



eNaBLE, an on-line tool to evaluate Natural Background Levels in groundwater following the Italian Guidelines

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The EU Water Framework Directive (WFD) and the Groundwater Directive (GWD) establish the necessity for EU Member States to assess the chemical status of their groundwater bodies (GWB) by setting Threshold Values (TVs) taking into account natural background levels (NBLs) when they occur due to natural hydro-geological reasons. Background Level has been defined in the GWD as "the concentration of a substance or the value of an indicator in a groundwater body corresponding to no, or very minor, anthropogenic alterations to undisturbed conditions".

The EU FP6 BRIDGE project provides methodological approaches for assessing the threshold values (TV) and the NBL in groundwater bodies. Mainly, the BRIDGE methods are established either on a purely statistical approach, suggesting that the NBL can be determined by population separation techniques or on a simplified pre-selection method. The latter method is based on markers of human activities such as nitrates or other anthropogenic contaminants; the samples exceeding a fixed threshold value of the marker are in advance excluded. On the "pristine" unaffected water samples dataset, a value is chosen as NBL (e.g. 90th, 95th or 97.7th percentile).

In 2017, a National Guideline for the NBL assessment in groundwater bodies was published in Italy. The procedure is based mainly on the preselection method but different assessment paths are proposed according to the redox conditions of the groundwater body, the sample size in both the spatial and temporal dimension and the type of the distribution, normal or not, of the pre-selected dataset. The complexity of the schema was essential because of the great heterogeneity of the different GWB monitoring data. For this reason, moreover, the obtained NBLs are labelled with a different confidence level in function of: number of total observations or number of total monitoring sites, extension of groundwater body and aquifer type (confined or unconfined). For GWBs characterized by NBLs with low confidence levels, further monitoring activities are requested.

To provide support to operators involved in the use of the Guidelines and to achieve a harmonization of procedures between the different structures involved, eNaBLE, an on-line tool, was developed at IRSA. The complete procedure, written in PHP and using MySQL as DBMS, is arranged into three different blocks:

- i) Selection of the calculation parameters (redox facies separation parameter and relative threshold, marker threshold, time series analysis method, confidence level assignment method);
- ii) NBL calculation for all the chemical parameters that show concentration values exceeding the relative TV using the calculation parameters previously selected. The different basic procedures (data validation, preselection, outliers management, time series analysis, normality test, etc) are written as separate modules to match the different assessment paths provided by the Guidelines;
- iii) Graphical output of the results

The tool is still under testing for a thorough verification of all the possible variants in dataset structures and GWB conceptual models, also taking into account the suggestions of the stakeholders.