In Situ Thermal Remediation - Isn't it cheaper to dig it up?

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TRS is on a quest to reduce the cost of thermal remediation.

A core part of every TRS thermal remediation project is cost optimization through value engineering. TRS believes we have an obligation to look for better and lower cost solutions to accomplish our clients' goals. While thermal remedies routinely reduce contaminant concentrations by 99+%, we realize that clients may have lower cost options. For example, if you have a small treatment volume, excavation and off-site disposal may be less expensive than thermal remediation. Where is the cut-off? How much dirt do you have to dig before it would be more economical to do in situ thermal remediation?

How does a thermal remediation approach differ from excavation?

The major differences between the strategies are summarized in the table below and further discussed in the paragraphs that follow.

Considerations	Excavation and Off-site Disposal/Treatment	In Situ Thermal Remediation
Probability of volume growth	High – downward smearing and sidewall sampling	Low – thermal treatment volume is delineated first
Need for shoring or sheet-piling	For deep sites and near structures, and for dewatering	Not required
Buildings and utility lines	Must be demolished	Treatment below and around
Fugitive emissions	High risk unless a tent is used	Low risk, drill cuttings containerized or drummed
Transportation of the waste	Yes – to treatment facility and later for disposal	No
Exposure to the contaminants	High – excavation and handling	Low - contained
Off-site treatment or disposal	Yes	No
Liability removed	Maybe – depends on final treatment	Yes
Energy usage	High – includes transport and final treatment	Medium to high – just the energy to treat

Table 1. Comparison of in situ thermal remediation and excavation with off-site transportation, disposal, and treatment

For large volumes thermal remediation is the low-cost option.

For large volumes, thermal remediation compares favorably to excavation because:

- Eliminating excavation reduces impacts to active facilities and exposure to the contaminants.
- The costs of shoring, sheet-piling, and dewatering are avoided for deep sites and sites with shallow groundwater.
- Transportation to a treatment facility is avoided.
- Thermal treatment in situ occurs at lower temperature than off-site thermal destruction, uses less energy, and reduces potential exposure and release pathways.

A few recent projects illustrate this:

- An industrial client estimated it would cost $10 million to excavate a 40-foot deep PCE source zone in upper New York State. The treatment volume was 9,800 cubic yards (cy). Applying in situ heating, the client spent less than $5,000,000 (Heron et al. 2016).
- A developer saved approximately half of the cost of excavation by treating a 122,300 cy DNAPL source area thermally (Heron et al. 2015).

Generally, thermal remediation costs less than excavation for volumes above 3,000 cy. Additional analyses on the volume cut-off are provided below. For very shallow contamination where heat losses are high, the cut-off is usually lower.

The distance to a treatment or disposal facility is a key parameter.

The cost to drive truckloads of contaminated dirt to a treatment or disposal facility is about 25 cents per ton-mile. For a typical truckload of 16 cubic yards, which is about 20 tons, the trucking cost is about $4 per mile. Thus, transporting 1,000 cy of material 1,000 miles would cost approximately $250,000. If your site is far from a facility that will accept the waste, in situ thermal remediation may become more favorable, even at volumes less than 3,000 cy. Crownover and Oberle (2010) discussed the details of this comparison.

If it is a small project and you can dig it up, do just that.

If excavation is practical, treatment volumes under 1,000 cubic yards are not thermal remediation candidates. In general, thermal projects involve enough planning, design, and equipment to make it difficult to treat a site for less than $500,000. Excavating and off-site disposal or treatment of small volumes likely will cost less than thermal remediation. Figure 1 illustrates the relationship between treatment volume and cost for a typical TCE source zone site with treatment to 40 feet below ground surface (ft bgs).

