



FACT SHEET

Granular Activated Carbon (GAC) Filtration Systems at Petroleum Contaminated Residential Property State Financed Installation and Removal

What is Granular Activated Carbon (GAC)?

Activated carbon is made from materials such as petroleum coke, bituminous coal, lignite, wood products, coconut shell, or peanut shells. Activation is achieved in a process where steam and high temperature contacts with the material, producing a carbon substance with many small pores. The activated carbon is crushed to produce a granular or pulverized product. Small pores in the granular activated carbon (GAC) increase the surface area of the material, allowing certain compounds/contaminants attracted to the carbon to be adsorbed onto the carbon. The efficiency of the adsorption process is influenced by the characteristics of the carbon and the contaminant, as well as the amount of water pumped through the filter.

Different types of carbon remove different contaminants, and no one type of carbon removes all contaminants. Activated carbon filters will not remove microbial contaminants, calcium, magnesium, fluoride, nitrate, and many other compounds that are highly soluble in water. However, most carbon compounds, such as those found in gasoline and oil, are removed effectively.

Types of GAC Systems

The two types of residential GAC filtration systems commonly used are:

- **Point-of-Use (POU) System.** A system, installed either at a tap or underneath a sink, which typically treats cold water used for drinking and cooking. POU systems treat water at a location in the home.
- **Point-of-Entry (POE) System.** A system that treats all water by being connected to the supply line as it enters the home. This system is recommended for most petroleum contaminant situations. This system usually consists of two 2-cubic-foot fiberglass-reinforced GAC filters, 12 -inch diameter by 48-inch height, piped in series with sampling ports installed before the first filter, in-between the two filters, and after the two filters. Once the POE system is installed, a sampling schedule will be set up to collect samples pre-, mid-, and post-filtration. The schedule of sampling is based on the level of contamination and amount of water used in the home. The sampling frequency will be adjusted as a filter history is developed.

Some drawbacks for a home using a GAC unit include pressure decline, staining of water fixtures, and change in taste. These items can normally be addressed through the proper choice of carbon material and system service. We recommend changing or servicing the filters at least once a year to avoid bacteria buildup and ensure proper water pressure is maintained in the home. We further recommend the use of virgin coconut shell carbon as a filter medium.

Criteria for State-Funded GAC System Installation

A residential drinking water well is sampled using EPA Method 524.2 and petroleum concentrations are detected above the federal and State Safe Drinking Water Standard (i.e. MCL). The Maryland Department of the Environment's Oil Control Program (MDE-OCP) reserves the right to request another confirmatory sample to verify contaminant levels. The maximum contaminant level (MCL) for benzene, toluene, ethylbenzene, and xylene (BTEX) and the State's action level for methyl-tertiary butyl ether (MTBE), chemicals commonly detected as a result of petroleum impact, are:

- 5 ppb for benzene
- 1,000 ppb for toluene
- 700 ppb for ethylbenzene
- 10,000 ppb for xylenes
- 20 ppb for MTBE

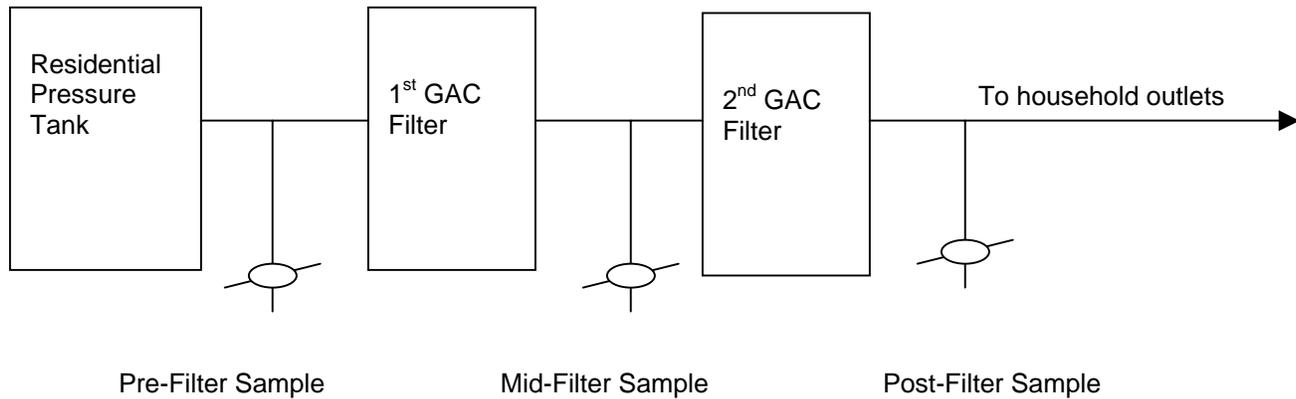
The MDE-OCP will finance the installation of a GAC system provided the residential property is the primary place of residence for the property owner and it is not utilized as a rental property or for commercial purposes. The Department will finance the installation of two 2-cubic-foot carbon filters in series and initiate a schedule to sample water circulating through the GAC system to determine frequency of sampling and efficiency of the filtration system. Sampling and maintenance of the filtration system will be at no cost to the homeowner.

If the residential drinking water well is suspected to be impacted by an on-site activity (e.g. leaking heating oil tank), it will be the responsibility of the property owner to install his or her own treatment system. The Department will continue to investigate the source and extent of the subsurface petroleum impact and ensure that off-site impacts are limited. If off-site impacts are identified, it will be the responsibility of the property owner who caused the subsurface leak to install a filtration system for the off-site drinking water well.

Residential properties meeting the MDE-OCP criteria for a State-funded GAC system will first sign an Access Agreement with the Department. Simply stated, the Access Agreement is a mutual understanding between the Department and the homeowner. The homeowner basically allows the MDE-OCP and/or its contractor access to the residence to install the GAC system and to collect water samples. The Department, in return, maintains the filtration system and returns the property to its original condition upon termination of the filtration system usage.

The MDE-OCP and/or its contractor will initiate a sampling schedule comprised of monthly sampling for the first three months, then sampling every two, three, or four months, depending on analytical results and quantity of water usage. State contractors contact the resident to perform a carbon change when sampling shows that contaminants in the first GAC filter have saturated all pore spaces in the carbon, resulting in what is termed "breakthrough" into the second filter. The second filter acts as a backup to the first filter and will adsorb contaminants moving through the first tank until replacement of the filter has occurred.

Schematic Diagram of a Typical Point of Entry GAC System



GAC System Removal

When the MDE-OCP has determined that a GAC system is no longer required at a residence, the Department will, based on the residents choice, either offer the filtration system to the resident or contract to have the system removed and water piping returned to its original condition. The MDE-OCP will terminate maintenance of a GAC system when one of the following conditions is met:

- Sampling data for residential drinking water for one year has been non-detect for the regulated compounds.
- Sampling data for 18 consecutive months indicate that petroleum constituents are present, but levels have not exceeded the MCL or the State action level for the regulated compound.

If you have any questions about GAC filtration systems, please call the Oil Control Program at 410-537-3443.

Disclaimer:

The intent of this fact sheet is to provide information to the reader. To fully understand the subject, the reader should research additional sources of information. MDE makes no claims to the accuracy of this information and accepts no liability regarding the use or interpretation of this document.