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ABSTRACT

EVALUATION OF SURFACTANT AND FOAM PROCESSES FOR IN-SITU NAPL REMEDAITION IN A MILITARY BASE, SOUTH KOREA

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Introduction

Surfactant and foam processes have been widely used in enhanced oil recovery from the petroleum-bearing geological formations [1, 2] and in-situ subsurface remediation from shallow formation and aquifer [3, 4].

This study investigates the potential of using surfactant and foam processes for the in-situ remediation of shallow subsurface NAPL phases within a field in a US/Korea military base, South Korea. It consists of two major components: the first is a history matching of surfactant enhanced aquifer remediation treatment and the second is a prediction of follow-up foam injection treatment. The site has a 5 m x 5 m treatment area with 3 m depth with 3 injection wells and 3 extraction wells.

Results

Surfactant treatment: Over 10-days surfactant treatment exhibits a partial success in terms of NAPL removal. The relatively higher-permeability area contacted by the surfactant chemicals shows a mobilization of NAPL phases because of a reduced level of capillary trapping (i.e., low dimensionless capillary number). It is the area with relatively lower-permeability values, however, that prevents a successful sweep from occurring. History matching from simulations shows why such an early breakthrough happens in some extraction wells, and what roles the subsurface heterogeneity plays in overall in-situ treatment with surfactant solution.

Foam treatment: A foam treatment, proposed as a potential follow-up action, is evaluated see if how foam can overcome subsurface heterogeneity. The outcome seems very promising such that foam can improve the sweep and increase the recovery factor over 80 - 90%. The final results are shown to vary with foam strengths as summarized by using a sensitivity analysis. Foam field test is designed in the near future.

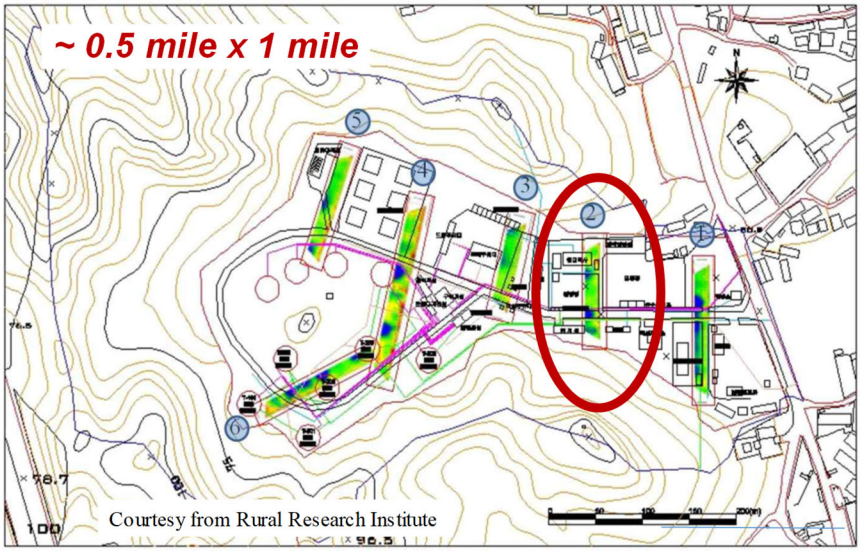

Figure 1: Map of the entire field and the location of the in-situ remediation site (in circle): The colors show the concentration of contaminants from the resistivity log prior to the treatment

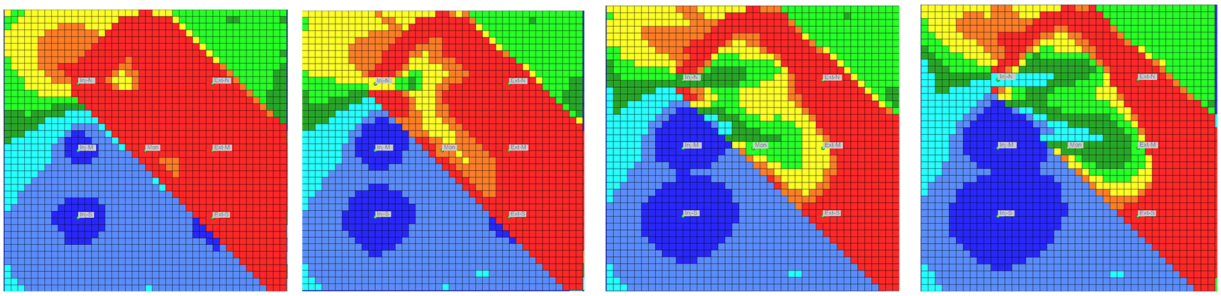

Figure 2: Migration of injected surfactant solution with time, as predicted from simulations: The contact area and sweep efficient are greatly affected by the level of heterogeneity in the system

References

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