

# THE TECHNOLOGY OF OIL OUTPUT AND OIL RECOVERY ENHANCEMENT BY SEISMOWAVES IMPACTS

## Introduction

We have worked out and developed the Technology of Seismowaves Impacts, T-SWI, to intensify oil production and increase oil recovery “The methods to intensify oil extraction”. The Technology has been awarded Patents by Eurasian (No. 001474 dated 18 December 2000), European (No. EP 1266121 dated 21 December 2005) and Canadian (№ 2406794, February 17, 2009) regulatory bodies (authors Ikram H. A. o. Kerimov, Seymour I. o. Kerimov).

Experimentally proved that the Technology can be applied practically on all geological structures and on oil reservoirs of a wide range of depths and thicknesses of the layers and characteristics of reservoir pressures and water-cut. The T-SWI during its application does not require additional injection of water or other chemicals.

Prevention of oil reservoir distraction and rehabilitation of its damages, prolong oilfield lifetime, increase of percentage rate of oil in extracted liquid, increase of layer pressures, reduction of environmental pollution allow to achieve and maintain over a long period of time important economic and environmental results:

- increase in oil output by 15-35 %;
- decrease the current level of water-cut of the output liquid on 5-12% for wells with low and middle debit and on 20% for wells with high debit;
- increase current coefficient of oil recovery up to 45%;
- increase final oil recovery up to 70-80% or more.

The T-SWI is environmentally friendly and can be used as the sole method of enhanced hydrocarbon recovery, or be used in conjunction with other methods of enhanced recovery. And during the T-SWI application the process of the oil field exploration and all other kinds of works and methods concerning it are going on in the former regime.

The Technology has no adverse risks, but gives tremendous added value. The period of time until the first profit, which, in fact, will compensate all expenses, takes 3-4 months.

The most important economic indicator of the effectiveness, relevance and uniqueness of T-SWI is a huge cost savings by reducing the volume of injected water into the reservoir to maintain the layer pressure. And for water injection should be used on the oilfield only wells situated by geophysical data in sensitive places because in same periods of time the injections of water in other wells undesirable and can lead to increasing of water-cut. Gradual implementation of the developed water injection new tactics to maintain reservoir pressures with 20-60% less than before volumes of the injected water will result in together with the vibration exposure to a significant reduction of water-cut.

Different from conventional methods of enhanced hydrocarbon recovery that attempt to maintain reservoir pressure through water and gas injection, the T-SWI by means of increasing the stress state of the medium increases and maintains reservoir pressure from outside of the hydrocarbon reservoir.

Effectiveness of the T-SWI as an enhanced hydrocarbon recovery technique has been demonstrated over 15 years for a single, or for a group of mature oil fields situated on area from 500 to 2000 sq. km. According to geophysical data the T-SWI may be purposefully implement on area of 10-15 thousands sq. km to increase oil production at all fields in the area.

Results of the T-SWI implementation showed that it can be applied for solution wide range of important tasks. Thus, due to correctly organized impacts the vibrations are restoring the natural state of the environment, fractured on large and small disruptions caused by the uncontrolled oil field exploitation in previous years and bring it into energetically homogeneous state.

A seismic and electromagnetic monitoring revealed after several cycles of vibrational impacts the existence in the medium the strong variations of dynamic processes by intensity and spatial distribution. Have not take them into account is a factor of uncontrolled exploitation which leading to many negative effects and to low level of oil recovery.

The effects exceptionally interesting for the T-SWI additional use have been identified, as the development recommendations for the correct selection of sites for drilling production and injection wells for increasing their efficiency and durability of exploitation.

Taking into account the above factors the other important consequence of the use of T-SWI which also was determined by us, that the conduct of any geological and geophysical studies of the structure of the medium must be preceded by bringing it in energetically homogeneous state.

Thus, T-SWI allowed to revise and with a completely new position to consider the modern concept of oil field exploitation, methods to maintain reservoir pressure and increase production, the selection of sites for drilling, the search and explore new structures.

The T-SWI is the result of many years of research and experiments to develop methods to effectively control and manage geodynamic processes and to solve with completely new positions the environment protection problems caused by the large-scale industrial activities.

Its scientific background is a discovery of the new physical law of weak high frequency seismic signals propagation and interaction with medium, registered by the State Committee on Discoveries and Inventions of the former USSR in March, 1988, with a priority from May, 1979 (author I. H. A. o. Kerimov).

### **The distinguished features of the Technology are as follows:**

1. Application of vibro-impacts are done from the surface, not from within the wells;
2. Application are made on the entire oil field, not a part thereof, or a separate oil well as done in other methods;
3. Application is done on territory that is bigger than the oil field by 1.5-2.0 times;
4. Methodology of monitoring the stressed state of the medium based on the geophysical fields data and studies of the microseisms variations on earth surface;
5. Methodology to find out the parts of the oilfields the most sensitive in each period of time to external impacts;
6. Development the model of stressed state of the mediums;
7. Development of the vibro-impacts model, tactics of application thereof from the Earth surface and creation the high energy local volumes within the oilfield.

Vibrations induced at the surface can cause intense seismic emission, leading to redistribution of the stress state within the sedimentary rock containing the hydrocarbon reservoir, to increase of the reservoir pressures, and in turn, causes an increase in fluid flow in layers and, consequently, to oil productions.

Work on the implementation of the Technology T-SWI is held by company Seismotech Globe B.V., Netherlands, which has the rights to its use given by the authors. Employees of the Seismotech Globe B.V. only are controlling the quality of measurements and their further analysis. The whole range of activities carried out by local organizations with which Seismotech Globe B.V. shall make appropriate contract:

- to carrying out of geological and geophysical measurements;
- to estimation of the background level of oil production on all wells and on the whole field;
- for realization of the vibro impacts program.

### **The Implementation Expenses and Profit of the T- SWI**

The expenses for the SWI Technology implementation depend only of the works area and, correspondingly, of the number of geophysical observation points and vibroseism machines.

The daily oil production in fields located within this area may vary in a widest range, from 100 up to 10 000 tones and more, but the T-SWI costs will remain unchanged.

Accordingly, the higher the level of daily oil production in the area, the more profitable use of technology SWI.

The expenses of the first cycle of works – 3-4 months for an area of 1000 sq. km before receiving the first profit may reach 200-400 thousand Euros, depending on the cost of certain services in the region of works. But even if daily production is 150 tons and T-SWI will increase it by only 10%, (T-SWI allows to increase production on 15-35%) all expenses are covered within 2 months after the start of vibrational impacts.