

If You Have all the Thermal Tools, How Do You Pick the Best One for a Site?

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Background/Objectives. Cascade Technical Services and TerraTherm have industry-leading experts and equipment to implement all major forms of in situ thermal remediation:

- Electrical resistance heating (ERH),
- Thermal conduction heating (TCH),
- Steam enhanced extraction (SEE),
- Thermally enhanced soil vapor extraction, bioremediation, and hydrolysis.

The latter technologies are variants of the first three – the energy delivery methods would depend on the subsurface conditions. We evaluate hundreds of sites every year and provide advice on thermal options, pricing, and applicability. This means that every week, several sites must be evaluated for thermal treatment: which thermal method would be the best choice, and most cost-efficient? The obvious question is: How do we do that?

Approach/Activities. Our site screening process will be explained – how we gather the necessary data, what is most important, and how it is used to select the best options. We start with the site conceptual model – a thorough understanding of the subsurface, what was released, and what governs the fate and transport of the chemicals. What are the remedial objectives, and what does a successful outcome entail? Based on all this, and experience from more than 100 completed thermal projects, we select the most promising option. Then a preliminary design is developed, and a remediation price is estimated. Often this is done for several technologies, if the selection is not obvious. This process reveals where the sweet-spot is for the different technologies, and the most cost-efficient and certain option is selected.

Results/Lessons Learned. The presentation will reveal how we do it – including an analysis of each technology and the sweet-spot. There are major differences between the heating technologies – examples are:

- SEE is superior in permeable formations and layers – it can heat quickly and ensure that groundwater flow does not hinder heating,
- ERH is best suited for treatment of VOCs in fine-grained, moist materials, where electricity flows well,
- TCH is favored for vadose zone treatment, sites with multiple interbedded layers, deep sites, and when stringent remedial objectives must be met. Due to its simplicity and economy of scale, it is often the choice for complex and/or large sites.
- Fractured bedrock requires heating of both the matrix blocks and the fractures. TCH works for all rock types, ERH works when the rock is porous and wet. SEE is used to heat the major fractures and to limit groundwater cooling.
- When SVOCs must be treated to stringent soil standards, TCH is the only applicable technology.

Several examples of good fits and bad fits of technologies will be presented. The presentation will finish with a key list of critical site features every client or consultant should be aware of, when engaging thermal experts and seeking the best solution. It is far more economical to face these challenges prior to selection of the thermal technology.