

wellcare[®] information for you about Volatile Organic Compounds (VOCs) & Groundwater

What are Volatile Organic Compounds?

Volatile Organic Compounds (VOCs) are a class of chemical compounds that share two main properties: (1) they evaporate easily from water into the air and (2) they contain carbon. Low concentrations of VOCs in water can produce a sweet, pleasant odor that is easily detected.

VOCs are associated with products such as gasoline, plastics, adhesives, dry-cleaning fluids, refrigerants and paints. Biological sources of VOCs include trees, cows and termites (methane), and cultivation. Crude oil tanking can also release VOCs into the atmosphere.

When spilled or improperly disposed of, VOCs may be released into the environment. Any portion that does not evaporate may soak into the soil and can be carried into groundwater by rain, water and snow melt. The U.S. Environmental Protection Agency (EPA) estimates that VOCs are present in one-fifth of the nation's water supplies.

Factors that influence the likelihood of contamination include:

- 1) proximity of the well to the source of contamination;
- 2) the amount of VOCs that are spilled or discarded;
- 3) depth of the well (shallow wells are affected by surface spills more quickly and more severely than deep wells);
- 4) local geology (groundwater that is protected by thick, dense soils is less vulnerable to contamination); and
- 5) time (groundwater moves slowly, so it can take months or years after a spill before contamination reaches wells).

What are the health effects of Volatile Organic Compounds?

The harmful effects of VOCs vary considerably. At high levels, some VOCs may damage the central nervous system, the kidneys or the liver. They may cause irritation upon contact with the skin, and may irritate mucous membranes if inhaled. Some VOCs are known or suspected carcinogens.

The U.S. Environmental Protection Agency (EPA) has established maximum contaminant levels (MCLs) for the following VOCs:

<i>Volatile Organic Compound</i>	<i>Maximum Contaminant Level (MCL)*</i>
Benzene	5 parts per billion (ppb)
Carbon tetrachloride	5 parts per billion (ppb)
Chlorobenzene	0.1 parts per million (ppm)
Ortho-dichlorobenzene, (o-DCB)	0.6 parts per million (ppm)
Para-dichlorobenzene (p-DCB)	75 parts per billion (ppb)
1,2-Dichloroethane (1,2-DCA)	5 parts per billion (ppb)
1,1-Dichloroethylene (1,1-DCE)	7 parts per billion (ppb)
1,2-Dichloroethylene (1,2-DCE)	.07 parts per million (ppm) for the "cis" form, and 0.1 ppm for the "trans" form
Dichloromethane (DCM)	5 parts per billion (ppb)
1,2-Dichloropropane (1,2-DCP)	5 parts per billion (ppb)
Xylene	10 parts per million (ppm)
Ethylbenzene	0.7 parts per million (ppm)
Styrene	0.1 parts per million (ppm)
Tetrachloroethylene (PCE)	5 parts per billion (ppb)
Toluene	1 part per million (ppm)
1,2,4-Trichlorobenzene (1,2,4-TCB)	0.07 parts per million (ppm)
1,1,1-Trichloroethane (1,1,1-TCA)	0.2 parts per million (ppm)
1,1,2-Trichloroethane (1,1,2-TCE)	5 parts per billion (ppb)
Trichloroethylene	5 parts per billion (ppb)
Vinyl chloride	2 parts per billion (ppb)

* The EPA MCL information was current as of November 28, 2006.

How do I test for Volatile Organic Compounds?

You should test your well for VOCs if it is in close proximity to a gasoline service station or other fuel tanks (500 to 1000 feet, or one to two city blocks), or if your water has the taste or odor of gasoline or solvents. If your test results determine that VOCs are present, you may wish to have your well retested before taking action. Contact your local Cooperative Extension Office or the Health Department for a list of state-certified laboratories in your area.

What are the treatments for Volatile Organic Compounds in drinking water?

