



Natural background level assessment in groundwater: application of the Italian national guideline

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Inorganic potentially toxic elements in groundwater may derive from both natural processes and anthropogenic activities. Natural background levels (NBL) are often assessed to distinguish the anthropic impact and assess the environmental status of groundwater bodies, as requested by the Water Framework Directive. The geochemical approach for the NBL assessment requires the identification of groundwater with no or negligible human impact, using markers such as nitrates/ammonia in oxidising/reducing environments, organic compounds, isotopes, etc. The statistical approach involves the separation of uninfluenced and influenced populations by means of statistical procedures. Recently, a national guideline for the NBL assessment was published in Italy. The procedure is based on the preselection method and the percentile calculation; it takes into account the groundwater body conceptual model and different assessment paths are proposed according to the sample size both in the spatial and time dimensions.

In this study, we apply the national procedure to a study case in the volcanic province of Latium (central Italy). Redox facies were separated using DO ($>/< 3$ mg/L). The “influenced” samples were discarded using $\text{NO}_3 > 37.5$ mg/L to obtain the “pre-selected dataset”. Then, the natural background levels of As, F, Mn, Ni, Fe and SO_4 were estimated as follows. When one or more outliers exist, we assume they represent different populations and processes. Regardless their anthropic or natural origin, the outliers usually represent localised phenomena, which differentiate from the background, and should be treated as such. When data approximate one normal population, we assume that they all refer to the background population and the maximum concentration value is proposed as NBL. When the normality test fails, the 95th percentile is selected as NBL. In the oxidizing facies, the NBL obtained for As and F are always above the EU Drinking Water standards, while Mn, Fe, Ni and SO_4 show rather different NBLs, largely below the limits of the Italian legislation for the groundwater body chemical status definition. As for the reducing facies, the number of samples does not allow for a sound NBL definition.