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# ENVIRONMENTAL Fact Sheet

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## Organics in Drinking Water

### Introduction and Occurrence

The term “organics” in this document means compounds that have the element carbon as a principal constituent. Organic compounds can be of many types and have many origins. Some organics in drinking water are caused by the decay of naturally occurring vegetation. These decay compounds are called lignins or tannins. The presence of these compounds, dissolved in water, would be part of the natural environmental condition of that water resource.

A much larger group of organic contaminants are the thousands of manmade organic chemicals, which are commonly grouped into two classes: Synthetic Organic Compounds (SOCs) and Volatile Organic Compounds (VOCs). These groups can be further divided into subcategories that are often more recognized (and more easily pronounced) than the more formal chemical name. These subcategories are given below, along with a few examples of specific contaminants in each subcategory.

1. Industrial solvents, such as trichloroethylene, carbon tetrachloride.
2. Hydrocarbons, such as benzene, xylene, toluene.
3. Pesticides, such as aldicarb and chlordane.
4. Herbicides, such as alachor and silvex.

Another category of organic compounds, per- and polyfluoroalkyl substances (PFAS), have recently been found in New Hampshire’s water. For more information, go to the [NH PFAS Investigation website](#).

All of these contaminant subcategories are manmade and the result of land use or other human activity such as agriculture, manufacturing or improper waste disposal.

### Health Effects

Due to the large number and wide variety of organic contaminants, there are many possible health effects. Some examples include increased risk of cancer, reproductive difficulties, increased blood pressure, liver, kidney or other organ damage, problems with nervous system, and anemia among others.

Health effects for specific organic compounds is provided by the NHDES Environmental Health Program and [USEPA Integrated Risk Information System \(IRIS\)](#)

### Water Quality Standards or Health Advisory Levels

The U.S. Environmental Protection Agency (EPA) regulates some of these contaminants as health risks under the

Safe Drinking Water Act (SDWA). The upper acceptable concentration of regulated contaminants in drinking water is called the maximum contaminant level (MCL). The [MCL concentrations for the organics](#) regulated by the SDWA are available from the USEPA.

New Hampshire has also established state-specific Ambient Groundwater Quality Standards (AGQs) or groundwater cleanup standards for several organic chemicals. By regulation, ambient groundwater quality standards (AGQS) are also considered drinking water standards if a MCL standard has not been developed for a particular compound. A list of New Hampshire AGQS can be found in [NHDES Administrative Rules Env-Or 600](#).

### **Testing**

A certified laboratory can provide a list of SOCs and VOCs regulated in drinking water in New Hampshire.

MtBE, benzene and industrial solvents are the most common volatile organic compounds (VOCs). MtBE and benzene are found in gasoline, and MtBE has been detected even in remote areas.

Tests for pesticides, herbicides or other synthetic organic compounds (SOCs) may be a good idea if your water has elevated nitrite or nitrate concentrations, or if significant amounts of pesticide have been applied near your well.

NHDES recommends that prospective homebuyers test the water in a home with a private well before purchase. Water quality in properly located and constructed wells is generally stable, and if a change is going to occur, it occurs slowly.

The following conditions would call for more frequent testing:

- Heavily developed areas with land uses that handle hazardous chemicals.
- Recent well construction activities or repairs. NHDES recommends testing for bacteria after any well repair or pump or plumbing modification, but only after thorough flushing of the pipes.
- High levels of contaminants found in earlier testing.
- Noticeable changes in the water, such as a change in taste, smell or appearance after a heavy rain, or an unexplained change in a previously trouble-free well.

(Note: NHDES recommends testing private wells for bacteria and nitrate annually and performing the standard and radiological analysis every three to five years.)

### **Treatment & Mitigation**

#### **Abatement of Contamination**

Before beginning evaluations as to what treatment techniques will remove the contaminant(s) of concern, an effort should be first made to identify and abate the origin of the contamination. This can minimize the size of the treatment device and will shorten the period during which treatment will be necessary. Determining the origin of manmade contaminants, particularly in bedrock wells, is difficult. Contact the Drinking Water and Groundwater Bureau at (603) 271-2513 for assistance.

#### **Treatment Options**

(Note: A water treatment system supplier and/or contractor can provide additional information and recommendations for your particular situation. NHDES fact sheet WD-DWGB-7-3, "N.H. Small Public Water Systems Contractors," contains a partial list of water treatment system suppliers and contractors in New Hampshire.)

