In Situ Thermal Remediation in Europe: Advances and Lessons Learned at Multiple Sites (2005 to Present)

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Background/Objectives. Since implementing one of the first in situ thermal remediation (ISTR) projects in Europe, a number of technical advances and lessons learnt have been incorporated in the implementation of multiple projects in this geography that have used different heating techniques, involved bench scale testing to full scale implementation, were applied in a wide range of geological settings (including fractured bedrock) and to treat a wide range of contaminant types. The lessons learnt cover safety, technical and commercial application of ISTR at >10 project sites in Europe. Thermal remediation advancements and application trends over time are discussed.

ISTR was first applied for environmental remediation in North America in the 1980s; however this approach has only become widely used to remediate contaminated sites in Europe since 2005, as the benefits of rapid remediation, independent of geology or magnitude of impact, and to relatively low concentrations become recognized.

Approach/Activities. During implementation of the first full-scale steam injection project in London by ERM UK during 2005/2006, significant collaboration with US experts assisted with successful application of the, at the time, relatively unknown technology, although optimization of the heat delivery system was not undertaken during design or implementation. However, in the last 5 years greater emphasis has been placed on sustainable system design and implementation at our project sites.

Process equipment has been designed to reduce carbon consumption. Laboratory bench tests and innovative thermal modelling are used to optimize well configuration and heating duration. Technology advances in the operational phase include the use of ERM's low temperature volatilization (LTV) approach to reduce the target treatment temperature from that traditionally applied, use of alternative recovery mechanisms to volatilization to recover contaminant mass, and integration with follow on biological approaches.

Results/Lessons Learned. The project examples show that while the technology basis has not changed significantly, the method of application is now more considered and targeted through innovation, experience, and global collaboration between thermal practitioners and clients; leading to reductions in energy, cost and time. It is expected that ISTR will be ever more important as the remaining contaminated land sites become more complex, continuing the increased use of these technologies.