Spatial Data Analysis of Water Production from Unconventional Reservoirs, Case Study from the Williston Basin, North Dakota

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Abstract

With the instability of oil prices and the high investment cost associated with developing unconventional reservoirs, oilfield operators, contractors, and service companies are exploring new ways to optimize produced water (PW) management and reduce transportation, treatment, and disposal costs. In addition to this global trend, the Williston Basin faces more challenges due to pressurizing of underground disposal formation and the inadequacy and cost of existing purification technologies. Besides efforts toward the investigation of novel treatment methods that might offer new frontiers for PW reuse, reducing the co-produced water from upstream is still among the top solutions. Recent research showed the potential of spatial data analytics to disclose important information that serves future wells development and minimizes water production. The present study subscribes to these energies to demonstrate the role of spatial data analytics in a better understanding of the PW trend and to identify the high-volume root causes. Production data including multiple fields and producing formations were treated, normalized then visualized for this purpose. The first step, two production sections have been segregated from the data, flow back water and PW section. In the second step, an open-source GIS software was used to generate surface maps. Results analysis showed high values of water oil ratio (WOR) in West, Northeast, and Southwest fields of the Williston Basin with values reaching 94%, and low WOR recorded in central fields with values as low as 10%. The study confirmed the substantial correlation between WOR and the basin's geology configuration. The findings can be used to select a storage facility location and screen out field candidates for water control intervention. The research suggested merging production data with geology, well geometry, and completion data for in-depth insights and analysis.