Check with a local water treatment specialist in your area regarding the best type of treatment for your situation. Three types of treatments may be used to remove or reduce VOC levels in drinking water, either alone or in combination with one another. These are Granular activated carbon (GAC) filters, Distillation, and Packed tower aeration (PTA).

Granular activated carbon (GAC) filters may be used to reduce VOC levels in drinking water. Treatment success depends on a number of factors, including (1) the type and amount of contaminant, (2) the rate of water usage, and (3) the type of carbon being used. Carbon filters should be replaced according to the manufacturer's instructions, and water should be tested after a treatment system is in place to ensure the system is working properly.

Filtration systems may either be installed at the faucet (for point-of-use treatment), or where water enters the home (point-of-entry treatment). Point-of-entry systems provide safe water for bathing and laundry, as well as for cooking and drinking, and are therefore preferred for treatment of VOCs.

Distillers can remove VOCs using gas vents, fractional columns, and/or GAC filters. A combination of these methods is typically more effective for removing or reducing VOC levels than one of these methods alone. To maintain distillation equipment, empty the boiling chamber at least once a week, and more often if the distiller is used constantly.

Packed tower aeration (PTA) combines air with water to turn contaminants into vapor, which is either released into the atmosphere or treated and released. Pumps and blower motors should be serviced and air filters replaced, as needed, to ensure these systems operate effectively.

For some VOCs, temporary measures may include boiling the water (steam should be vented outside), or connecting to an uncontaminated neighboring well. Bottled water can be used as a short-term source of drinking water. If you choose to use these short-term measures, keep in mind that VOCs may still enter your body through skin absorption or through inhalation of water vapor.

For more information on VOCs and Groundwater

Derickson, R., Bergsrud, F, & Seelig, B. University of Minnesota Extension Service. *Treatment Systems for Household Water Supplies: Distillation*. Retrieved November 16, 2006 from www.extension.umn.edu/distribution/naturalresources/DD5943.html

Jennings, G.D., Sneed, R.E., & St. Clair, M.B. (1996). North Carolina Cooperative Extension Service, Water Quality and Waste Management. *Volatile Organic Compounds (VOCs) in Drinking Water*. Retrieved November 14, 2006 from www.bae.ncsu.edu/programs/extension/publicat/wqwm/ag473_5.html

Minnesota Department of Health. VOCs: Volatile Organic Chemicals in Private Drinking Water Wells. Retrieved November 14, 2006 from www.health.state.mn.us/divs/eh/hazardous/topics/vocs.html

National Drinking Water Clearinghouse Fact Sheet. (August 1997). Tech Brief: Organic Removal. Retrieved November 16, 2006 from www.nesc.wvu.edu/ndwc/pdf/OT/TB/TB5_organic.pdf

U.S. Environmental Protection Agency. (1995). National Primary Drinking Water Regulations. Retrieved November 14, 2006 from www.epa.gov/ogwdw/dwh/c-voc.html

For more information on your drinking water

The following websites provide up-to-date information on efforts to protect drinking water supplies and steps you can take as a private well owner. In addition, you may contact the [wellcare®](tel:1-888-395-1033) hotline at 1-888-395-1033.

Underwriters Laboratories Inc. Drink Well™ Well Water Testing
U.S. Environmental Protection Agency
Water Quality Association

www.uldrinkwell.com
www.epa.gov
www.wqa.org

For more information about wells and other wellcare® publications

[wellcare®](http://www.wellcare.org) is a program of the **Water Systems Council (WSC)**. WSC is a national nonprofit organization dedicated to promoting the wider use of wells as modern and affordable safe drinking water systems and to protecting ground water resources nationwide. This publication is one in a series of [wellcare®](http://www.wellcare.org) information sheets. There were more than 60 available at the time this document was published. They can be downloaded FREE from the WSC website at www.watersystemscouncil.org. Well owners and others with questions about wells or ground water can also contact the [wellcare®](tel:1-888-395-1033) hotline at 1-888-395-1033 or visit www.wellcarehotline.org



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