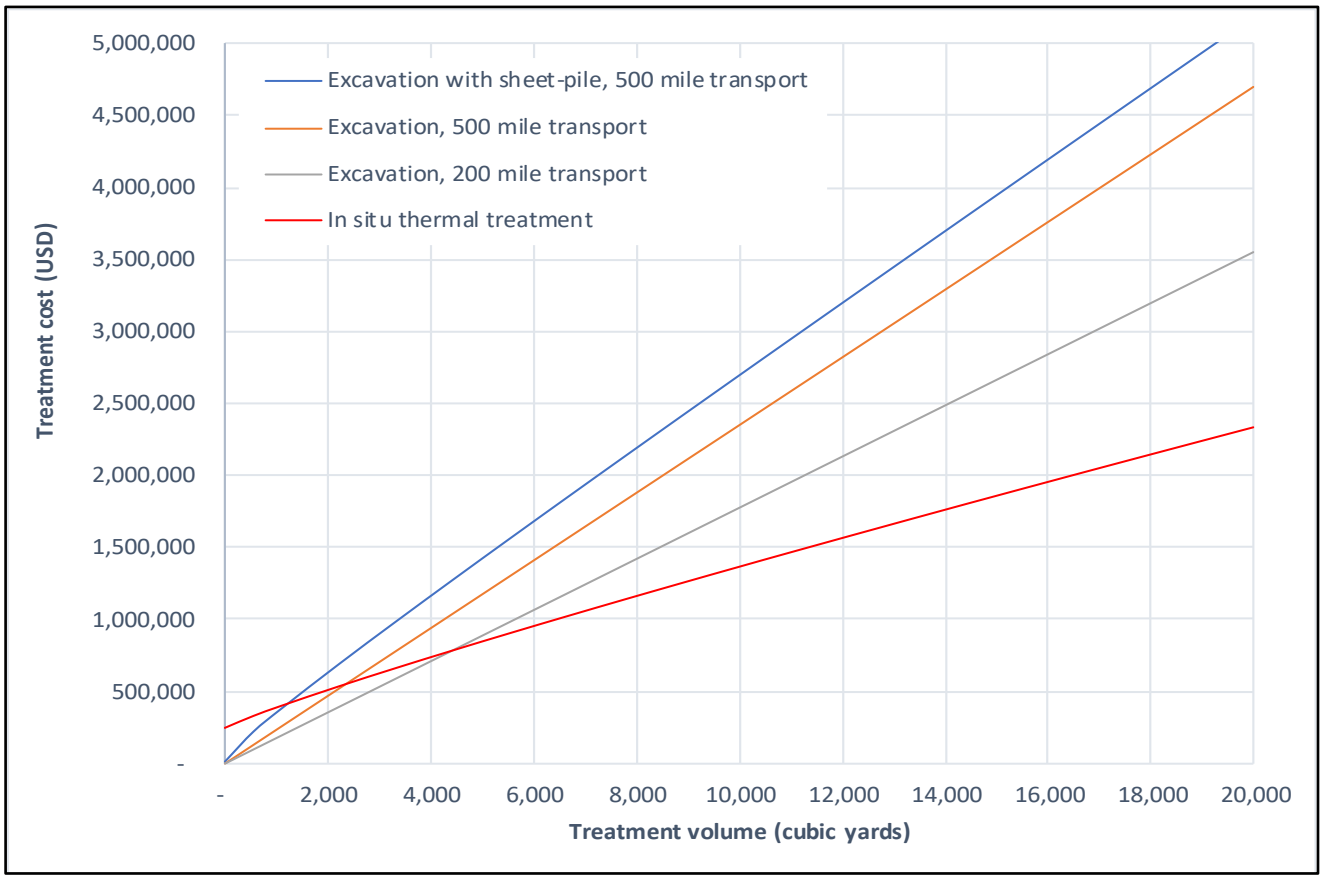

Figure 1. Estimated treatment costs as a function of final volume for a typical TCE site with treatment to 40 ft bgs. Assumed disposal and excavation costs are $100/cy and $15/cy, respectively.

When liability matters, complete treatment is preferred.

Some facilities, such as landfills, accept waste at modest fees; however, they do not destroy the contaminants. The ownership of the liability remains with the waste generator and future costs to treat it are possible. Many companies prefer eliminating the liability, even if it increases costs. Thermal remediation systems include fluid (gas and liquid) treatment, such as thermal oxidizers or activated charcoal, which is subsequently incinerated, destroying the contaminants.

Volume growth during excavation is common.

Excavation volumes tend to grow, with attendant cost increases. Growth can be caused simply by the contaminated volume being larger than expected, as confirmed by side-wall samples collected during treatment. Additionally, downward smearing of DNAPL can cause the excavation depth to grow. Clients tell us that excavation volumes routinely double from initial estimates, making the cost comparisons with thermal remediation difficult. A major advantage of thermal remediation is the treatment volume is defined before design. Thus, volume growth is rare.

The cost certainty of thermal remediation is an attractive feature. Even with scope adjustments, most thermal projects finish with costs less than 10% higher than the estimate.

Buildings and infrastructure can complicate excavation.

TRS has treated many small sites where excavation was impractical due to the presence of buildings or other structures. We have safely treated near utility lines, under concrete floor slabs, and near foundations. An example is shown in Figure 2. By avoiding demolition of buildings, thermal remediation may be economical for small volumes.

Figure 2. Thermal remediation under an active manufacturing facility.

For sites in the grey zone, get a quote.

We are happy to evaluate thermal remediation options and provide cost estimates. Please feel free to reach out to us at info@thermalrs.com.

References

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Author Biographies

Gorm Heron, Ph.D. – As TRS's Chief Technology Officer, Dr. Heron focuses on technology selection, development, and optimization. Additionally, he supports domestic and international business development.

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