Why is Site Remediation So Darn Expensive?

By Stephen E. Fauer
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The full scope and cost of environmental remediation are sometimes difficult to predict and can be expensive. Depending upon site conditions, costs can accelerate over the course of a project. In fact, even when ESA implements a remedial project with exquisite precision and the utmost frugality, some clients are unhappy. Occasionally, I am asked, "Why is site remediation so darn expensive?" This month's e-newsletter addresses this sensitive and very important subject. Note: For simplicity, all comments in this article pertain to organic forms of contamination.

When scoping a remedial project, the first consideration is the adequacy of the site investigation. Each site investigation must answer a series of fundamental questions to fully characterize the site. The next consideration is which remedial technology makes the most sense? The answer is derived by examining a wide array of factors and variables. And, before we decide, ESA always incorporates client feedback to ensure that our decision conforms with their wishes to the extent it is possible and practicable. The third consideration is time. Specifically, how much field-time is required to have an effective cleanup? Typically, projects executed in less time cost less. Sometimes, aggressive schedules can save money by incurring less field time. The fourth issue is access. How much room is available for the necessary workers and equipment? Restricted site access escalates costs. Because each of these four issues tend to compete with one another, the quality of each site investigation becomes critical.

Most remedial projects are driven by impacted soil or groundwater. In general, it is often easier and less expensive to address impacted soil versus impacted groundwater. The most expensive remedial projects usually fall into one of the following four categories:

1. Groundwater;
2. The excavation, transportation, and disposal of thousands of tons of impacted soil;
3. Impacted soil that lies beneath a house or other permanent structure; or
4. Some combination of the above.

Groundwater Issues

Remediation of impacted groundwater is complicated. When organic impacts reach the groundwater, the groundwater quality must be fully characterized. Thorough groundwater characterization answers the following questions:

1. What chemicals are present and in what amounts?
2. Are there any concentrated pockets of chemical in the soil or pools of chemical in the groundwater?
3. What is the horizontal and vertical extent of the impacts?
4. In what direction does the groundwater flow?
5. What is the groundwater quality as it exits the site?
6. What is the quality of the groundwater as it enters the site?

A sufficient number of wells are needed to address items 1-5 (the answer to item No. 6 may not require a well). A minimum of three monitor wells is required to determine the direction of groundwater flow. Vertical delineation of groundwater requires, at a minimum, one additional monitor well. After groundwater flow direction is defined, additional downgradient monitor wells may be required to determine the impact's horizontal extent. Therefore, the initial number of monitor wells can number four or more. Each monitor well can cost $2,500 - $4,000 or more. Each well must then be sampled, usually on a quarterly basis. Thus, you can see how investigative costs can escalate even before remediation begins. And remember, these wells need to be sampled quarterly, usually for the life of the project. In addition, each quarterly sampling event is accompanied by a brief report. In this fashion, costs continue to mount and the groundwater project seems to take on a life of its own.

Remedial design begins after the groundwater has been fully characterized. There are many groundwater remedial technologies from which to choose. Here are a few considerations regarding the selection of the preferred remedial technology:

1. It must effectively treat the target compound(s).
2. The geology in which the impacted groundwater is present must lend itself to the selected technology. Groundwater impacts in bedrock are always more difficult to remediate.
3. Less operations and maintenance of the remedial system means that costs will be lower.
4. How intrusive is the selected remedial system, and does the site allow for the installation of the selected system? Some systems are simply more compact than others.
5. Will the selected system enable the owner/operator to continue their operations?
6. Is the organic contamination dissolved in the groundwater, or do pockets (pools) of free product exist?
7. Are the contaminants lighter or denser than water? Generally speaking, denser-than-water contaminants are much tougher to remediate and therefore more expensive to clean up.

After these considerations have been addressed, one can identify likely remedial technologies and then begin to winnow them down to two or three technologies that make the most sense.

Soil Issues

In general, soil impacts are easier to address than groundwater impacts. The most common remedial method is excavation and disposal of impacted soil. In almost all cases, this is the fastest, least expensive, and most certain form of remediation. When impacted soil is gone, it's gone! Clear site access and the absence of obstructions often means that impacted soil can be removed with relative ease and for a reasonable price. An obstruction, by the way, can be a house or other structure, a fence, air conditioner, transformer, underground utilities, bedrock, a street or highway, etc. Projects become dramatically more expensive and time consuming when access to impacted soil is impeded.

There are two customary ways to address impacted soil that exists beneath a building: physical removal and in situ[1] remediation. Soil can be excavated from beneath a structure after an engineer-designed structural support system has been installed. Additionally, now may be the time to examine closely the practicality of using an in situ remedial technology (structural support is probably unnecessary when an in situ method is used). The two most commonly used in situ methods are bioremediation and oxidation.

Bioremediation involves the use of bacteria that actually "eat" the organic contaminant(s). It is important that the bacteria fully metabolize the contaminants because incomplete metabolization can produce deleterious byproducts.

