

# **Delineating Reservoir's Continuity & Flow Paths within Selected Oil & Water Formations in Magwa Oil Field, Kuwait**

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## **Abstract**

Oil field formation waters contain natural geochemical compositional tracers and isotopic signatures that are commonly used to: identify reservoir compartments, determine the origin of unexpected water, allocate commingled water production, identify mechanical or completion problems and distinguish formation waters from meteoric waters. The main objective of this paper is to identify and characterize the geochemical and the isotopic fingerprint of the water in selected oil/water formations, and to identify the flow paths of water within and across the reservoirs in order to develop a conceptual model of water seepage and communication between reservoirs. To fulfil these objectives the scope of the project included revision and collection of existing data, selection wells for sampling preparation of sampling plans and protocol, conduction of sampling and shipping of water samples to designated laboratory, conduction of geochemical and isotope analyses, evaluation and interpretation of the results and reporting. Oil and water samples were collected from 22 wells in East Kuwait oil field. The samples were collected from oil wells representing Wara, Burgan (BGSU1, BGSU2, BGSM, BGSL1 and BGSL2) and Marrat formations. Samples were also collected from water wells from Kuwait Group and Dammam Formation aquifers in addition to samples from injector wells and the effluent water disposal pits. It was concluded that there is vertical discontinuity between the upper two aquifers (Kuwait Group and Dammam formation) with the deeper formations at the sampled locations. Burgan formations (BGSU1, BGSU2, BGSL1 and BGSM) are compositionally inseparable and therefore freely communicating. The presence of homogenous brine in Burgan formations suggest vertical flow pathways between them. Wara formation samples from wells at southwest Magwa field are compositionally identical confirming the lateral continuity within the formation, while samples from Wara formation at north of Magwa were compositionally dissimilar to Wara at southwest and to the other brines. BGSL2 is compositionally intermediate between the brines of EWDP-01 and 02, and that could be due to its mixing with Wara brines through the path of the prominent NW-SE faults. Marrat formation water is of two compositional families separated by the fault-bounded structure. Finally, the isotopic and the geochemical analyses that have been reported in this project can be used as a reference to assure the origin of water mixing or leakage that may occur in future.