Community Guide to Monitored Natural Attenuation

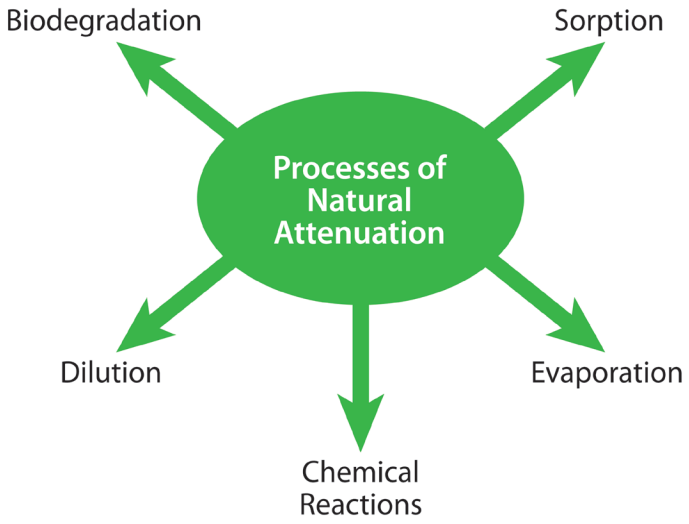
What Is Monitored Natural Attenuation?

Natural attenuation relies on natural processes to decrease or "attenuate" concentrations of contaminants in soil and groundwater. Natural attenuation occurs at most contaminated sites. However, the right conditions must exist underground to clean sites properly and quickly enough. Scientists monitor these conditions to make sure natural attenuation is working. Monitoring typically involves collecting soil and groundwater samples to analyze them for the presence of contaminants and other site characteristics. The entire process is called "monitored natural attenuation" or "MNA."

How Does It Work?

When the environment is contaminated with harmful chemicals, nature may work in several ways to clean it up:

- **Biodegradation** occurs when very small organisms, known as "microbes," eat contaminants and change them into small amounts of water and gases during digestion. Microbes live in soil and groundwater and some microbes use contaminants for food and energy. (See *Community Guide to Bioremediation*.)



- **Sorption** causes contaminants to stick to soil particles or rock surfaces. Sorption does not destroy the contaminants, but it keeps them from moving deeper underground or from leaving the site with groundwater flow.
- **Dilution** decreases the concentrations of contaminants as they move through and mix with clean groundwater.
- **Evaporation** causes some contaminants, like those from gasoline and industrial solvents, to change from liquids to gases within the soil. If these gases escape to the air at the ground surface, air will dilute them and sunlight may destroy them.
- **Chemical reactions** with natural substances underground may change contaminants into less harmful forms. For example, in low-oxygen environments underground, the highly toxic "chromium 6" can be converted to a much less toxic and mobile form called "chromium 3" when it reacts with water and naturally occurring iron.

MNA works best as the last step in the cleanup process when contaminant concentrations are low. For instance, the source of contamination, like buried drums of waste, would be first dug up and disposed of properly. The most highly contaminated soil and groundwater would be treated to lower contamination levels. Natural processes then may remove the remaining, smaller amount of contaminants in the soil or groundwater. The site is monitored regularly to make sure contaminants are not spreading and that they attenuate fast enough to meet site cleanup objectives.

How Long Will It Take?

MNA may take several years to decades to clean up a site. The cleanup time will depend on several factors that vary from site to site. For example, even after the more contaminated areas are cleaned up, MNA will take longer where:

- Contaminant concentrations are higher.
- The contaminated area is large.
- Site conditions (such as temperature, groundwater flow and soil type) provide a less favorable environment for MNA.

Is Monitored Natural Attenuation Safe?

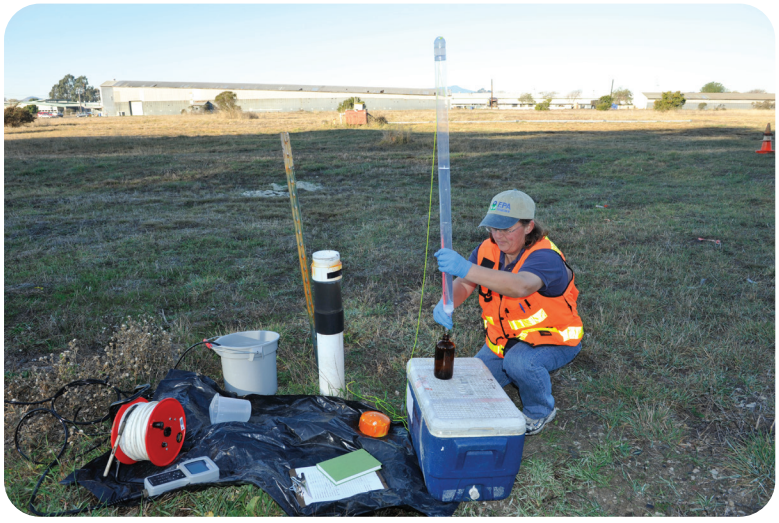
MNA does not pose a threat to the community or to site workers. MNA does not involve excavating soil or pumping groundwater to the surface for aboveground treatment, so the potential to contact contaminants is limited. Regular monitoring is conducted to make sure contamination does not leave the site and that contaminant concentrations are decreasing at a rate that's consistent with cleanup goals for the site.

How Might It Affect Me?

Generally, MNA does not cause much disruption to the surrounding community since it does not require any heavy machinery or other equipment. You may initially see and hear drilling rigs when wells to monitor groundwater quality are installed. Workers will need to visit the site to collect samples of groundwater, soil or sediment to ensure MNA is working properly and is protective of human health and the environment. At those times, you may hear pumps or generators used to collect groundwater samples from wells or drill rigs to collect soil samples.

Why Use Monitored Natural Attenuation?

MNA is usually selected when contaminant sources have been removed and only low concentrations of contaminants remain in soil or groundwater. MNA requires less equipment and labor than most methods, which decreases cleanup costs. However, the cost of many years of monitoring can be high. MNA has been selected for use at hundreds of Superfund sites and other cleanup sites across the country.



Monitoring natural attenuation at a site by collecting a groundwater sample.

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Example

MNA was used to complete groundwater cleanup at the Mannheim Avenue Dump Superfund site in New Jersey. The dump received municipal and industrial wastes for nearly 20 years, which contaminated groundwater with the solvent tricholo-roethene (TCE) and other chemicals.

As a first step, drums, sludge and other sources of contamination were removed from the dump. A pump and treat system was installed in 1994 to remove the volatile chemicals from groundwater, and the treated water was injected back underground. After 18 months, the system was shut down and MNA was conducted to remove the remaining low levels of TCE. By 2002, levels of TCE in all monitoring wells were below the cleanup level. The site was deleted from the National Priorities List in 2007.

For More Information

- About this and other technologies in the Community Guide Series, visit: https://clu-in.org/cguides or https://clu-in.org/remediation/
- About use of cleanup technologies at a Superfund site in your community, contact the site's community involvement coordinator or remedial project manager. Select the site name from the list or map at http://www.epa.gov/superfund/sites to view their contact information.