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Management of Drilling Cuttings in Term of Volume and Economics in Oil Field

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ABSTRACT
The process of drilling oil and gas wells generates large volumes of drill cuttings and spent muds. The American Petroleum Institute estimated that about 150 million barrels of drilling waste was generated yearly from onshore wells in the United States alone. Of the total drilling waste, approximately 50% is solid drilling waste. The biggest contributors of drilling wastes are drilling cuttings and mud. Reducing the drilling fluids not only it reduces the waste volume, but it also reduces the environmental effects associated with it. The main purpose of drilling waste management is to find to ways by which the generation of waste can be controlled to minimize or eliminate its negative impact on the environment. Minimizing waste is always the priority, however, it not always the most cost-effective solution. The objective of this report is to provide study in, the economics of management of drilling cuttings is explored in a case from West Kuwait.

I. BACKGROUND

The volume of drilling wastes can range from 1,000 to 5,000 m3 per well [19]. There are many factors affecting the total volume of waste produced; geology, well depth, hole diameter, drilling fluid, solids control equipment, service products and problems encounter during operations [20]. Preventing waste generation minimizes the problems and cost associated with waste management.

The main impacts of drilling waste to the environment can be of organic or inorganic origin and may include: spills; toxicity; fouling; bioaccumulation and fish tainting; biochemical oxygen demand; persistence [4].

A negative impact on the environment is caused by many of the materials and wastes associated with drilling activities. The wasted material, its concentration after release and the biotic community that is exposed are the factors that affect the potential impact on the environment. The environmental risks vary in a range between highly significant to very low risks according to the potential of the wasted material. Great concerns go to major impacts such as pollution of water bodies, air pollution and land pollution. Marine life is exposed to danger because of the improper disposal of contaminated drill cuttings into oceans. While the excessive disposal of wastes into land causing physical environmental impacts including increase in turbidity. And this will in turn have adverse effects on invertebrate populations, spawning grounds, and feeding habitats [9].

II. CASE STUDY

The combined waste volume of cuttings that are created while drilling and the excess or spent drilling fluid might be the best measure of performance and cost savings offered by a fluids system. The volume of spent mud determines what the mud-maintenance and disposal costs are and affects the long-term responsibilities that are associated with waste disposal. Even under ideal situations, the volume of wet cuttings generated can easily exceed hole volume by a factor of two or more. Minimizing the volume of spent mud and cuttings is the key to effective waste management.

In this paper, we analyze data for a drilling waste case study provided by a drilling team in two Kuwait fields. We include five wells for each field in order to compare the drilling waste volumes that would be associated with the operations, given that no lost circulation occurred and no mud is associated with the cuttings. We also calculate the economics required to treat the waste according to the following reference:

Table 1. Comparison of drilling waste management techniques [18].

Comparison Factor	Fixation	Thermal Treatment	DCRI	Bioremediation/ Composting
Environmental Impact	Low	High	Low	Medium
Cost	$9-10/bbl	$90/metric ton	$5/bbl	$500/m3
Safety Risk	High	High	Low	Medium
Technical	Low	Medium	High	Medium

III. RESULT AN ANALYSIS

3.1 Drilling cut volume

In field A, the drilling waste generated surpassed the 6 million cubic feet of drilling cuttings for only 5 wells drilled. More than half of the waste is produced at the beginning of the drilling operations**,** Fig. (1). In field B, the drilling waste generated surpassed the 32 million cubic feet of drilling cuttings, Fig (2).

Figure (1). Drilling waste generated by each casing size in field A.

Figure(2) . Drilling waste generated by each casing size in field B.

3.2 Cost treatment analysis

If the volumes of drilling waste generated by conventional wells in fields A and B were going to be treated, the cost for bioremediation would exceed the 25 million US dollars in field A (shallow depth) and the 90 million US dollars in field B (deep wells), figure (3).

The costs for managing drilling waste by fixation, thermal treatments and DRCI are much more economical than for bioremediation, figure (4) & (5).

Figure 3. Management cost for wells in field B (by management technique).

Figure 4. Management cost of drilling cuttings for field A (without bioremediation).

Figure 5. Management cost of drilling cuttings for field B (without bioremediation).

The drilling waste is greatly reduced in shallow wells (field A) when a slim hole design is applied. There is a 55% reduction in volume for slim hole design. Also, the costs associated with treating these volumes reduce significantly, figure (6).

Figure 6. Drilling waste generated in field A when utilizing a slim hole design.

Figure 7. Management cost of drilling cuttings for field A when utilizing a slim hole design.

Similarly, the drilling waste is greatly reduced in deep wells (field B) when a smaller hole design is applied. There is a 40% reduction in volume for a smaller hole design.

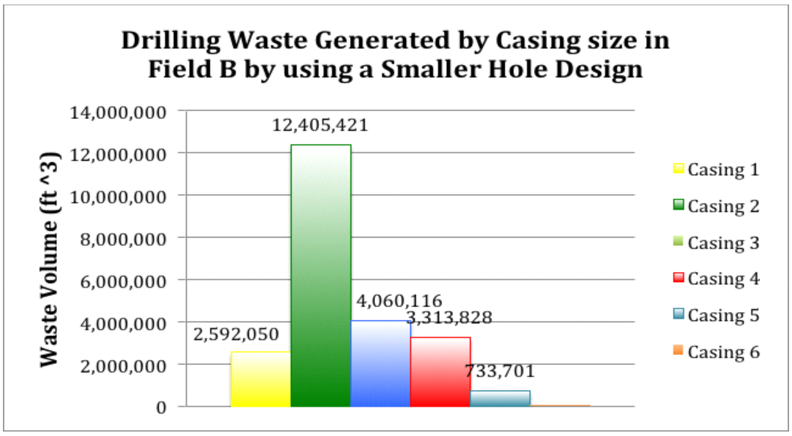

Figure 8. Drilling waste generated by casing size in field B by using a smaller hole design.

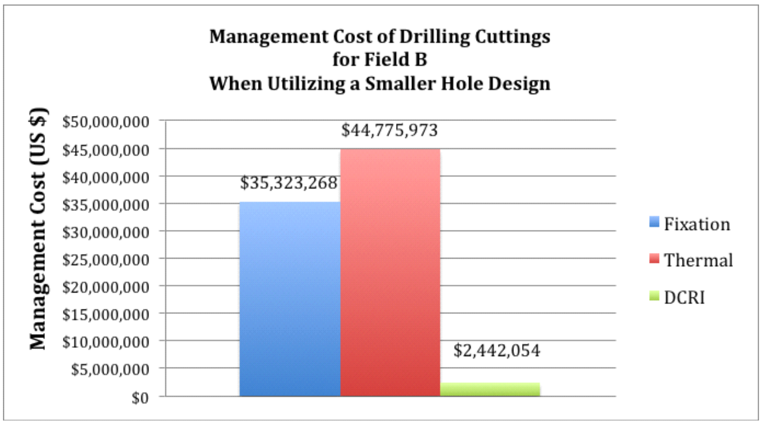

Figure 9. Management cost of drilling cuttings for field B when utilizing a smaller hole design.

IV. CONCLUSIONS

It is very clear that drilling activities in the oil and gas industry generate large volume of drilling cuttings and spent mud. The environmental impact of the generation of these wastes can be enormous. The desired sequence of drilling waste management option should be source reduction,waste recycling or reuse, waste treatment and waste disposal. Waste minimization techniques via process modification include slim-hole drilling, solids control and mud system monitoring. Treatment and disposal of waste depend on the waste characteristics and regulatory requirements of each country. These management practices include on site burial, land farming, thermal treatment, DCRI and bioremediation.

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