

# ABCs of Water Contamination

Americans pride themselves on having very high quality water and many make the assumption that all water is the same. A thorough study of water sources would tell a different story. **The U.S. is in an unprecedented water quality crisis, where treatment costs are skyrocketing (in recent months, towns across America have doubled their water supply rates) and where clean water is a rapidly diminishing resource.**

*Depending on where you live, it is easy to find amounts of chlorination byproducts, organics, nitrates, pesticides, heavy metals, radioactive compounds, petrochemicals and parasites coming from the local municipal water supply.* Even if you get your water from a **private well, you may be surprised to know that all of these contaminants can be present.**

**We recommend you contact your local water testing service and get your tap water tested.** They can give you a good snapshot of the quality of your tap water and inform you of any violations that have occurred recently. Once you know what contaminants are present in your water you will have a better idea of what type of filtration system you require.



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## Biologicals

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- **Chlorine** – The primary disinfectant used in the USA and world-wide. A powerful oxidizer that is used to kill microbes such as bacteria, viruses, and cysts. Also changes the state of various in-organics (i.e. Iron & Hydrogen Sulfide) reducing taste, clarity, and odor problems. Reacts with all organic matter, producing countless combinations of byproducts (DBPs).
- **Chloramines** – The second most common disinfectant used in the USA, primarily for large municipal surface water supplies. Combines Chlorine with Ammonia to create a more stable and less reactive compound. Nearly as effective in killing microbes and oxidizing organics as Chlorine. Chloramines is used because it produces less DBPs than Chlorine; unfortunately it is also much more difficult to remove from water and early reports have shown that the byproducts it produces are far more toxic than those of its Chlorine counterpart.
- **pH** – The “balance” of water. Ideally slightly basic (7.0 – 7.8) but it is common for water to be acidic (less than 7). Acidic water can corrode copper piping and other plumbing fixtures and sometimes leads to green-tinted water.
- **Sediment & Particulates** – Common in surface water supplies or wells with damaged casings. Sediment (dirt) can cause clarity and taste issues.
- **Iron & Manganese** – Two common inorganic minerals that when present in high levels give water a rusty color that deposits onto piping and fixtures.
- **Hydrogen Sulfide** – A colorless gas that results from the bacterial breakdown of organic matter in the absence or oxygen. Common in untreated water sources such as wells, causes a “rotten egg” smell.
- **Cysts** – Microorganisms such as Cryptosporidium, Giardia, and Toxoplasma which are resistant to oxidation and can sometimes contaminate municipal water supplies due to inadequate treatment or through cracks in the distribution pipe post-treatment that allow contaminated dirt into the water stream.

