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A 3D Multi-Source Conceptual Model to Support the Remediation of a Jet Fuel Contaminated Site

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The management of a contaminated site requires to integrate simultaneously the information related to the hydrogeophysical sphere in all its dimensions. The construction of a 3D multidisciplinary geodatabase and the realization of an integrated model constitute the tools for the management, the fusion, the integration, and the analysis of multi-source data. The research aims to demonstrate the contributions of a multiple lines approach leading to the refinement of the Conceptual Site Model (CSM), the assessment of contamination, and successful remediation of a polluted site. An illustrative case history is here presented. It concerns the military airport of Decimomannu (Cagliari, Italy), affected by various aviation fuel (jet phuel-JP8) spills in 2007 (40000 L), in 2009 (5000 L), and in 2010 (5000 L). A multiscale approach was followed for the creation of a 3D hydrogeophysical model which acts as an effective "near real time" decision support system able to manage and release data during the different remediation phases from the site characterization up to the proper remediation intervention, all by allowing the user to view, query and process data in 3D space. The construction of a multi-source conceptual model along with Laser Induced Fluorescence (LIF) and Electrical Resistivity Tomography (ERT) capture the information related to the hydrogeochemical sphere in all its dimensions. The 3D pseudo-real visualization catches the high resolution characterization of geological eterogeneity and contaminated bodies at the scale of pollution mechanisms and decontamination processes. The physicochemical and data-driven model, which links geophysical signals to contaminant characteristics within contaminated porous media, explains the observed contaminant-geophysical behaviour. The interpretation of contaminant dynamic has strong implications for the reliability of the CSM, affecting the selection and the performance of remediation strategy. The display of integrated data allows a real-time interaction with the multi-source model (and the 3D geodatabase), to extract useful information for the decision-making processes during the different stages of remediation. The rich data set, and the data-driven models comprise, collect, and establish a connection between the environmental variables. They optimize the contribution of each aspect and support unequivocally the design and the adoption of an effective and sustainable clean-up intervention.