

SURFACE HYDRAULIC FRACTURE MONITORING BY FULL-WAVE LOCATION TECHNOLOGY

Ryzhov V., Gradient CJSC

Hydraulic fracturing is most effective technology for enhancing of oil recovery especially in low permeability reservoirs and shale oil and gas reservoirs. For wide using hydraulic fracturing it is necessary to control real directions of cracks development.

The downhole monitoring has been the most effective method for that purpose. But downhole monitoring requires using nearby wells on the distance approximately of 300 m. This requirement not always technically feasible and often is not cost effective.

We offer an alternative and the most effective approach for hydraulic fracture monitoring – Full-Wave Location (FWL).

The FWL technology includes a set of solutions which allow increase noise stability of depth events location on the base of surface observations. The FWL technology allows increasing noise stability in ten times.

Data acquisition is performed by sensors of seismological class. The tool kit includes a sensor, recorder and accumulator. The recorder has the GPS time synchronization. It is memory tool which does not depends of any wires and can be installed into quiet place near investigated zone.

We perform full wave numerical simulation of wave propagation from reservoir to measurements points on surface.

The measurements points correspond to real sensors' location. Obtained responses are matches to real signals by maximum likelihood method.

There were estimated noise stability and uncertainty of location in comparison to the conventional technologies which are used for surface and downhole hydraulic fracture monitoring.

Applications of FWL method for hydraulic fracture monitoring in vertical and horizontal wells of Tatneft, Lukoil and Gazprom are represented in the report.