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The Results of the Vibro Impacts Technology Implementation

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SUMMARY

The vibro impact Technology implementation results for last 12-15 years shown that it is highly ecologically friendly method which is very efficient and could increase oil production for 15-30 %, oil recovery up to 60-70 %, and substantially decrease watercut and volume of pumping in water.

We have worked out and developed a technology to intensify oil extraction and enhancement of oil recovery via means of vibration, which has been invented and patented (Eurasian Patent No. 001474 dated 18 December 2000, European Patent No. 1266121 dated 21 December 2005 and Canadian Patent № 2406794, February 17, 2009).

The Technology development was preceded by series of research and trials. It was determined that there was a maximum permissible range of stratum pressure differential during oil field development (it's about 28-35 atmospheres), which was appeared on pumping in and pumping out of liquids from the stratum. If this range is exceeded negative processes triggered in the medium, which lead to destruction of oil reservoir, creation of a vibration filed, decrease of resistibility to deformations, stratum flows, worsening reservoir properties etc. It was also determined that there are interactive effects among the oil wells, groups of oil wells and oil fields. We proved that wrong approach in development of one of the oil field had an impact on other oil fields, which were located 50-70 km. around and resulted in oil output decrease by 15-37% on them. All that required development of new geophysical methods of medium condition control, the method, which became the core of the Technology. The technology implementation provides increase in oil output by 15-30% and rising oil recovery up to 60-80%. Moreover it provides ecologically correct development of oil fields and preserving oil reservoirs in their natural condition for maximum period.

Since August, 1995, the Technology was employed on the Kala and the Old Kala oilfields, which are located in the Absheron peninsula (Azerbaijan), operated by the Azizbekovneft OGPD (Oil and Gas Production Department). These small oilfields have been exploited for more than sixty years. The water cut varies in average between 92 – 93%, and oil content is approximately 8% in the liquid produced, which at 15,000 – 15,500 bbl per month is considered extremely low.

The vibro impacts started in December, 1995. Initially the reservoir pressure increased by 3 – 10% and the production rate from each oil-bearing horizon, increased by (depending on horizon) from 10 to 50%. Then based on the actual data analysis, some corrections were made in the vibrators' locations and, as a result, in February a considerable increase in the reservoir pressure and oil production rate was noted in all nineteen oil-bearing horizons. In comparison with the production rates in November, 1995, the data indicated a significant increase in the monthly summary oil production as follows (and much less increase in water output): December – 19.7% (8,2%), January – 22.5 (11,4%), February – 15.7% (9,1%), March – 31.5% (14,5%), April – 18.7% (9,2%), May – 23.7% (12,3%), June – 13.1% (7,4%), July – 19.2% (7,7%), August – 17.4% (12,8%). Thus vibroimpacts led to sharp decrease in water cut. These data once more confirm an important scientific and practical results (shown in the previous publication) which indicate the possibility of “curing” the deposit - creation of stressed state area which prevents penetration of waters from external sources into the deposit.

Confirmation of the substantial changes of the medium stressed state was also noted by the measurements of different geophysical parameters. The repeated first class leveling covering the entire oilfield territory of several dozens of square kilometers reflected the vertical movements of surface, which level rose by 25-30 mm in average.

These results strongly support the high efficiency of the Technology. For this period, the production samples showed the considerable reduction in the rise of the watercut (18 wells). A decrease in the watercut was indicated in the 50 wells. All the data was compared with the prior sample analysis of each field. The implementation of Technology leads to increase of percentage correlation of oil in recovered liquid, decrease of the rate of irrigation of fields and prevents its destruction due to penetration of underground water from external sources.

According to reiterated measurements, stratum pressures (shown in Table 1) varied as follows: rose from 0.7 to 34 kg/cm², i.e. from 0.6% to 75.4%. Maximum rise in P (adjusted) (to 34 kg/cm²) was detected in the well N441 (over-Kermeki clayey, OKC). Maximum percentage (75.4%) of P (adjusted) increase was detected in the well N 367. Note that stratum pressures fell from 0.3 to 12.6 kg/cm², i.e. from 1% to 18.6%. Maximum P(adjusted) reduction up to 12.6 kg/cm² was detected in the well N1513 in OKC, and maximum reduction percentage was detected in the well N886 (IVcde). According to our estimates, accuracy of stratum pressure measurement ranged between 0.5-0.7 kg/cm².

Since September, 1996, the Technology was employed on the territories of Komarovskoye, Pervomayskoye and Bondyujskoye oilfields, all operated by the Prikamneft OGPD (Tatarstan). These oilfields have been in production for more than 35 years and are characterized by a high water cut. Average monthly oil production for the above mentioned oilfields was 2,500 tons (18,500 bbl), 15,000 – 18,000 tons (111,000 – 133,000 bbl) and 27,000 – 30,000 tons (200,000 – 222,000 bbl), respectively.

