

KOUAMÉ Amenan Agnès (2018): Apport de la modélisation hydrogéologique dans l'étude des risques de contamination de la nappe d'Abidjan par les hydrocarbures. Cas du benzène dans le District d'Abidjan (Côte d'Ivoire)

ABSTRACT

This study on the aquifer of the Continental Terminal is carried out in the Abidjan District located on the coastal sedimentary basin in southern Côte d'Ivoire (West Africa). This unconfined aquifer of the city of Abidjan of Mio-Pliocene age is called "Abidjan groundwater". The water quality of this aquifer is facing with diverse sources of anthropogenic pollution such as scattered deposits of solid and liquid wastes of all kinds. Indeed, the inadequacy of sanitation and drinking water supply systems increases the pollution risk of the Abidjan's groundwater. Besides, the proliferation of petrol stations, including tank breaking, needs to be considered in the event of an accident, which poses a real threat to groundwater given the complex hydrogeological structure of the region. In order to ensure the effective protection and management of the Abidjan groundwater, this work proposes to evaluate the risk of contamination of groundwater in the Abidjan aquifer by hydrocarbons such as benzene for the purpose of the implementation of protective measures. To achieve such an objective, a model of underground flow and contaminant transfer was designed from field data and literature. Soil analysis showed two types of soils: sand and silty sand. Using the FEFLOW software, the predictive simulation of underground flow coupled with the transport of benzene deposited on the soil surface at the N'Dotré and Anador stations was implemented. The initial concentrations of dissolved benzene are 43.12 and 14.17 mg/l for the two sites respectively. The results revealed that a borehole named ZE11 of the "Zone Est" capture field is polluted after 44 years and 2 months because the threshold concentration of 0.001 mg/l is reached. A maximum concentration of 0.011 mg/l is reached at this drilling at 47 years and 2 months. In this zone, 5 other wells: ZE1, ZE7, ZE8, ZE13 and ZE14 are threatened by pollution because the dissolved benzene was detected after a period of time ranging from 39 to 46 years. The ZE10 has even recorded with a maximum concentration of 0.0008 mg / l in 46 years. The average distance from Anador site to "Zone Est" pumping wells is 4 km. At an average distance of 2 km from the N'Dotré service station, 8 boreholes belonging to the Anonkoua Kouté: AK15 AK5, AK6, AK7, AK8, AK10 AK4 and AK17, are also threatened by pollution and dissolved benzene has been detected for times between 38 to 47 years.

With the software HYDRUS, for an initial concentration of 2 mg/cm³, the dissolved benzene takes 105, 112 and more than 365 days to cross the 100 cm cylinder of sand, silty sand and clay respectively, taking into account the delay. Without delay, these times are reduced to 100, 80 and 50 days respectively for clay, silty sand and sand.

During its journey, if the pollutant crosses channels, its total times could be 10 to 100 times shorter. Therefore, special attention should be given to the sites of N'Dotré and Anador in case of rupture of the tank especially as this groundwater of Abidjan is the only source of drinking water in the District of Abidjan. The proposed method of decontamination of the unsaturated zone is "bioventing", taking into account the high percentage of sand that constitutes the soil of the District of Abidjan geological formations.

Keywords: Pollution, Abidjan groundwater, modelling, FEFLOW, Benzene, decontaminate