- **Virus** – Considered one of the most common but least understood sources of waterborne illness, Viruses such as Adenovirus, Norovirus, Coronavirus, and Parvovirus are very difficult to treat on a municipal level and can pass through all but the tightest mechanical membranes.
- **Bacteria** – The primary reason we use disinfection methods such as Chlorine, bacteria are naturally occurring microorganisms that are present nearly everywhere on earth. A milliliter sample of fresh water typically contains 1 million bacterial cells. The majority of the bacteria present in water are healthy and not necessary to remove; however, there are types of bacteria that can be very dangerous to health, such as E-coli, Legionella, Salmonella, and Cholera.
- **Pharmaceuticals** – As drugs such as Tylenol, Viagra, etc. are excreted into waste water, trace amounts are returning with the water to treatment plants, where they react with the treatment processes to create countless byproducts. Recent studies have found both the original compounds and the byproducts in the treated water of more than a dozen major municipalities across the USA. The health effects of these trace compounds are currently unknown, but of great concern to the public.
- **Bisphenol A (BPA)** – An organic compound that is used in the production of polycarbonate, approximately 3 million tons are produced every year. Suspected of being hazardous to humans since the 1930s, concerns about the use of Bisphenol A in consumer products grabbed headlines in 2008 when several governments (most notably, Canada) issued reports questioning its safety, and some retailers pulled products made from it off their shelves. Bisphenol A is an endocrine disruptor: it is an estrogen receptor agonist, and such agonists can act like the body's own hormones, leading to similar physiological effects on the body. There is concern that long-term low dose exposure to Bisphenol A may induce chronic toxicity in humans.
- **Radon** – An alpha/beta emitter that is produced by the decay of radium. It is a very dangerous carcinogen but short-lived, with a half-life of only 3.8 days. Water-borne Radon contamination is a problem in some areas, but generally less of a concern than air or soil Radon contamination.
- **Volatile Organic Contaminant (VOC)** – VOCs include Toluene, Xylene, TCE, PCE, Benzene, MTBE, Styrene and hundreds of other chemicals, which are typically introduced into the water table through industrial contamination. They are extremely toxic in levels as low as 5 parts per billion (ppb).
- **Trihalomethane (THM)** – THMs are generated in water whenever Chlorine comes in contact with organic matter. Considered as DBPs (Disinfection By-Products), they are toxic and carcinogenic. Typically found in higher levels in surface water supplies (lakes and reservoirs), DBPs such as Trihalomethanes are the primary reason many major municipalities have switched from Chlorine to Chloramines, a more stable compound that produces less byproducts.
- **Pesticides & Herbicides**– Pesticides and Herbicides are chemicals used primarily in agriculture to control pests and plants. It is estimated that over 98% of pesticides and 95% of herbicides reach a destination other than their target species, including other species, food, water, air, and soil. The primary source of contamination in water is soil runoff from areas treated with the chemicals.
- **PCBs** – Polychlorinated Biphenols were used widely with electronics, pesticides, hydraulic fluids, sealants, paints, and other materials until they were banned in the 1970s due to the high toxicity of most PCB congeners and mixtures. PCBs are classified as persistent organic pollutants which bioaccumulate in animals. The primary causes of water contamination.

- **Methyl-tertiary-butylene-ether (MTBE)** – A VOC that is derived from a gas additive that has been used since 1979 to help prevent engine “knocking”. Its use increased dramatically in 1992 with the passing of the US “Clean Air Act”. By 1995 some water supplies were registering high levels of the chemical and between 2000 and 2006 the additive was mostly eliminated from use due to concerns regarding the health effects of the levels of chemical being detected in public water supplies.
- **Fluoride** – Introduced into water either naturally as Calcium Fluoride or through municipal fluoridation as hydrofluorosilic acid. Research over the last century favors the theory that a level of approximately 1ppm of fluoride in water is beneficial in reducing tooth decay. However, this theory is still hotly debated. Of greater concern is the source of fluoridation in the USA, hydrofluorosilic acid. This compound is a waste product of the phosphate mining industry that is diluted down and sold to municipalities. Along with Fluoride it contains low levels (<1%) of Lead and sometimes other heavy metals such as Arsenic. E.P.A. is fighting for MORITORIUM on fluorinated water.
- **Nitrates** - Nitrates oxidize the iron atoms in hemoglobin from Ferrous Iron (2+) to Ferric Iron (3+), rendering it unable to carry oxygen. This condition is called methemoglobinemia and can lead to a lack of oxygen in tissues. Infants, in particular, are especially sensitive to methemoglobinemia as a result of nitrate exposure. This is most caused by high levels of nitrates in drinking water.
- **Arsenic** – A heavy metal that is considered carcinogenic in levels as low as 10 ppb and lethal in higher doses. Arsenic is typically introduced into water through natural deposits.
- **Lead** – A heavy metal that can impair neurological function, especially in infants, in levels as low as 15 ppb. Introduced into water through soil runoff contamination or natural deposits. Industrial contamination has been significantly reduced since the 1980s when several uses of the material were banned.
- **Mercury** – A heavy metal that comes from the erosion of natural deposits or discharge from refineries, factories, landfills, or croplands. Known to cause kidney damage.