ENVIRONMENTAL Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Organics in Drinking Water

TYPES OF ORGANIC CONTAMINANTS

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 that have been created in the last 50 years. The U.S. Environmental Protection Agency (EPA) regulates some of these contaminants as health risks in 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 shown at the end of this document.

These manmade organic contaminants can be grouped 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 illustrations 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

Trihalomethanes are the byproducts of the chemical reaction between chlorine and the natural occurring organics in drinking water. These naturally occurring carbon compounds are not hazardous by themselves, but when combined with chlorine, produce byproduct reactants, which have a health concern. Examples of compounds in the trihalomethanes subcategory include chloroform and bromoform.

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

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) 271-1168 for assistance.

TREATMENT OPTIONS

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. Refer to the referenced contaminant list in this document to determine which method(s) is predicted to give superior performance for the type of contaminant(s) present in your water.

If the concentration of the contaminant is high, two treatments 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. Visit the fact sheet web page and scroll to 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 contaminants.
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 state, a direct recovery method is also necessary to reduce the size of the treatment system. Please check with our Groundwater Protection Program at 271-1168 to ensure that this contaminated location is known to DES.

Activated Carbon Treatment: Advantages and Disadvantages . Activated carbon has an enormous surface area for the volume it displaces. One pound has the surface area of more than a football field. Activated carbon is a material that attracts many types of organic contaminants onto its surface. 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 ADDITIONAL INFORMATION

For further information concerning the layout of a water treatment system and its purchase, please refer to the DES fact sheet entitled, “Considerations When Purchasing a Water Treatment System.” Visit the fact sheets webpage and scroll to WD-DWGB-2-5. In particular, we are interested in identifying other solutions (or problems) that you encounter when installing treatment for organics. We would appreciate your suggestions concerning this fact sheet.

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 or visit www.des.nh.gov, click on A-Z List and choose Drinking Water and Groundwater Bureau. All of the bureau’s fact sheets are on-line at http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm.

Note: This fact sheet is accurate as of September 2009. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.

TREATMENT OPTIONS

VOC Organic Chemicals	Maximum Contaminant Level (mg/L)	Granular Activated Carbon	Packed Tower Aeration	Oxidation, Chlorination or Ozonation
Benzene	0.005	c	a	
Carbon tetrachloride	0.005	c	a	
1,2 Dichloroethane	0.005	c	a	
Trichloroethylene	0.005	c	a	
Para-dichlorobenzene	0.075	c	a	
1,1 Dichloroethylene	0.007	c	a	
1,1,1 Trichloroethane	0.200	c	a	
Vinyl Chloride	0.002		a	
cis-1,2 dichloroethylene	0.07	c	a	
1,2 Dichloropropane	0.005	c	a	
Ethylbenzene	0.7	c	a	
Monochlorobenzene	0.1	c	a	
o-Dichlorobenzene	0.6	c	a	
Styrene	0.1	c	a	
Tetrachloroethylene	0.005	c	a	
Toluene	1.0	c		
trans-1,2 Dichloroethylene	0.1	c	a	
Xylene (Total)	10.0	c	a	
Dichloromethane	0.005		a	
1,2,4 Trichlorobenzene	0.07	c	a	
1,1,2 Trichloroethane	0.005	c	a	

TREATMENT OPTIONS

Synthetic Organic Chemicals	Maximum Contaminant Level	Granular Activated Carbon	Packed Tower Aeration	Oxidation, Chlorination or Ozonation
Alachlor	0.002	c		
Aldicarb	0.003	c		
Aldicarb sulfoxide	0.004	c		
Aldicarb sulfone	0.002	c		
Atrazine	0.003	c		
Carbofuran	0.04	c		
Chlordane	0.002	c		
Dibromochloropropane (DBCP)	0.0002	c	a	
Ethylene Dibromide (EDB)	0.00005	c	a	
Heptachlor	0.0004	c		
Heptachlor epoxide	0.0002	c		
Lindane	0.0002	c		
Methoxchlor	0.04	c		
Polychlorinated Biphenyls (PCB)	0.00005	c		
Pentachlorophenol	0.001	c		
Toxaphene	0.003	c	a	
2,4,5-TP (silvex)	0.05	c		
2,4-D	0.0002	c		
Dalapon	0.2	c		
Di(ethylhexyl)adipate	0.4	c	a	
Di(ethylhexyl)phthalate	0.006	c		
Dinoseb	0.007	c		
Diquat	0.02	c		
Endothall	0.1	c		
Eudin	0.002	c		
Glyphosate	0.7			o
Hexachlorobenzene	0.001	c		
Hexachlorocyclopentadiene	0.05	c	a	
Oxaml (Vydate)	0.2	c		
PAH's				
Benzo(a)pyrene	0.005	c		
Benz(a)anthracene	-			
Benzo(b)fluoranthene	-			
Benzo(k)fluoranthene	-			
Chrysene	-			
Dibenz(a,h)anthracene	-			
Indenopyrene	-			
Picloram	0.5	c		
Simazine	0.004	c		
2,3,7,8 TCDD Dioxin	0.0000003	c		