



Application of geoelectric methods for man-caused gas deposit mapping and monitoring

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The rather new application of original geoelectric methods of forming of short-pulsed electromagnetic field (FSPEF) and vertical electric-resonance sounding (VERS) (FSPEF-VERS technology) (Levashov et al., 2003; 2004) is discussed. In 2008 the FSPEF-VERS methods were used for ascertaining the reasons of serious man-caused accident on gas field.

The emission of water with gas has occurred near an operational well on one gas field. The assumption was discussed, that some part of gas from producing horizons has got into the upper horizons, in aquiferous stratum layers. It promoted creation of superfluous pressure in aquiferous stratum which has led to accident on the field. Operative geophysical investigations within an accident site were carried out by FSPEF and VERS geoelectric methods on 07.10.08 and 13.10.08 on the first stage. The primary goal of executed works was detection and mapping of gas penetration zones in aquiferous stratum of cross-section upper part, and also the determination of bedding depths and a total area of distribution of gas in upper aquiferous stratum.

The anomalous zone were revealed and mapped by FSPEF survey. It is caused by raised migration of water in upper horizons of a cross-section. The depths of anomalous polarized layers (APL) of "gas" and „aquiferous stratum" type were defined by VERS method. The VERS data are presented by sounding diagram's and columns, by vertical cross-sections lengthways and transversely of gas penetration zones, by map of thicknesses of man-caused gas "deposit".

The perforation on depths of 450 and 310 m was spent in a producing borehole on the first day investigation data. Gas discharges were received from 450 and 310 m depths.

Three degassing boreholes have been drilled on 08.11.08 working day. Depths of wells are about 340 m. Gas inflows were received from 330 m depth. Drilling of fourth well was conducted.

The anomalous zone area has decreased twice in comparison with two previous surveys. So, the anomaly total area made $S=20.7$ hectares on 07.10.08, and $S=19.7$ hectares on 13.10.08 and $S=10.5$ hectares on 08.11.08. The anomaly intensity has decreased, some local extremum has appeared. All this testifies that there is an intensive degassing process of cross-section upper part through producing wells and the drilled degassing wells.

Exclusively important feature of the FSPEF-VERS technology is an operationability(!) the of practical problems solving. For an emergency situation on gas field an operationability of technology has crucial importance. For one day of works only the field staff management has received considerable volume of operative information, allowing in quite proved manner to estimate as accident scales and it possible reasons, and so those threats, which this accident can represent for nearby located settlements. So, the imposing of a sketch-map of distribution of a "man-caused" gas deposit on a map of wells location has shown that this deposit does not extend over field border and, hence, does not represent essential threat for nearby settlements.

Technology operationability in a whole and practical experience of repeated measurements testifies about possibility of the FSPEF-VERS methods using for operative carrying out of monitoring character survey. Such monitoring survey can be spent on a field after degassing wells drilling to check the process of gas pump-down from a "man-caused" deposit.

Geoelectric researches on an emergency site of field on 08.11.08 and the received thus results practically show efficiency and working capacity of the FSPEF-VERS technology in a monitoring mode. The performed experimental works have shown, that process of gas pump-down from a "man-caused" deposit can be traced in time by the FSPEF-VERS technology. It is expedient to locate the additional degassing wells for definitive

elimination of accident consequences with taking into account the data of monitoring works by FSPEF-VERS methods.

The experiment results testify of practical possibility of these methods using for operative solving the specific problems of oil- and gas-extraction, as well as they are one more weighty arguments to practicability of the more broad using of FSPEF-VERS technologies in geological prospecting process for oil and gas.

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