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HEISTT

High Efficiency In Situ Treatment Technology for Contaminated Groundwater

Period 2 Publishable Summary

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Publishable Summary

HEISTT is a European collaborative project with the intention of creating an innovative system of injecting remedial chemicals into the subsurface for the purpose of treating contaminated groundwater. The proposed technology aims to develop a rapid and highly efficient method of application providing enhanced efficiencies for the installation of this type of treatment and removing cost based entry barriers for those wishing to implement in-situ oxidisation based remediation.

The idea for the HEISTT concept derives from the rapid installation of multiple band drains which could be deployed to include chemical treatment for the remediation of polluted groundwater plumes. Chemical remediation treatments such as oxidation and reduction are generally well established and successful, nevertheless at individual sites they can be financially uncompetitive, with high installation costs as a result of specialist rig hire, and slow rates of drilling. The HEISTT concept is providing proof of concept and an early development prototype system capable of being mounted on a standard excavator arm and EMV combination. The system will rapidly install treatment chemicals into the subsurface treatment zone. The improved installation rate, control over well depth and accuracy in chemical placing when combined, will enable the technology to become both more widely accessible in terms of people able to use the technology and spectrum of sites which would become cost effective for treatment using the HEISTT system.

Description of work performed and main results

At the beginning of the project a wide range literature view was carried to expand the scientific and engineering knowledge of the consortium and to pass on operational challenges from the SMEs to the Researchers. The literature review covered available technologies both within ultrasound and pile driving, including ultrasonic parameters, soil types, groundwater flow, along with the transport and fate of contaminants and remediation agents.

Understanding both groundwater flow and the degradation of the effectiveness of the remediation compound are key to the success of the project. For this reason, significant import has been given to the investigation and development of software modelling. A simple but powerful model, Visual MODFLOW, one of the most complete and easy-to-use modelling environment for practical applications in 3 dimensional groundwater flow and contaminant transport simulations was selected for use due to its broad use within both construction and remediation industries.

A known contaminated site was chosen from literature to model for the project. Groundwater flow, contaminant transport and the physical removal of contaminant from the groundwater were studied under different scenarios based on soil types and characteristics. Different soil types were used to see the effects of transport, remediation, groundwater flow etc. As a result of this work it was concluded that every soil type and contamination can be modelled without problems and that the distance between injection wells can be determined in order to ensure that the treatment is applied to the contaminant zone efficiently and effectively. As the project moves into the field in year 3, the model will be further calibrated using the data gathered from trial sites and an End User Decision Support Tool will be created.

Early Results

The first HEISTT prototype probe has been fabricated and is demonstrating a reduction in force required for insertion in laboratory scale experiments. When coupled with an excavator and EMV piling head, this will enable much faster creation of wells.

The manufacture of geotextile socks proved to be costly, even before they were filled. The HEISTT team have overcome this issue by designing a geotextile insertion system which allows the geotextile to be formed into tubes during insertion and cut to the required length. This not only removes significant fabrication costs, it reduces waste as the exact amount required can be used and it permits the geotextile to be transported to site on rolls, reducing bulk and therefore the associated costs of transport.

Expected final results and potential impacts

It is anticipated that the proposed HEISTT system will represent a step change over existing in situ chemical deployment technologies with the potential to deliver:

- Order of magnitude improvement in speed of remediation treatment chemical installation
- Installation of 5 boreholes a day may be typical under conventional methods whilst up to 100 bore holes per day are proposed through the HEISTT system
- Reduced remedial treatment costs through more efficient use of treatment chemicals
- Simpler and safer installation of remedial treatment chemicals
- An increased rate of remediation through better distribution of treatment chemicals

In addition the potential for use in non-remediation situations continue to present with areas such as the installation of solar farms being investigated as a sector where the particularly narrow gauge of the pile and its ability for easy reaction being of particular interest.

Project public website address: www.heistt.com

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