A Citizen's Guide to Vertical Engineered Barriers

What Are Vertical Engineered Barriers?

A vertical engineered barrier, or "VEB," is a wall built below ground to control the flow of groundwater. VEBs may be used to divert the direction of contaminated groundwater flow to keep it from reaching drinking water wells, wetlands, or streams. They also may be used to 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 *A Citizens Guide to Permeable Reactive Barriers* [EPA 542-F-12-015].) However, cleanup methods often are used together with VEBs to treat the isolated soil or groundwater.

How Do They Work?

VEBs are made of impermeable or slightly permeable materials, which means they prevent or minimize 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 narrow trench, usually 2 to 4 feet wide with a backhoe or long-reach excavator. The trench is filled with slurry, which consists of soil mixed with water and clay. A type of clay called "bentonite" is used most often because it expands when wet to fill gaps or holes in the VEB. Cement may be added to make the slurry wall stronger.

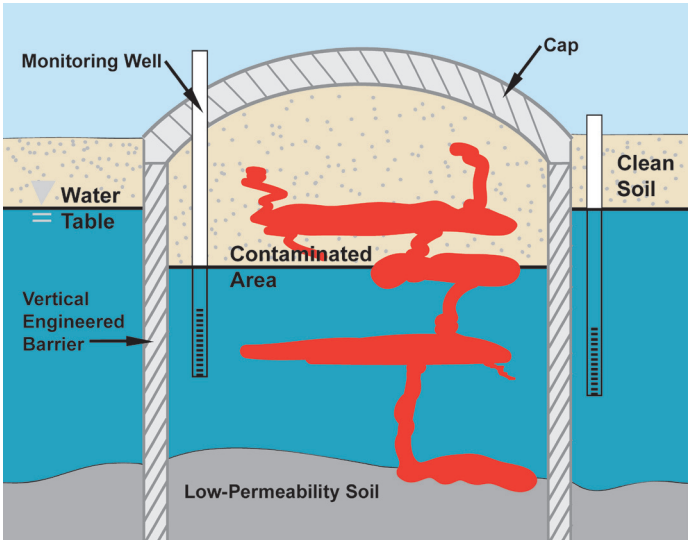

Illustration of a VEB containment system around a contaminated area

A VEB also can be constructed using sheet pilings made of steel, vinyl, or other materials. Sheet pilings are large sheets linked together at their edges to form a wall. Equipment is used to hammer or vibrate the sheets 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 the soil or to the top of the bedrock, which helps to keep groundwater from seeping beneath the wall. A protective cap may be installed atop the VEB to prevent damage from vehicle traffic or other activities. A larger impermeable cap often is placed over the entire contaminated area enclosed by the VEB to prevent rain water and snow melt from entering it. (See *A Citizen's Guide to Capping* [EPA 542-F-12-004].)

Even when surrounded by a VEB and cap, contaminated groundwater may build up in the isolated area or move outward through small openings in the VEB toward clean areas. To prevent this, wells may be 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 anywhere from several days to several months. Construction of a VEB may take longer where:

- The contaminated area is large or deep.
- Soil is hard or rocky.
- The VEB is wide.

These factors vary from site to site. Some VEBs may stay in place permanently.

Are Vertical Engineered Barriers Safe?

The materials used to construct a VEB 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 contaminants are not moving to other areas.

How Might It Affect Me?

Residents near the site may see increased truck traffic as materials are brought to the site. Construction of the VEB may involve backhoes, pile drivers, or other noisy machines. If sheet pilings are hammered or vibrated into place, nearby residents also may feel the vibrations. 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 cause 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 Vertical Engineered Barriers?

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 and wildlife can come in contact with it. VEBs are also helpful in cases where cleanup methods could push contaminants to uncontaminated areas. VEBs typically are less expensive to build and maintain than other types of technologies, especially in large contaminated areas. VEBs have been selected or are being used at dozens Superfund sites across the United States.

Installation of sheet piling

Excavation of a slurry wall trench

Example

Spills of wood-treating chemicals contaminated the 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 a plume of contaminated groundwater. The VEB encloses a 6-acre area and extends 14 to 16 feet below ground where it is keyed into bedrock. A protective asphalt cap installed over the VEB and contaminated area protect the VEB from heavy equipment traffic and prevent rainwater from soaking into the area it encloses.

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

For more information about this and other technologies in the Citizen's Guide Series, visit:

www.cluin.org/remediation
www.cluin.org/products/citguide

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United States Environmental Protection Agency

Office of Solid Waste and Emergency Response (5102G)

EPA 542-F-12-022
September 2012
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