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Isotope tracing of uranium flows and assessment of mining waste impact over groundwater quality along a catchment in the Brazilian semi-arid region.

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The uranium unit of Caetité - in charge of all the “yellow cake” produced in Brazil - is located in the semi-arid Northeast region at Bahia State. The geological uranium content of the ore is 3000 ppm, which is mainly associated with albites (NaAlSi8O8), and its extraction is achieved by means of a Heap-Leach process. This process has a low water demand, which is supplied by a network of wells, but can contribute to change the groundwater quality and in some cases the extinguishing of wells was observed. The managing of liquid mining wastes formed by drainage waters from mine pit and solid waste piles is not enough to avoid unwarranted releases in the environment, which turn necessary the waste treatment through passing them into the industrial plant in order to reduce radionuclide concentrations. The groundwater is Na-HCO3 type water and relative high concentration of Cl are observed in some groundwater. It seems that levels of uranium in groundwaters are mainly a consequence of the complexation of the metal by carbonates (or other anions) and not by any sort of the contamination of these waters by the drainage accumulated in the open pit. The speciation modelling allows identifying some areas where the replenishment of the aquifer is more active, but in general the recharge is a fast process run by direct infiltration. The stable isotope data (δ 2H and δ 18O) showed that evaporation plays a role during the infiltration, causing the groundwater salinization. These data discard the possibility that groundwater salinization was caused by discharge of deeper saline groundwater through faults associated to a regional groundwater flow system. The presence of an active shallow groundwater flow system offers better possibility for sustainable use of the groundwater resources in this semi-arid region of Brazil.