Simulation and Analysis of the infiltration phenomenon in earth dams: The Case of the Fountain Gazelle Dam, Biskra.

Abstract

Water, one of the key sectors of sustainable development, where progress is still possible thanks to the existing resources and technologies currently at our disposal. The sustainable development of humanity depends on the supply of water. It is estimated that more than a third of food production depends on irrigation. As such, the Algerian state has given great importance to investments in this field, building more than eighty large dams with large transfers. However, these dams are often confronted with technical or natural problems in which considerable quantities of water are lost each year due to infiltration. These infiltrations can put the safety of these storage structures in critical states.

The zoned fountain of gazelle dam located in Biskra in south-eastern Algeria has suffered since 2004 from seepage problems on its right bank after early filling of its reservoir. An abnormal pressure disturbance was observed in the P3 piezometer located on the downstream face in accordance with leaks that occurred at the downstream toe of the dam.

The objective of the present thesis is oriented firstly to the detection of the origin of these infiltrations for which the isotope geochemistry method with stable isotopes (^{2}H, ^{18}O) was used.

Secondly, to simulate the infiltration problem after having opted for the injection solution with cement grouts to treat the effect of the fault under the dam foundation. The results obtained showed that the source of the infiltration water is of the reservoir and the simulation of the coupled hydro-mechanical (HM) problem using the numerical code of Code Bright.V13, gives logical, significant and comparative results with those of measured data with very acceptable errors (MAPE= 2.41% and R2= 0.832). The simulation with the proposed solution presents efficiency in the reduction of 65% of the P3 piezometer pressures and put the structure in complete safety.

Keywords: simulation, fontain of gazelles, code Bright, seepage, isotopes stables