

Community Guide to Granular Activated Carbon Treatment



What Is Granular Activated Carbon Treatment?

Granular activated carbon or “GAC” is a material used to filter harmful chemicals from contaminated water or air. It is composed of granules of coal, wood, nutshells or other carbon-rich materials that have been heated to “activate” the surface of the granules. As contaminated water or air flows through GAC, contaminants sorb (stick) to the GAC surface and are removed. GAC can sorb a wide range of contaminants such as fuel oil, solvents, polychlorinated biphenyls (PCBs), dioxins and other industrial chemicals, as well as radioactive materials. It also sorbs low levels of some types of metals. GAC is commonly used as a treatment step in other cleanup methods. (See the community guides to [In Situ Carbon Amendments for Groundwater](#), [In Situ Sediment Amendments, Pump and Treat](#), and [Soil Vapor Extraction and Air Sparging](#).)

How Does It Work?

GAC treatment typically involves pumping contaminated water or soil vapor through a column or tank filled with GAC. As contaminated material flows through the GAC, the contaminants sorb to the outer and inner surfaces of the granules. The water or vapor exiting the container is cleaner. Sometimes the

water or vapor must be pumped through additional columns or tanks to ensure all contaminants are removed. The water or vapor is tested to make sure cleanup levels are met.

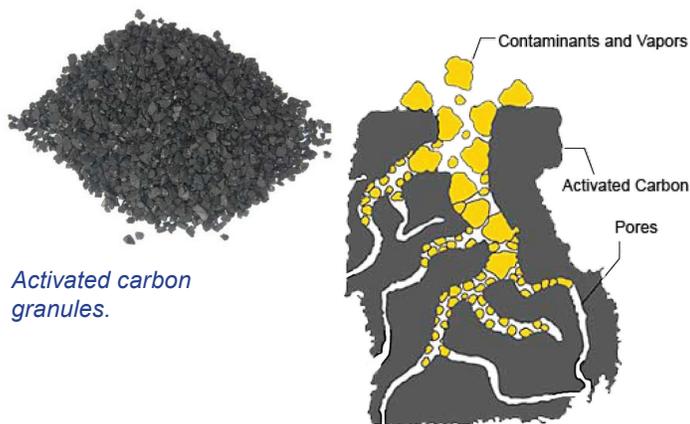
Once air is treated to cleanup levels, it can be released outside. Treated water that meets cleanup levels can be reused or discharged for disposal. Depending on the site, treated groundwater may be discharged to a nearby stream or river or back underground through injection wells or trenches. A sprinkler system can distribute treated water over the ground surface so that it seeps into the soil. The water also may be discharged to the public sewer system or in some cases, reused for other site activities.

GAC needs to be replaced when the available surfaces on the granules are taken up by contaminants and additional contaminants can no longer sorb to them. The “spent” GAC may be replaced with fresh GAC or regenerated to remove the sorbed contaminants. To regenerate spent GAC, it is usually sent to an offsite facility where it is heated to very high temperatures to destroy or remove the contaminants.

How Long Will It Take?

It takes only a few minutes for water or vapors to pass through a GAC filter. However, the time it takes to clean up a site with GAC can take several months or years. The cleanup time will depend on several factors that vary from site to site. For example, GAC will take longer where:

- Contaminant concentrations are high or the source of contamination has not been completely removed.
- The amount of groundwater or soil vapor requiring treatment is large.
- Groundwater cannot be pumped at a fast rate.
- Treatment of groundwater or vapor involves additional cleanup methods.



Contaminants and vapors sorbed to GAC.

Is GAC Treatment Safe?

GAC treatment is similar to that of home water filters and is generally considered safe to use. Treated water and air are sampled and analyzed regularly to ensure that the carbon continues to adequately sorb contaminants. If concentrations start to increase in the treated water or air, the carbon is replaced with clean carbon. The tanks are replaced with care to avoid releasing contaminants. Larger carbon filters are often preferred because they do not have to be replaced as often as small ones. When treatment is complete, spent carbon that contains hazardous contaminants requires special handling and disposal at a hazardous waste facility.

How Might It Affect Me?

You may notice increased truck traffic when construction equipment and materials come to the site, or later, when carbon tanks are exchanged. Construction of the GAC treatment system may be noisy, but operation generally will not disrupt your community as noise levels are low. Depending on the amount of groundwater or vapor that needs to be treated, tanks of activated carbon can range in size from a 55-gallon drum to a tank that is 20 feet tall and 10 feet or more in diameter.

Why Use GAC Treatment?

GAC treatment is the most common approach to treating contaminated groundwater and soil vapor. GAC units can be brought to the site and set up relatively quickly, eliminating the need to transport contaminated water for offsite treatment. GAC has been selected for use at hundreds of Superfund sites and other cleanup sites across the country.



Large groundwater treatment system with five tanks of GAC.



Small groundwater treatment system with two tanks of GAC.

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Example

Disposal of chemical wastes at the Conservation Chemical Company Superfund site in Missouri contaminated the soil and groundwater with solvents, waste oil, PCBs and pesticides. A pump and treat system began operating in 1991 to keep the contaminated groundwater from moving offsite. The pumped water is being treated with a series of cleanup methods. One of the final treatment steps is the use of two columns of GAC to remove remaining contaminants.

Water exiting the columns is sampled routinely for metals and quarterly for PCBs, pesticides and other contaminants to ensure the system is working. The columns are refilled with reactivated GAC when they can no longer remove contaminants adequately. Sampling of groundwater continues to show that the system is protecting human health and the environment. The treated water is discharged to the nearby Missouri River.

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.