Community Guide to Phytotechnologies

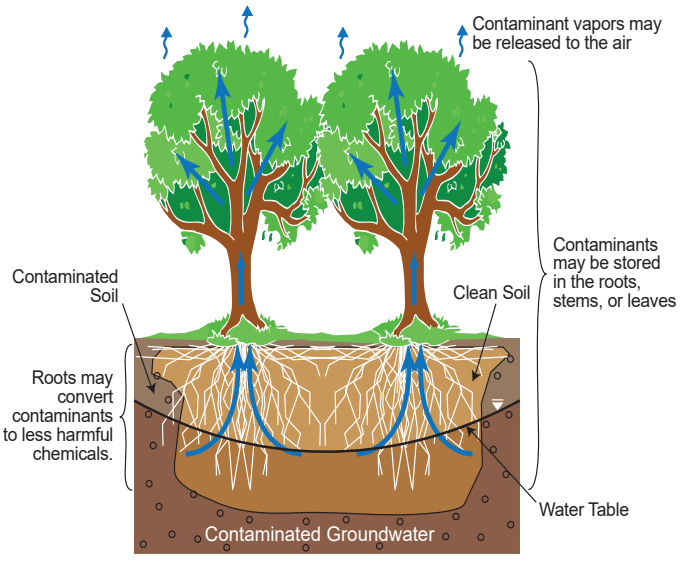
What Are Phytotechnologies?

Phytotechnology uses plants to clean up or contain many types of contaminants in soil, sediment and water, including solvents, metals, pesticides, explosives and oil. Plants either **degrade** (break down) contaminants or **bind** (stick) them in place. Plants also provide "hydraulic control," which means they prevent water from moving contaminants deeper underground or to surrounding areas. Examples of phytotechnologies include **phytoremediation**, **evapotranspiration (ET) covers** (see *Community Guide to Evapotranspiration Covers*), **hydraulic control**, and **constructed wetlands**.

How Does It Work?

Plants take in water and nutrients from soil, sediment or groundwater. During this process, certain plants can clean up contaminants by:

- Storing the contaminants in their roots, stems or leaves.
- Converting them to less harmful chemicals within the plant or, more commonly, the root zone.



Different ways phytotechnologies clean up contamination.

- Converting them to vapors, which are released into the air.

Plants are often used for hydraulic control to slow the movement of contaminated groundwater and reduce the size of the contaminated plume. Trees pump groundwater up through their roots, which keeps the groundwater and contaminants from moving.

Wetlands can be constructed to treat contaminated surface water and runoff. The area is planted with water-loving vegetation typical of existing wetlands in the area. Contaminants can be degraded by the plants, stored in the root zone or converted to vapors.

Certain plants are better than others at removing or containing contaminants. Plants must be able to grow and survive in the local soil and climate and survive contact with the contaminants. Depth of contamination is another factor. Small plants like ferns and grasses have been used where contamination is shallow. Because tree roots grow deeper, trees such as poplars and willows are used for hydraulic control or to clean up deeper soil and groundwater contamination.

How Long Will It Take?

Phytotechnology may take several years to achieve cleanup goals at a site. Plants need time to grow to be effective. Plant growth rate depends on the length of the growing season, soil type and water availability. The cleanup time will depend on several factors that vary from site to site. For example, phytotechnology will take longer where:

- The contaminated area is large or deep.
- Plants that have a long growing time are used.
- The growing season is short.

Plants may have to be replaced if extreme weather, pests or animals damage them. This also will add time to the cleanup. When used for hydraulic control, trees may need to be in place for many years.

Are Phytotechnologies Safe?

Phytotechnologies can be a desirable method for cleaning up or containing low levels of contamination. Fences and other barriers keep wildlife from feeding on contaminated plants. Under some conditions, plants may release chemical vapors into the air. If there is a potential for vapors, workers sample the air to make sure the plants are not releasing harmful amounts.

How Might It Affect Me?

Planting causes little disruption to your community. Equipment may be needed to grade or till the soil, or to plant trees and large shrubs. You may hear equipment noise or detect an odor if fertilizer is added to the soil. Any airborne dust is minimized by watering down the soil.

Plants make a site more attractive. The use of native plants is encouraged and can create attractive habitats for birds and other wildlife.

Why Use Phytotechnologies?

Phytotechnologies are popular for many reasons. They take advantage of natural plant processes and require less equipment and labor than other methods since plants do most of the work. The site also can be cleaned up without digging up and hauling soil or pumping groundwater, which saves energy. Trees and smaller plants help control soil erosion, make a site more attractive, reduce noise, improve surrounding air quality, and restore lands damaged by contamination. Phytotechnologies have been selected for use at dozens of Superfund sites and other cleanup sites across the country.

Poplar trees at a phytotechnology site.

Example

Phytotechnology is being used to clean up contaminated groundwater near a former disposal area at the Aberdeen Proving Ground in Maryland. This area was used for disposal and burning of industrial and warfare chemicals from 1940 through the 1970s. Chemicals used as industrial degreasers and solvents were a particular problem in the groundwater.

Sources of the contamination were removed from the disposal area. In 1996, 182 poplar trees were planted to remove remaining low levels of groundwater contaminants and break them down in the root zone. Additional trees, including types native to Maryland, have been planted since then to replace damaged and dying trees. The trees are routinely inspected and fertilized to maintain health and growth.

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.