Thermal Solutions

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What are Thermal Solutions?

In-situ thermal focused solutions can provide rapid, cost effective and sustainable answers for the most complex site contamination problems and source areas of recalcitrant compounds, such as chlorinated solvents, PCBs, Pesticides and 1,4-dioxane.

Key to the approach is the understanding that Thermal Solutions can be applied at a wide range of temperatures, not just via a traditional volatilisation mechanism. Crucially it is driven by an understanding of the geology and contaminant properties.

ERM have provided effective solutions at as low a temperature as 50^{o}C as we understand that mechanisms such as viscosity reduction and enhanced biotic and abiotic reactions are equally viable processes.

When can Thermal Solutions be used?

In the context of contaminated land and groundwater in south east and southern Europe thermal solutions may be applicable in addressing some of the more complex difficult sites to treat source areas, enabling rapid treatment, combining with other technologies and potentially avoid the need for long term treatment or containment that may otherwise lead to blighting of the site.

Maximising Asset Value

Often the value of a site asset can be maximised if it can be remediated rapidly. This is enhanced if a change of land use zoning is possible. Our Thermal Solutions have made possible the sale of difficult sites within a 12 – 18 month timeframe, in one example enabled a change in zoning in a 12 month timeframe which facilitated a six fold increase in land value for the client.

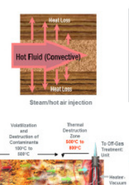
Managing Liability Exposure

Contaminants beneath operational sites may contravene permits or pose risks to receptors. Effective removal of contaminant sources is key to mitigation. For many sites this is not possible and long term pump and treat is the norm. ERM's Thermal Solutions provide alternatives, for example use of temperature to mobilise and remove pesticide contaminated oils or creating fracture pathways to remove solvents from confined fractured bedrock.

It's getting hot - ISTR Technologies Available

Convection

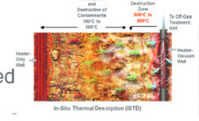
- Heat transfer by mass motion of a fluid such as air or water
- Heated fluid is caused to move away from the source of heat, carrying energy with it.



Steam Enhanced Recovery → SER

Conduction

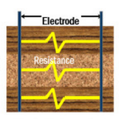
- Process by which heat energy is transmitted through collisions between neighboring molecules.



Thermal Conduction Heating → TCH

Resistance Heating

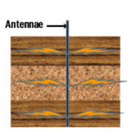
- Generation of heat by passing an electric current through a conductive material



Electrical Resistance Heating → ERH

Radio Frequency Heating

- Generation of heat by electromagnetic waves, (similar to microwave oven)



Radio Frequency Heating → RF

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The business of sustainability

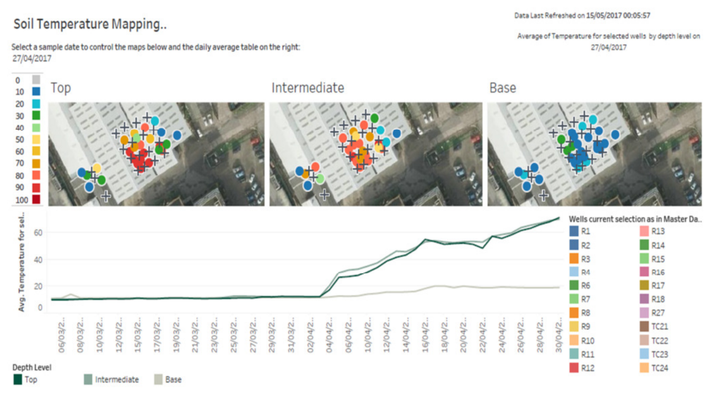
Sustainable Thermal Remediation of Pesticides

Introduction

- The Site has been used since the 1960's for the manufacture of wood preservatives
- Following multiple phases of site characterisation, several thousand kilograms of mass was estimated to be present (mostly Kerosene with approximately 10kg of pesticides)
- The driver for remedial action was the risk posed by pesticides to the underlying regionally important Chalk aquifer
- A Remedial Options Appraisal identified limited treatment options due to the recalcitrant nature of Dieldrin but in-situ thermal remediation was considered most applicable using Thermal Conductive Heating (TCH) in the primary source

Results

- Maximum temperature achievable in the unsaturated zone was predicted to be 150°C meaning Kerosene could be volatilised, but the pesticides could not
- Significant groundwater pumping would be needed to increase temperatures needed for TCH
- However, a change in methodology (mobilisation/recovery) meant steam rather than TCH could be used to heat the subsurface (less wells and energy)
- 4,160kg of Kerosene was recovered, with circa 7.5kg of pesticides, as free, dissolved phase and 'sludge'



Conclusions

- The remediation cost estimate reduced from £5million+ to £2.6million due to change in heating methodology
- Remediation was achieved on schedule and within the £2.6million budget.
- Risk reduction objectives were achieved with the balance between sustainability and cost metrics optimised
- Lower temperature mechanisms helped to recover the Dieldrin and this approach could potentially be applied at other sites with similar contaminants

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