Historic nitrate storage in groundwater system - a non-negligible process in nitrate water pollution management

Lei Wang[1], Robert Ward[1], Marianne Stuart[2]

[1]*British Geological Survey, Keyworth, Nottingham, UK, NG12 5GG*
[2]*British Geological Survey, Maclean Building, Wallingford, Oxfordshire, UK, OX10 8BB*

Nitrate water pollution is not only an environmental issue but also a threat to the economy and human health. It remains an international problem and has been identified as a major threat to water quality and the delivery of the EU Water Framework and Nitrates Directives targets.

It could take decades for nitrate derived from historic fertiliser application, which leaches into groundwater, to travel through thick unsaturated zones (UZs) and saturated zones, and arrive at rivers and boreholes. ***However, the capacity to store nitrate in the system, and the long lags, have generally been ignored within the water resource management in the UK.***

A nitrate time bomb method (NTB) has been developed to simulate the nitrate transport in both unsaturated and saturated zones. Its successful applications in Great Britain and the Eden catchment show that the model is applicable at both national and catchment scales. This study highlights the need to take into account the groundwater pathway if effective management strategies are to be implemented, and conflicts between policy makers, farmers, industry and other stakeholders in the environment are to be avoided. Five ongoing projects (2 Natural Environmental Research Council, 2 Department for Environment, Food and Rural Affairs, and 1 Environment Agency) have used or are going to use this NTB method to investigate nitrate pollution processes and to provide scientific evidence in nitrate water pollution management. For example, in England and Wales DEFRA uses this method to identify catchments where the mitigation of agricultural diffuse pollution is unlikely to achieve any ecological benefit. The EA is now trying to implement this method to designate Nitrate Vulnerable Zones across whole of the UK.