In addition, there are many ways to effect bioremediation. In general, bioremediation works well when the following conditions are present: the soil texture is sufficiently permeable to allow the bacteria/nutrient-laden solution to penetrate and permeate the impacted zone (this method does not work well in clay soil), the concentration of the target contaminant is not too high (meaning that the concentration of the target compound is not toxic to the bacteria), and the client has the luxury of time to allow this process to work. Bioremediation can take anywhere from six months to several years to complete.

Oxidation is another excellent methodology. This technique requires the addition of an oxidizing agent (there are several from which to choose). It is critically important that the oxidizing agent directly contacts the organic contaminants. When full contact does not occur, pockets of residual impacts can remain. Accordingly, when oxidation is contemplated, the up-front investigation must be more rigorous than usual so the extent of the impacted soil is fully identified. Oxidation can also become highly exothermic (i.e., generates heat). Unless great care is exercised, an out-of-control oxidative chemical reaction can "explode" up to the surface. Therefore, the people

[1] i.e., “in the natural or original position”

applying this technology must be highly experienced practitioners. One important advantage of oxidation (when correctly applied) is that it will destroy large pockets of pure concentrated contaminants; something that bioremediation cannot do readily.

A Word About Site Closure

ESA strives to gain administrative closure of each remedial project as swiftly as possible. Closure can take one of several paths. In New Jersey, LSRPs confer closure by issuing a Remedial Action Outcome (RAO) that can be conditional or unconditional. Conditional closure enables responsible parties to leave behind concentrations of impacted soil or groundwater that are above the cleanup standards. This closure mechanism is used on many remedial projects.

Conditional closure of soil remediation is done via establishing a Deed Notice whereby elevated levels of impacted soil can remain in place conditioned upon two criteria: establishing both engineering and institutional controls for the affected area. The first is recording a Deed Notice document (i.e., an attachment to the property deed defining the affected area. This satisfies the institutional control criteria). The second is the installation of a physical barrier that ensures no one will come in contact with the impacted soil. Capping of the area with an impervious cap (i.e., a building, parking lot, clay cap, etc.) satisfies the engineering control requirement). Utilizing a Deed Notice as a remedial measure also requires that some sort of financial assurance be established to ensure that the "cap" will be maintained. Furthermore, a biennial certification must be submitted to the NJDEP, demonstrating that the "cap" remains protective (i.e., it is secure and intact).

The conditional closure mechanism for groundwater remediation projects is known as a Classification Exception Area (CEA). A CEA requires continual groundwater monitoring (typically on a quarterly basis) to verify that the groundwater quality shows a consistently decreasing concentration trend. Similarly to conditional soil RAOs, the establishment of a CEA requires the submission of a biennial certification for groundwater to ensure groundwater impacts are continuing to degrade and that no receptors are in danger of being impacted.

Unconditional closure will be granted if soil or groundwater impacts are remediated (or naturally attenuated) to below standards. Because this is often deemed too expensive to achieve, the conditional closure mechanism is often selected.

A Final Word

The most important thing anyone can do is to avoid remediation. While that may sound trite, some remediation’s are avoidable! Ensure that your home or business is following sound common sense practices. This may require, at the very least, a conversation with an environmental professional and possibly a site visit by that professional. An ounce of prevention is still worth a pound of cure. Sometimes people will spend a million dollars on a property yet fail to see the value of spending a few thousand dollars on proper due diligence.

Proper and appropriate due diligence performed prior to purchasing a new home or commercial/industrial property is critically important. Homeowners should not buy homes with underground storage tanks (USTs) until they have been assured that the tank system is either not leaking and is sound, or that the UST has been properly closed[2] or preferably removed. The buyer's attorney must address this and other items with proper language in the contract of sale. Commercial and industrial properties can potentially harbor a wider variety of vestigial issues. Sadly, I am still privy to stories about people who purchased such properties and failed to retain their own environmental professional to perform due diligence. Due diligence performed for another owner or a financial institution is NEVER a substitute for performing one's own due diligence. Is this a redundant cost? Not if your consultant finds something that protects you from an expensive and avoidable financial liability! Ask yourself: is it worth it to spend a few thousand dollars to protect an important expensive asset?

It is beyond the scope of this essay to address every remedial scenario. Therefore, some readers may find that their questions remain unanswered. So... this may be a good time to call ESA. We will answer your questions immediately to facilitate a fuller understanding of this important and complicated subject.

Regards,
Stephen E. Fauer

[2] Some homeowners tell ESA that their UST is closed in place. Some statements that I frequently hear from homeowners include, “We used a certified tank company” or “The town engineer/inspector was on site and approved the work.” Sadly that is all meaningless because, in ESA’s experience, most in-place UST closures (while performed legally) were improperly performed. This means that most closed-in-place USTs still pose a potential environmental hazard and therefore remain potential environmental liabilities that must be addressed. These “closed” USTs can complicate (or ruin) a real estate deal if you address them when you are ready to sell your home. If at all possible, address these potential liabilities now.