NJECTIS
In situ soil remediation

Advanced In Situ Bioremediation of Hydrocarbon-Contaminated Soils – LIFE InBioSoil Project

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The LIFE InBioSoil project demonstrates the feasibility of Advanced In Situ Bioremediation (AIB) for soils contaminated with Total Petroleum Hydrocarbons (TPHs).

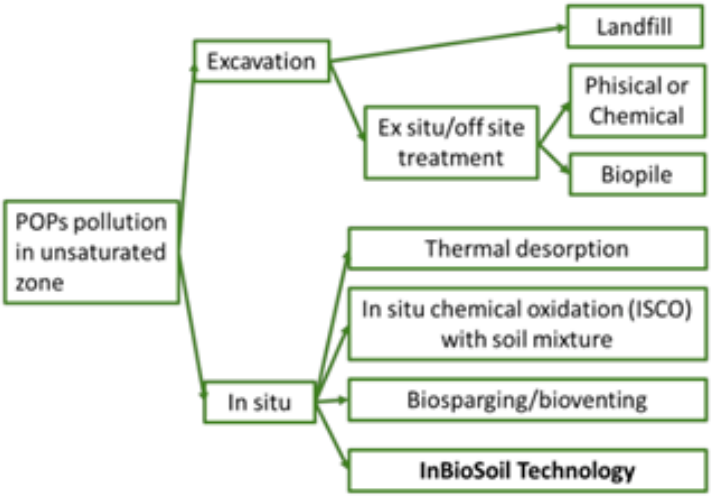
Using a low-pressure injection system, it enables both mycoremediation and the biostimulation of native microorganisms. Demonstration sites in Spain and Belgium test the method under different soil and climate conditions. The project aims for 40–85% Persistent Organic Pollutants (POPs) degradation while cutting greenhouse gas emissions by 80% and energy use by 90% compared to thermal desorption. With Injectis' patented SPIN® technology, reagents are evenly distributed even in low-permeability soils, making bioremediation more reliable, sustainable, and scalable.

Context

The LIFE InBioSoil project aims to demonstrate the feasibility of Advanced In Situ Bioremediation (AIB) for TPHs in contaminated soils, using a low-pressure injection system that enables both mycoremediation and biostimulation of indigenous microorganisms. Through demonstration sites in Spain and Belgium, Injectis validates the efficacy of this approach across contrasting geological and climatic contexts.

The project targets 40–85% degradation rates of POPs while minimizing environmental impacts, including an 80% reduction in greenhouse gas emissions and a 90% decrease in energy consumption compared to thermal desorption. This innovative solution promotes sustainable, low-impact in-situ remediation and supports EU objectives for the circular economy and soil health by avoiding excavation, reducing CO_2 emissions, and restoring soil functionality on-site.

Injectis contributes not only its patented SPIN® Injection Technology—providing controlled, low-pressure delivery that ensures homogeneous reagent distribution even in low-permeability formations—but also its ability to safely inject living microbial cultures, whose viability is highly sensitive to pressure. In addition, Injectis brings extensive expertise in injection engineering, enabling optimal performance in unsaturated and heterogeneous geological contexts that are often difficult to manage and monitor. These combined strengths significantly enhance the reliability, effectiveness, and scalability of advanced bioremediation strategies.



Energy	Economic cost	GHG transport and operation	Removal efficiency	Soil Health
NA	Depends on regulation	↑	X	X
↑	↑	↑	↑	X
↓	↓	↑↓	Biodispo-nibility	
↑	↑	↑	↑	X
↑	↑	↓↑	↑	X
↓	↓	↓	Volatile POPs	
↓	↓	↓	Biodispo-nibility	

Geology

The project focuses on developing in-situ bioremediation strategies through reagent injection in the unsaturated zone, a challenging environment where biological degradation rarely occurs due to the absence of optimal conditions — particularly the lack of sustained aerobic environments.

Following extensive laboratory simulations and bench-scale testing, pilot-scale field trials will be carried out on two hydrocarbon-contaminated sites (Medium- to light-chain hydrocarbons): one in Belgium and one in Spain (Catalonia). On both sites, Injectis' expertise in injection design and low-pressure delivery will be key to optimizing reagent distribution and contact efficiency under these specific unsaturated conditions.

The geological settings are expected to be variable, ranging from sandy to silty-sand formations, allowing evaluation of the injection system's performance across different soil textures and permeability levels.

In **ISCO** treatment, chemical reaction and hence **physical contact** is the **key parameter** to guarantee successful remediation results. In addition to using the SPIN® Injection Technology, the remediation company opted for electrical tomography measurements to verify the quality of the reagent distribution.

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Injection Technology – SPIN®

As a specialized expert in in-situ injection systems, INJECTIS is responsible for the technical execution of the injection activities within the project. The company provides its patented SPIN® technology, designed to enable low-pressure, homogeneous injections in soils of varying lithologies.