In accordance with the program, all necessary preliminary background evaluations were conducted prior to the oilfields' exposure to the vibrational impacts. On the basis of the achieved results and along with the additional information, the stressed state model for the oilfields as well as the vibrational impact model were established.

The most valid prove of any oil output increase technology effectiveness are data of the oil wells monitoring results. In our case we paid particular attention to the oil measurements, which were taken by oil production division operators via our request from the so we called control oil wells (about 25% of the total wells: 81 oil wells on Pervomayskoe and 39 on Bondyujskoe oil fields).

Water cut of the oil well №1528 was reduced by 5% during our works and oil output was increased by 5 tons a day (from 2 to 7 tons). Water cut of the oil well №1444 was reduced by 24% and oil output was increased from 0.1 to 0.8 tons a day. Water cut of the oil well №714 was reduced by 7% and oil output was increased from 5 to 23 tons a day.

It has to be noted that water cut reduction was achieved during constant increase of pump in volumes of water to maintain technological level of stratum pressure. In 1966 the monthly volume in tons was 370 000 but in 2004 – 720 000. Such kind of oil field development practice seems to be non-acceptable, ecologically incorrect, resulting in its destruction.

Our results show convincingly, that the medium condition is altered permanently by the impacts done by pumping in and pumping out processes. And it is very important to note that the alterations are different for the different volumes of the medium.

In real practice the beneficial factors which affect the medium of the oilfields are the methodology of their development and exploitation itself. The processes of production and liquid injection with existing methodologies do not count any relationship between them and processes taking place within the medium. Not in one oilfield the volumes of the produced and injected liquid for the well are based on the analysis of varieties of the current sensitivity of separate spots. The tactic of its development is not the same for the entire medium in one field. It means that we have not equal volumes of the produce and injected liquid, but unequal (larger or smaller) volumes computed without fail, based on the analysis of each spot parameter. Only following this condition it becomes possible to provide unified impacts on the entire oilfield.

In the process of long geological evolution, each oilfield has relatively close parameters practically in the all its zones (at least in the dome zone). The methodology of the oilfield development and exploitation, without taking under control the mentioned above parameters, leads quickly to the change in balance of the natural forces. As a result of such imbalance, the properties (permeability, porosity, jointing and etc.) of the reservoir change.

Theoretically (in first approximation) for the geological condition of Tatarstan, two wells, the production rate of which varies by a factor of 10^2 , should be located at a distance of about 10 km. In other words if there is a change in the reservoir properties of different zones of the oilfield, and it is normal to be so considerable, that the distance of 10 km between wells is necessary to make their production rate to differ by a factor of 10^2 . But it is absolutely amazing, that practically everywhere there are pairs of wells located very close to each other (in a distance of 10 m), and the production rate has such a difference.

Analysis of the location of wells of high and low production rate allows to make a conclusion that the number of the low production rate wells depends on ignoring of the above mentioned factors. Furthermore, the increased number of such wells during the oilfield development is the result of uncontrolled volumes of produced and injected liquid.

The obtained results allow us to allege with certainty that currently existing methodology of oil deposits development and exploitation is imperfect, ecologically incorrect and promotes quick increasing of water-cut and destruction of deposits. It decreases considerably final oil recovery level of oil fields, and, in such a way, inflicts huge, though unrealized, economical and ecological damage. Using the developed by us Technology could allow decreasing incomparably the volume of pumped water and costs for this kind of geotechnology process as well. Calculations demonstrate that correct pumping would require 40-100 thousands tons monthly.

Conclusion

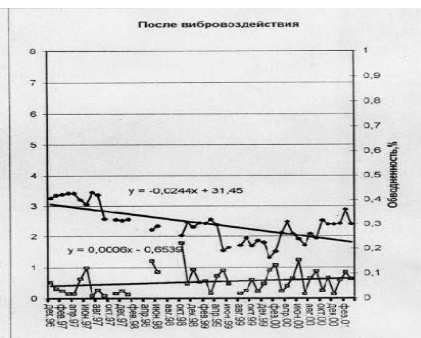
Thus the vibro impact Technology implementation results for last 12-15 years shown that it is highly ecologically friendly method which is very efficient and could increase oil production for 15-30 %, oil recovery up to 60-70 %, and substantially decrease watercut and volume of pumping in water.