There are three treatment methods that have been shown to be effective in removing organics from drinking water. They are aeration, adsorption using activated carbon and oxidation.

If the concentration of the contaminant is high, two treatment units (using different methods) are typically installed. The first unit is used to remove the “heavy” contaminant load, while the second provides a “polishing step” to assure full removal of the contaminant(s) and to address “breakthrough.” This sequential treatment configuration is called a **series** configuration. If appropriate for your contaminant, aeration is often the first method used, while activated carbon is often used as the polishing step. Please refer to NHDES fact sheet WD-DWGB-2-5 for purchasing and installation recommendations.

A treatment method(s) should not be purchased until sufficient water quality testing has been done to identify all of the following:

1. The short-term variability of the contaminant(s).
2. Whether each contaminant concentration is rising or falling over the long term.
3. What other contaminants are in the recharge area of your well, and how many are predicted to impact your well in the future.
4. Whether the contaminant is present in a dissolved or pure product form.

If contaminants are present in a pure product form, a direct recovery method is also necessary to reduce the size of the treatment system. Please contact the NHDES Waste Management Division (603) 271-3899 to ensure that this contaminated location is known to NHDES.

**Activated Carbon Treatment: Advantages and Disadvantages.** Activated carbon is a material that attracts many types of organic contaminants onto its surface. Activated carbon has an enormous surface area for the volume it displaces. One pound has the surface area of more than a football field. Once the carbon’s removal capacity is used up, the carbon may be returned to the manufacturer for rejuvenation (for very large users), or can be disposed of appropriately.

If activated carbon is used, the radon and mineral radioactivity concentrations of the water should also be determined. Activated carbon concentrates radioactivity, potentially creating a low level radionuclide waste and possible source of increased radiation within the home. Also, activated carbon can foster the growth of bacteria by concentrating the food the bacteria needs to live. A final concern with activated carbon is the possible release of contaminants already adsorbed. This is known as “dumping” and could occur when the carbon is nearly saturated with contaminants, and a contaminant of higher preference displaces another with lower adsorption preference.

To address exhaustion and dumping, the overall amount of carbon should be divided into two treatment tanks, and the two tanks installed in series such that breakthrough in the first unit can be addressed by the newer carbon in the second unit. The advantage of activated carbon over aeration is that the water does not need to be repressurized and there is less likelihood of bacteria from contamination by dust and other airborne contaminants.

**Aeration: Advantages and Disadvantages.** Aeration treatment consists of passing large amounts of air through the contaminated water. The efficiency of the device is improved by breaking up the water flow into many small droplets. The goal is to maximize the water’s surface area to allow the contaminants to volatilize into the air stream. Aerator configurations include packed tower and low profile bubble tray styles. Where aeration is used, two operational problems are possible:

- Where there are elevated levels of iron or manganese, rusty staining of water use fixtures

- and clothing is possible.
- Bacterial slime may grow in aerators requiring continuous or periodic chlorination.

The advantage of aeration is that there is no disposal of radioactivity waste or regeneration of the treatment system necessary.

**Oxidation: Advantages and Disadvantages.** Certain organic contaminants will chemically react with oxygen and oxygen-like compounds. After this treatment is accomplished, the resultant compounds may be either fully neutralized or will have a lower level of hazard. Further treatment may still be necessary. Oxidizing chemicals include potassium permanganate, hydrogen peroxide and hypochlorite.

#### **Monitoring Program After Installation of a Treatment System**

Periodic laboratory testing should be done on both the raw and treated water to determine treatment effectiveness. The frequency of this monitoring would be determined based on level of health risk posed by the contaminants, variability and duration of the past sampling record, and other site-specific conditions. Where activated carbon is used, the carbon will lose removal capacity and will need to be replaced at some point. A monitoring program will be needed to predict the expected longevity of each new recharge of activated carbon.

#### **For More Information**

For further information concerning the layout of a water treatment system and its purchase, please refer to the NHDES fact sheet WD-DWGB-2-5 entitled, "Considerations When Purchasing a Water Treatment System."

For additional information, please contact the Drinking Water and Groundwater Bureau and the Water Well Board at (603) 271-2513 or [dwgbinfo@des.nh.gov](mailto:dwgbinfo@des.nh.gov) or visit our website at [www.des.nh.gov](http://www.des.nh.gov).

Note: This fact sheet is accurate as of July 2019. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.