

Long Term Chlorinated Solvents Pollution in UK Aquifers

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Extended Abstract

The use of chlorinated solvents in the UK dates back to the mid-20th century, when they became popular due to their effectiveness as cleaning agents and their low flammability compared to earlier solvents. Their toxicity, mobility, and persistence in the environment, however, have made them a long-standing challenge for environmental management[1]. In the United Kingdom, groundwater supplies over 30% of public drinking water and a significantly higher proportion in the south and southeast regions[2]. Since the 1980s, studies across UK aquifers have revealed widespread chlorinated solvent contamination, notably in Birmingham[3], [4], [5], Coventry[6], Cambridge[7], and the Sherwood Sandstone[8]. Trichloroethylene (TCE), Perchloroethylene (PCE), and 1,1,1-Trichloroethane (TCA) are the most common pollutants, largely linked to industrial activity, with TCE also associated with sewage leaks. In Birmingham, decades of monitoring showed that reductions in TCE levels were due to well closures, not degradation. Across all sites, solvent degradation has been minimal, and parent compounds remain detectable. The consistent conclusion is that, without intervention, solvent pollution in UK groundwaters will persist for decades or even centuries.

Despite these concerns, the UK lacks a comprehensive, centralised and publicly accessible national register of contaminated sites and associated remediation efforts. While the Environmental Protection Act 1990 (Part 2A) provides a legislative framework for identifying and remediating contaminated sites, its implementation has been fragmented and locally driven, resulting in substantial spatial and temporal data gaps[9]. This regulatory fragmentation severely limits the ability of researchers and policymakers to assess the effectiveness of remediation policies or to track long-term trends in pollutant degradation.

In this study, we examine the potential of state groundwater monitoring data, gathered by the Environment Agency, to serve as a proxy for evaluating the degradation of chlorinated solvents in the absence of structured land contamination records. The water quality database includes a large number of samples across England and Wales that routinely test for a suite of chemical parameters, including key chlorinated solvents. We are focusing on three solvents families in this study: chlorinated ethenes (PCE, TCE, Dichloroethylene (DCE)), chlorinated ethanes (TCA) and chlorinated methanes (Carbon Tetrachloride (CT), Trichloromethane/Chloroform (TCM)). We perform a longitudinal analysis of temporal trends on long-term monitoring sites spanning a minimum of 8 years. We identify the general trend between historical and recent concentrations. We deduce degradation rates for each solvent, and we examine whether observed declines correspond with expected natural attenuation processes or potential undocumented remediation efforts.

This work provides the most recent quantitative update since the 1990s on the persistence and degradation of chlorinated solvents in UK groundwaters. Through temporal and spatial analysis of long-term monitoring data, the deduced solvent-specific and aquifer-specific degradation rates enable differentiation between passive and potentially managed declines, offering a foundation for forward-looking models of contaminant behaviour. Furthermore, this study highlights the limitations imposed by the absence of a national unified contaminated land register and the value of addressing this structural gap.

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