The dynamics of changes oil productions and water cuts on control oil wells (№№ 1528, 1444, 1411, 714) before and after implementation of the vibro impacts Technology

Before



After



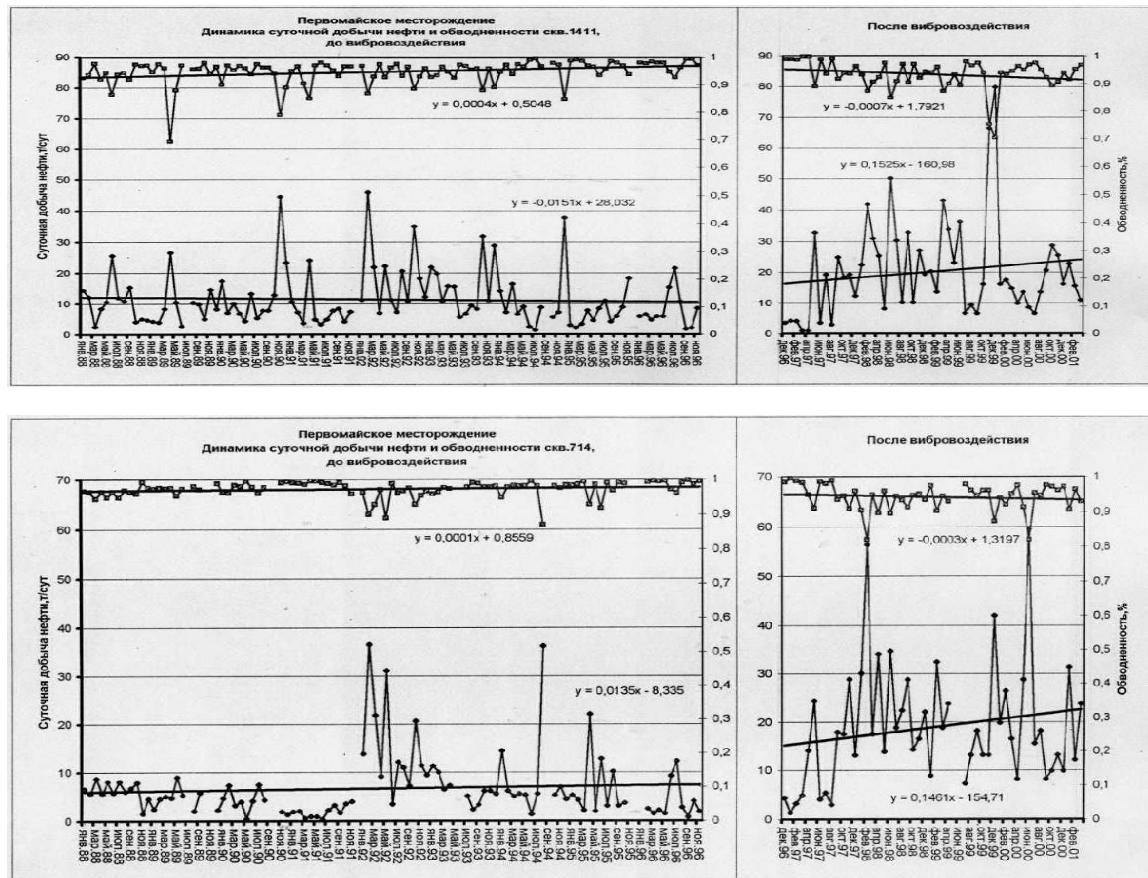


Table 1

NN of wells	Horizonts	Stratum pressure changes ΔP reduced. Last measurement		Date
		kg/sq.cm	percents	
255	B	+ 6,6	+ 33,0%	I.96
250	C	+ 15,4	+ 35,0%	III.96
1482	C	+ 10,0	+ 20,8%	III.96
367	CD	+ 23,4	+ 75,4%	II.96
552	II	+ 12,9	+ 31,3%	III.96
1274	II	0	-	I.96
1435	II	- 9,5	- 19,7%	II.96
752	II	- 0,8	- 1,7%	II.96
1312	II	- 0,3	- 1,0%	XII.95
541	II	- 5,0	- 11,9%	III.96
993	III-IV	- 2,0	- 2,7%	II.96
236	IVcde	- 9,3	- 13,2%	III.96
1472	IVcde	- 6,4	- 10,3%	III.96
886	IVcde	+ 0,2	+ 0,1%	III.96
1466	IVcde	- 7,7	- 7,2%	II.96
1199	VII	+ 0,8	+ 0,7%	III.96
853	VIII	+ 4,7	+ 5,3%	I.96
853	IX	+ 17,8	+ 15,3%	XII.95
1520	HKГ	+ 13,5	+ 11,0%	III.96
1513	HKГ	- 12,6	- 11,7%	I.96
441	HKГ	+ 34,0	+ 34,6%	I.96

1485	HKГ	+ 7,7	+ 6,4%	II.96
1510	KC1-2	+ 0,7	+ 0,6%	I.96
1508	KC1-2	+ 3,2	+ 2,6%	I.96
1500	KC5-6	+ 11,6	+ 10,1%	II.96
1244	KC9-12	+ 8,5	+ 5,0%	XII.95
1492	KC9-12	- 1,7	- 1,5%	I.96
903	KC9-12	- 4,8	- 3,8%	I.96
1494	ПK	+ 12,8	+ 14,4%	XII.95
1544	ПK	+ 3,9	+ 3,8%	I.96
1545	ПK	+ 40,4	+ 35,1%	III.96
1486	KaC1	+ 11,6	+ 7,7%	II.96
1540	KaC1	+ 4,8	+ 2,8%	III.96