Conceptual and numerical model on the PFAS contamination in Veneto region (NE, Italy)

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Introduction: In the last eight years, high concentrations of perfluoroalkyl compounds (PFAS) have been detected in the surface water and groundwater sampled in an area of about 170 km^2 in the Veneto region. A former factory, located in the province of Vicenza, was discovered to be the source of such extended pollution. The PFAS plume partially includes the venetian provinces of Verona, Vicenza, and Padova. Per- and polyfluoroalkyl compounds (PFAS) are a group of man-made organic chemicals that have been commercially used since the 1950s to make grease and water resistant: fabrics, paper, coatings for food containers but also to produce photographic films, fire-fighting foams, household cleaners. PFAS have recently received increasing public and scientific attention due to their persistence, bioaccumulative potential, and potentially toxic effects on humans and animals, enough to be included among the emerging contaminants. The spatial distribution of concentrations and their trend over time in the Veneto region demonstrates the age of pollution and the reaching of a quasi-steady condition.

Hydrogeological situation of the contaminated area is characterized by a high plain composed by gravel-sandy levels hosting a phreatic aquifer. The middle and low plain are constituted by silty-clay and sandy-silty sediments, separating sandy-gravel confined aquifers.

The first question is upgrading the local subsoil reconstruction thank to new hydrostratigraphic information available, focusing to define aquifer geometry and transition between the undifferentiated phreatic system, characterizing the high plain, and the more southern multi-levels confined system. Furthermore, the hydrostratigraphic characteristics of the groundwater divide Montecchio Maggiore – Brendola will be studied. Such a structure splits groundwater flow in two main directions. The most important is southward, spreading the contamination up to the Montagnana town, the second one is in the north-west direction toward the Vicenza town. Such a reconstruction will be fundamental to define a reliable conceptual hydrogeological model useful to implement a numerical simulation of the PFAS contamination behavior.

Aims: This thesis aims to reproduce the environmental contamination development, to verify the consistency with available experimental data, and to predict the fate of PFAS plume. Moreover, such simulations will support ARPAV to design a monitoring network able to control the PFAS contaminant evolution.

Methods: In the project 3D hydrostratigraphics reconstruction by Move software will be made. Such a reconstruction will be implemented in open-source numerical models MODFLOW code-based. Groundwater models will be used in transport simulation with MT3D-USGS. The fate of perfluoro octane sulfonic acid (PFOS) and Perfluoro octanoic acid (PFOA) contaminants will be simulated.

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