Community Guide to Vertical Engineered Barriers

What Is A Vertical Engineered Barrier?

A vertical engineered barrier, or "VEB," is a wall built below ground to control the flow of groundwater. VEBs may divert the flow direction of contaminated groundwater to keep it from reaching drinking water wells, wetlands or streams. They also may contain and isolate contaminated soil and groundwater to keep them from mixing with clean groundwater. VEBs differ from permeable reactive barriers in that they do not clean up contaminated groundwater. (See *Community Guide to Permeable Reactive Barriers*.) However, VEBs are often used together with cleanup methods that treat the isolated soil or groundwater.

How Does It Work?

VEBs are made of impermeable or slightly permeable materials, which means they are dense enough to prevent or decrease the flow of water and contaminants through the wall. A slurry wall is the most common type of VEB. It is constructed by digging a trench, usually 2 to 4 feet wide, with a backhoe or long-reach excavator. The trench is filled with slurry made by mixing soil with water and clay. A type of clay called "bentonite" is used most often because it expands when wet to fill gaps or holes. Cement may be added to make the slurry wall stronger. The slurry dries and hardens to form a wall.

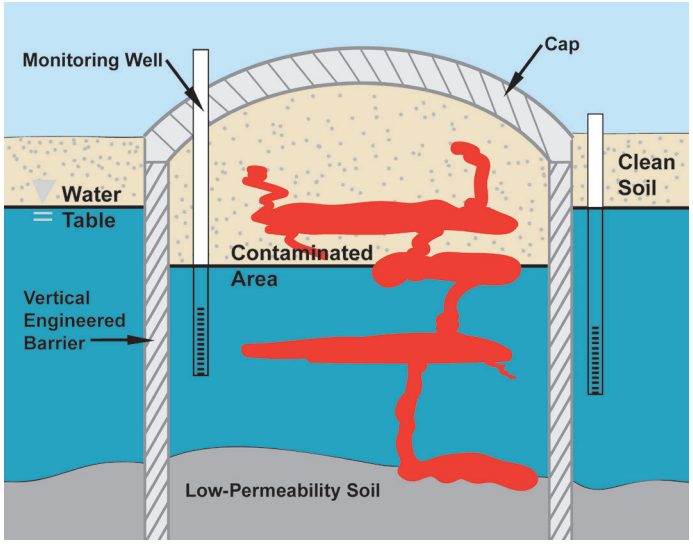

Illustration of a VEB containment system around a contaminated area.

A VEB also can be constructed using sheet pilings made of large sheets of steel, vinyl or other materials. Sheet pilings are linked together at their edges, and equipment hammers, vibrates or pushes the pilings into the ground.

Where possible, the bottom of the VEB is keyed into a low-permeability layer of soil or bedrock. This means the bottom of the wall extends several inches into this soil layer or to the top of the bedrock, which keeps groundwater from seeping beneath the wall. A protective cap may be installed over the VEB to prevent damage from vehicle traffic or other activities. A larger cap made of clay or other impermeable material often is placed over the entire contaminated area enclosed by the VEB to prevent rainwater and snowmelt from entering. (See *Community Guide to Capping*.)

Even when surrounded by a VEB and cap, contaminated groundwater may build up in the enclosed area or move outward through small openings in the VEB. To prevent this, wells are drilled within the isolated area to pump out groundwater. Contaminated groundwater that has been pumped to the ground surface usually will require treatment.

The VEB, cap and pumping wells are maintained and monitored to ensure the contaminated area remains isolated and that contaminated groundwater does not spread to clean areas.

How Long Will It Take?

Building a VEB may take several days to several months. The length of construction time will depend on several factors that vary from site to site. For example, construction of a VEB will take longer where:

- The contaminated area is large or deep.
- Soil is hard or rocky, which makes it hard to dig a trench or install pilings.
- The required VEB is wide or deep.

VEBs may need to stay in place as long as soil and groundwater are contaminated.

Is A Vertical Engineered Barrier Safe?

The materials used to construct VEBs generally pose little risk to people or the environment. VEBs are effective at keeping contaminated groundwater from flowing toward clean areas. A VEB will continue to be protective as long as it is properly inspected and maintained. VEBs and the groundwater are monitored to make sure that there is no damage to the wall and that contaminants are not moving to other areas.

How Might It Affect Me?

You may notice increased truck traffic as materials are brought to the site. You might also hear backhoes, pile drivers or other equipment during construction of the VEB. If sheet pilings are hammered or vibrated into place, you might feel some vibration. If buildings or people are nearby, monitoring can be conducted to make sure noise and vibration levels do not exceed limits. Workers often use equipment that causes as little noise and vibration as possible. Workers will need to access the area for VEB maintenance and repairs or to collect groundwater samples to ensure the VEB is working. At sites where groundwater is being removed and treated, workers may be present for longer periods of time.

Why Use A Vertical Engineered Barrier?

VEBs may be selected at sites where cleanup of contaminated groundwater is difficult and expensive or cannot be completed before contamination spreads to areas where people or wildlife can come in contact with it. VEBs can be less expensive to build and maintain than other types of technologies, especially in large contaminated areas. VEBs have been selected for use at dozens of Superfund sites and other cleanup sites across the country.

Installation of sheet piling.

Excavation of a slurry wall trench.

NOTE: This fact sheet is intended solely as general information to the public. It is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation with the United States, or to endorse the use of products or services provided by specific vendors.

Example

Spills of wood-treating chemicals contaminated soil and groundwater at the Taylor Lumber and Treating Superfund site in Oregon. A 2,040-foot long, 2½-foot wide VEB was constructed of bentonite and soil to isolate contaminated groundwater. The VEB encloses a 6-acre area and extends 14 to 16 feet below ground where it is keyed into bedrock. An asphalt cap installed over the VEB and contaminated area protects the VEB from heavy equipment traffic, prevents rainwater from soaking into the area it encloses, and protects people from direct contact with contaminated soil.

As part of the long-term operation and maintenance of the VEB, groundwater is pumped from four wells in the contaminated area to keep contaminants and groundwater from seeping outside the wall. Groundwater outside the VEB is regularly sampled to make sure contaminants remain in the enclosed area and do not pose a threat to human health or the environment.

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.