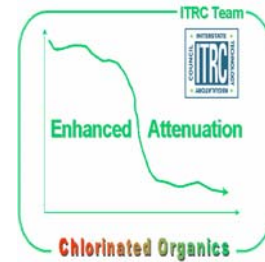




Enhanced Attenuation – Fact Sheet

Interstate Technology and Regulatory Council
Enhanced Attenuation: Chlorinated Organics (EACO) Team



Enhanced Attenuation – A Solution to a Common Groundwater Remediation Problem

- Many cleanup sites require a combination of remedies over time. A source removal action is often combined with active groundwater plume treatment, such as pump-and-treat, and ultimately monitored natural attenuation (MNA). A major challenge in this sequence is determining how and when to transition from more active treatments to MNA or, conversely, when to intervene at a site in MNA. Sites can get “stuck” in the process, delaying achievement of long-term groundwater cleanup goals.
- Enhanced Attenuation (EA) is a plume remediation strategy to achieve groundwater restoration goals by providing a “bridge” between source zone treatment and MNA and/or between MNA and slightly more aggressive methods. EA provides an organized, scientific, and disciplined approach to implement treatment technologies at appropriate sites and at appropriate times. Various remediation technologies can be designed to reduce the source flux and/or increase the attenuation capacity/rate in the plume to assure the plume will stabilize and shrink.
- While MNA is based on natural attenuation processes with “no human intervention,” EA adds human intervention to boost existing attenuation processes. This intervention enables less energy-intensive attenuation processes to achieve cleanup goals where natural attenuation processes are insufficient to reach those goals in the required timeframe.
- **Specifically, the EA strategy combines:**
 - **Detailed knowledge, investigation, and monitoring of a site’s natural processes and plume behavior.** As with MNA, EA requires a design basis, documentation, monitoring, and contingency plans in case the system does not perform as expected. The EA approach is consistent with MNA, but in addition, provides a supplementary toolbox to support evaluation of remediation metrics and overall progress. Compared to MNA, EA requires expanded use of deterministic models to project future plume behavior, plume response to potential enhancements, and the response of natural attenuation processes.
 - **Remediation technologies with enhancements.** Most existing remediation technologies can be used to support the EA strategy. These technologies range from methods that reduce contaminant releases from the source area to methods that increase the attenuation rate of contaminants in the entire system. The important feature is that they are designed and implemented according to mass balance principles.

Benefits of Enhanced Attenuation

The consensus view of the ITRC EACO Team is that EA may encourage systematic environmental solutions that are creative, effective, and efficient.

- **Enhanced Attenuation facilitates transition of contaminated sites through the remediation process.** Many sites require a combination of remedies over time (*i.e.*, treatment-train approach). Implementing EA using the concepts of plume stability and mass balance facilitates the transition of the site to MNA, especially for sites with ongoing active treatment and for sites where plumes are currently nearing stability. (Figure 1).
- **Enhanced Attenuation complements MNA and expands remediation opportunities.** Using a tailored intervention approach, successful EA strategy enables sites to realize some of the benefits of MNA. The type of intervention technology will be dependant on site-specific information.
- **Enhanced Attenuation encourages energy efficiency and developing the best solutions for the environment.** Deploying EA technologies results in naturally sustainable treatments that require less energy and investment to reach environmental cleanup goals. As a result, sustainable treatments are often less intensive, less expensive, and less disruptive to property and the environment, and can potentially reduce the time required to cleanup the site. These naturally sustainable treatments can be implemented to reduce residual contamination in source treatment areas as well as contaminants in the associated subsurface groundwater plume.

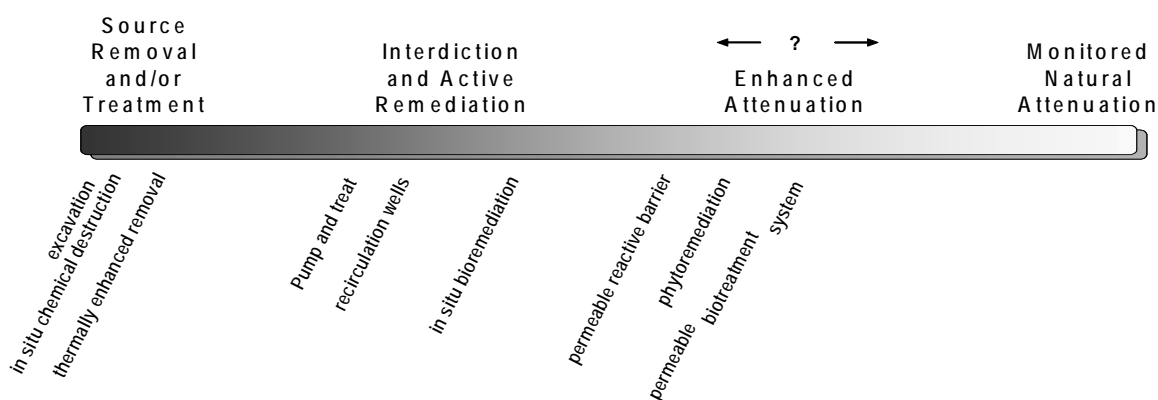


Figure 1. Transition to sustainable technologies using naturally available processes.

For more information on the EA concept and technologies, please contact:

ITRC Web Site: <http://www.itrcweb.org/homepage.asp>

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