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### **OPTIMIZATION OF HYDROCARBON INFLOW USING CUMULATIVE PERFORATORS IN THE BAZALIIVSKA AREA**

The Bazaliivska area, a significant hydrocarbon field, has been the site of various experiments aimed at optimizing hydrocarbon extraction techniques. Recent studies have focused on cumulative perforators, particularly PNKT perforators, to determine how changes in perforation density, shot depth, and well pressure affect hydrocarbon inflow rates [1, 2]. The efficiency of these perforators was assessed by analyzing the inflow rates and comparing them across varying test conditions to identify optimal parameters. This study examines the results from these experiments, highlighting the potential of PNKT perforators to improve hydrocarbon inflow and providing insights into optimal operational settings [3].

#### **Results**

The primary objective of the experiments conducted in the Bazaliivska area was to evaluate the effectiveness of cumulative perforators, specifically PNKT perforators with cumulative charges, in enhancing hydrocarbon inflow. Cumulative charges are designed to produce high-energy, focused jets capable of penetrating multiple casing layers and formation rock, thereby creating efficient flow channels for hydrocarbon extraction (Fig. 1). The cumulative PNKT perforators used in these tests were selected for their ability to create precise, deep perforations that could increase formation permeability and, consequently, improve hydrocarbon inflow rates.

Each test was conducted with a consistent setup in which key parameters—such as perforation density (holes per meter), shot depth, and well pressure—were systematically varied. The perforation densities tested ranged from 15 to 30 holes per meter, while shot depths were adjusted between 2400 and 2550 meters. Well pressures were also modified to reflect potential operational conditions in similar hydrocarbon fields.



Figure 1 – Cumulative PNKT perforator (a) and charge (b)

Standard measurement equipment was employed to capture hydrocarbon inflow rates immediately after perforation and at subsequent intervals to ensure reliable inflow data.

Pressure gauges and flow meters provided real-time measurements, ensuring accuracy in assessing the impact of each parameter setting on inflow efficiency. These tests aimed not only to identify the optimal perforation parameters for the Bazaliivska field but also to gather insights into the scalability of PNKT cumulative perforators in other fields with comparable geological features. The results from these experiments are presented in Table 1.

Table 1.

Experimental results from the Bazaliivska area

Test ID	Perforation Density (holes/m)	Shot Depth (m)	Well Pressure (MPa)	Hydrocarbon Inflow (m <sup>3</sup> /day)	Inflow Increase (%)
1	15	2400	10	20	0
2	20	2400	10	26	30
3	25	2400	10	32	60
4	30	2400	10	35	75
5	25	2450	11	36	80
6	25	2500	12	40	100
7	30	2500	12	38	90
8	20	2500	12	33	65
9	25	2550	13	34	70

The data indicate a distinct pattern in the performance of PNKT perforators across varying settings. The hydrocarbon inflow increases progressively with the increase in perforation density up to 25 holes/m and at shot depths close to 2500 m. Notably, Test 6, conducted at a perforation density of 25 holes/m and a shot depth of 2500 m, yielded the highest hydrocarbon inflow rate of 40 m<sup>3</sup>/day, representing a 100% increase over the baseline test (Test 1). Further increases in perforation density (e.g., Test 7) or shot depth (e.g., Test 9) did not result in higher inflows and, in some cases, led to a reduction, indicating diminishing returns or suboptimal settings beyond certain thresholds.

### Conclusions

Technological factors – including drilling methods, equipment selection, drilling process parameters, and operational practices – play a pivotal role in preventing drill string sticking incidents. Effective management of these factors, coupled with advanced technological solutions, can reduce the risks associated with stuck pipe and enhance both the safety and efficiency of drilling operations. By prioritizing well-maintained equipment, real-time monitoring, and optimized process controls, operators can significantly mitigate the likelihood of drill string sticking and ensure uninterrupted drilling progress.

### References:

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