

用於含氯溶劑污染場址之整合複雜傳輸解析解模式、地理資訊系統及人體健康風險評估的軟體開發

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摘要

地下水污染因化學物質處置不當而頻繁發生，含氯溶劑作為常見的地下水污染物，其重質非水相液體(Dense Non-Aqueous Phase Liquids, DNAPLs)的特性使整治過程更為複雜，而其致癌性則對人體健康構成嚴重風險。因此，開發先進工具以提升場址管理與健康風險評估的效率勢在必行。

本研究針對現有軟體 MUST 進行強化，該軟體利用解析解模式模擬污染物在地下環境的遷移，並內建健康風險評估模組以量化經由地下水攝入的風險。本研究使用 C# 程式語言開發，配合地圖以及視覺化套件，將現有軟體整合如展示場址污染範圍、地質與水文條件及污染物分布等的資訊管理與地理視覺化進階功能，並擴展健康風險評估模組至涵蓋多種暴露途徑。這些改進將提升軟體在污染場址的評估完整性與決策支持能力，提高場址管理效率並強化風險溝通，從而促進更精確的決策制定與利害關係人的有效參與。

關鍵字：含氯溶劑、解析解模式、人體健康風險評估、場址管理、軟體開發。

A software integrating sophisticated transport analytical model, GIS, and human health risk assessment for comprehensive site evaluation of groundwater contaminated with chlorinated solvents

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Abstract

Chlorinated solvents are common groundwater contaminants, their behavior as Dense Non-Aqueous Phase Liquids (DNAPLs) complicates remediation efforts, and their carcinogenic properties pose significant risks to human health. These highlight the urgent need for advanced tools to support site management and health risk assessment. This study enhances existing software MUST by integrating advanced functionalities for managing and geographically visualizing the site-specific data, including the range of the contaminated site, geological and hydrological conditions, and contaminant distribution. Additionally, the human health risk assessment module has been expanded to consider multiple exposure pathways, further strengthening the software's ability to provide a comprehensive framework for site evaluation and decision-making. These advancements improve the efficiency of site management while enhancing risk communication, enabling more informed decisions and fostering better stakeholder engagement.

Keywords: Chlorinated solvents, Analytical solution model, Human health risk assessment, Site management, Software development.