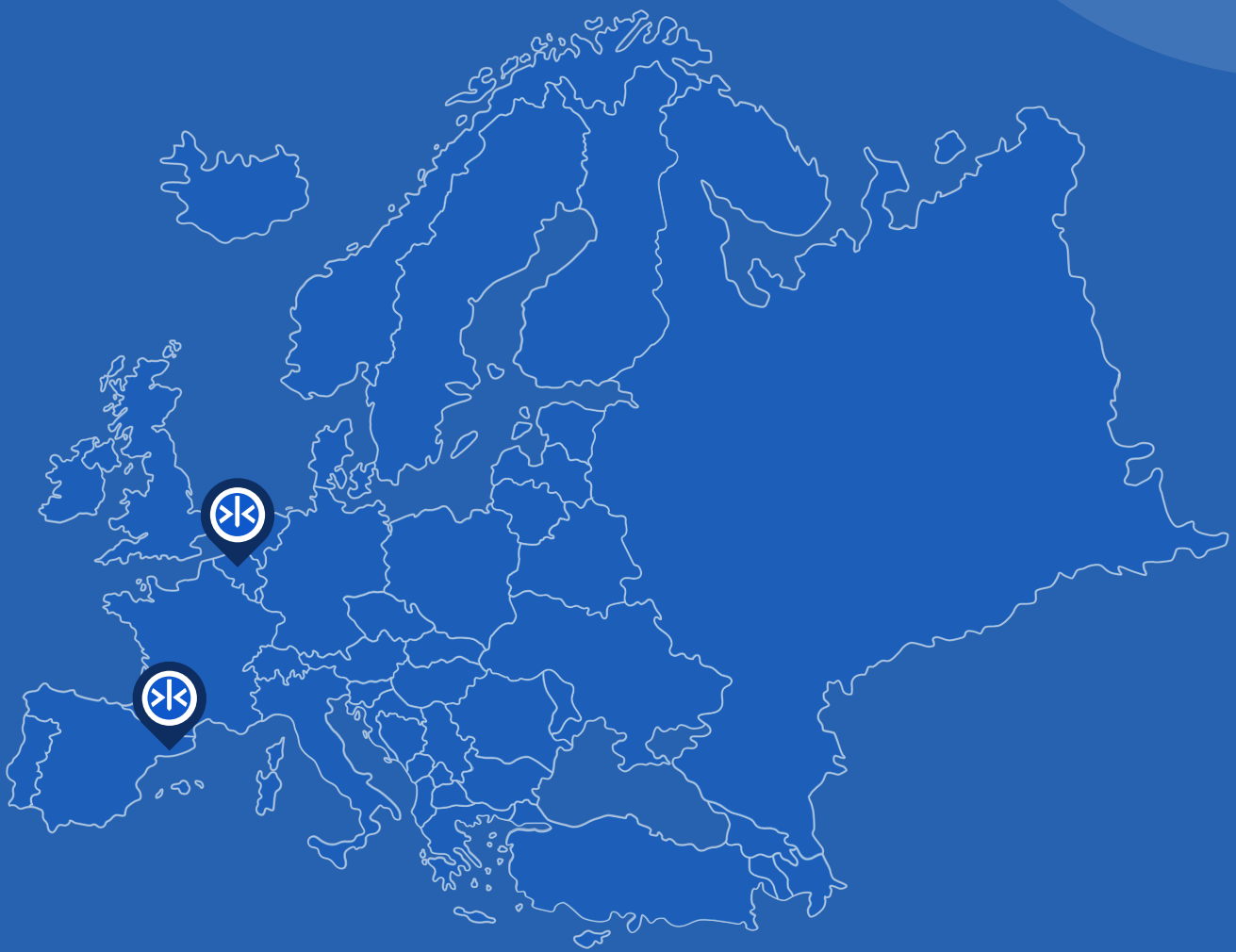
Low injection pressure is a critical factor when working with living organisms such as bacteria or fungi, as it minimizes shear stress and prevents cell destruction during injection. This ensures the successful delivery and survival of the biological agents within the subsurface environment.

For this specific project, INJECTIS' innovative approaches, including the potential use of horizontal injection systems, could be further developed to optimize reagent and microorganism distribution under complex field conditions.

However, due to the risk of oxidant-induced corrosion near underground infrastructure (e.g., metallic tanks and pipes), a soft alternative approach was chosen for this project. Instead of using an oxidant, **magnesium sulfate** was selected. This compound is not an oxidant but a salt that effectively stimulates sulfate-reducing bacteria, enhancing the anaerobic biodegradation of hydrocarbons. It offers a safe, cost-effective, and efficient biological alternative, particularly well-suited for sensitive or confined site conditions like those encountered here.

Injectis, your specialist partner for in situ soil remediation

Innovative techniques for cleaning and restoring contaminated soil in its original location.



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