the sorting screen is treated by miniaturized pressure filtration equipment.

(2) Drilling fluid treatment such as seawater bentonite slurry, simple polymer and biodrill A:EPS engineering ship is mainly used for treatment, with a treatment capacity of 450~600m3/D. the treatment capacity of miniaturized pressure filtration equipment on the standby platform is about 130~150m3/d.

(3) Treatment of drilling fluid and completion fluid: EPS workboat is used for treatment. The treatment capacity of drilling fluid is 120m3/d and that of completion fluid is 300m3/d.

(4) Treatment of cementing slurry: it shall be recovered by rock cuttings box, and recovered to land for treatment after adding retarder.

(5) Flowback fluid treatment: the flowback well completion fluid is recycled, and the crude oil is returned to the tugboat and transferred to nb35-2b platform for process treatment.

(6) Domestic sewage treatment: the output of each platform is about 20m3/d. the drilling ship is transformed to recover domestic sewage, which is regularly transported to Tanggu wharf by tugboat for treatment.

Taking a 3200m well in Bohai C oilfield as an example, the capacity of transmission system and processing system is checked.

(1) Rock cuttings processing capacity: Based on the daily footage of 800m in the second spud in the peak period, 25m drilling cuttings are generated per hour, EPS load utilization rate is 42%.

(2) Rock cuttings storage capacity: 336 ton bags per day×0.6+336×zero point four×one point zero nine×zero point three×0.5=224 bags, and two wells produce 952 tons of bags×0.6+952×zero point four×one point zero nine×zero point three×0.5=633 bags: 800 bags can be stored on EPS deck. Return to the port for unloading or transfer by material ship is required in 10-15 days (two well opening cycle).

(3) Mud handling capacity: 182 m3 of mud shall be disposed at the same time when drilling wells at the same time, and 330 m3 of drilling fluid shall be disposed at the same time when drilling two wells at the same time. EPS workboat can be completed within 1 day.

4.2 Rock Cuttings Closed Transmission System

In order to ensure the safety and reliability of rock cuttings transmission, two transmission schemes are adopted: the closed transmission pump is the main transmission scheme to realize the two transmission routes of rock cuttings to EPS working ship and platform disposal equipment; The screw conveyor is an alternative transmission scheme to transfer rock cuttings to the platform disposal equipment. The discharge port of the screw conveyor meets the conversion of three directions: transmission pump, sorting screen and rock cuttings box; The rock cuttings are transmitted from the

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platform solid control area to the closed transmission system through the screw conveyor, and then transmitted by the transmission pump to the EPS receiving ship through the main line; Rock cuttings are transferred from the platform solid control area to EPS sorting screen or rock cuttings box through screw conveyor.

Drilling waste is directly pumped to EPS working ship for disposal through screw conveyor and closed transfer pump. One transmission pipeline is used for standby and one for standby; It can realize the transportation and treatment of rock cuttings from two drilling ships by one EPS ship at the same time, reduce the working frequency of crane and reduce the occupation of drilling rig deck area.

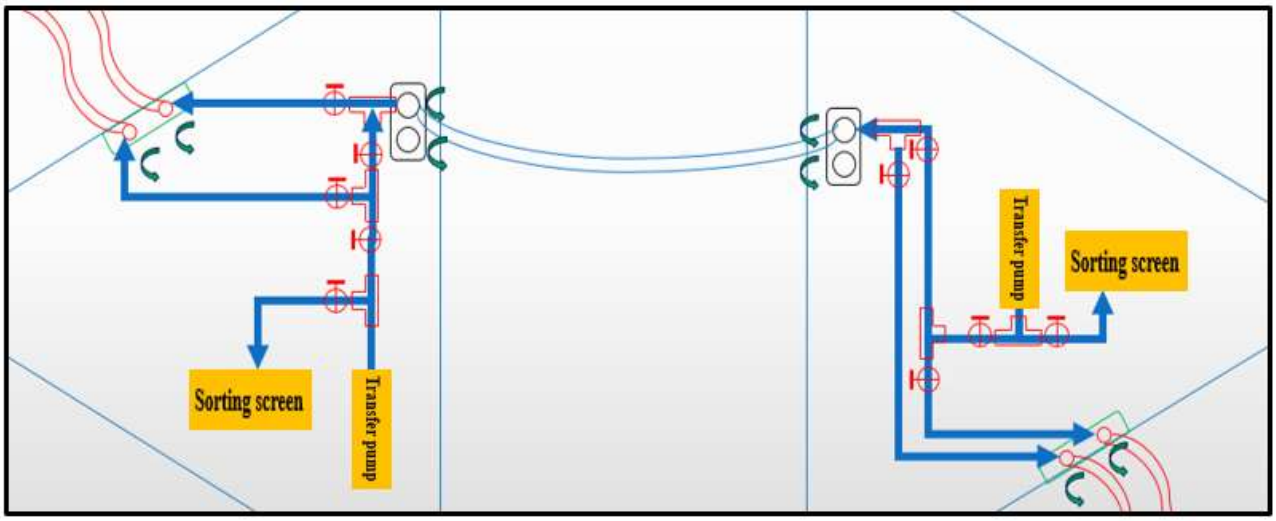

Fig. 1 Diagram of rock cuttings closed transmission system

5. Conclusion

(1) After the implementation of the new environmental protection law, direct discharge into the sea is prohibited in special sea areas such as the ecological protection area of offshore oil and gas fields and forestry and fishery. Many oilfields Taking Bohai C oilfield as an example are in the marine ecological red zone, which requires strict "zero discharge" of pollutants, which poses a great challenge to offshore drilling and oil and gas field development.

(2) In view of the environmental protection problems faced by offshore drilling, the design and research are carried out from the perspectives of mud recovery, rainwater recovery and drilling water-based mud treatment, which not only reduces the floor area of the equipment, but also reduces the operation cost of the equipment and comprehensively improves the economic benefits of the offshore platform.

(3) The practical application of "zero discharge" technology in Bohai C oil field has formed a unique full recovery operation mode, closed cuttings transmission system and drilling and completion waste liquid treatment method, which is of great significance to the development of oil and gas fields in marine ecological red area.

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