Perchlorates ions (ClO_4^-), explosives and nitrates in chalk aquifer of Champagne-Ardennes, France

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High ClO_4^- concentrations (>15µg/L) have been reported in groundwater used for water supply in Champagne-Ardennes (France), affecting a large number of people. ClO_4^- contamination can be a health concern due to its ability to disrupt the thyroid gland's use of iodine in the generation of metabolic hormones. Considerable uncertainties remain about its sources, fate and transport in the environment.

Perchlorates ions were used during the First World War (WWI) in the ammunitions. The location of the catchments showing high ClO_4^- concentrations in Champagne-Ardenne suggests a possible link with military activities. The relationship between the presence of perchlorates ions and other explosives from ammunition, and their behavior in the groundwater is studied. Agricultural activities were also another source of ClO_4^-. The chilean nitrate, containing high concentrations of perchlorates ions, was intensively exploited as fertiliser in France until the middle of the 20th century. The measurement of the isotopic signature of oxygen and chlorine in perchlorates ions makes it possible to determine precisely the source of the perchlorates ions (agriculture or military). Finally, a better understanding of the chalk aquifer properties, including the measurement of the residence time of groundwater and the monthly monitoring of ClO_4^- allow to assess the spatial and temporal evolution of ClO_4^- concentrations in the years to come, with a view to making appropriate recommendations in terms of management.