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Do You Need Home Water Treatment?

Questions Exist About Performance, Maintenance, and Marketing
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Walk into almost any household kitchen and it's likely that you won't see just a traditional faucet. Instead, many people are attaching filters or home water treatment units to provide what is hoped to be an added level of treatment. Why are home watertreatment units are becoming so popular? It's difficult to attribute to any one factor, but a few trends leading to the boom can be pointed out.

Often consumers choose home water treatment to improve the taste, color and odor of their drinking water. Every city's drinking water tastes a little different, often unpleasantly, when you firsttake adrink of it. That's because many city-produced waters are too hard or contain higher than average levels of salts or iron, even though they are safe. Almost all water contains dissolved minerals that do not cause health problems. Home water treatment can remove many impurities and make the water look and taste better. In some cases, however, these units can worsen water quality problems. If not properly maintained,filterscan become laden with bacteria or may exceed their useful life and provide little protection.

Right or wrong, an increasing numberof consumers are concerned about the safety of the water they drink. Many question the quality of their water because they know many pollutants are hard to detect and can't be seen, smelled or tasted. They're responding by purchasing and installing home water treatment units. Rural residents who rely on individual wells pump water that has not been treated to remove potentially harmful substances. In many of these cases, treating your own water makes sense. However, many urban residents are also beginning to use these devices.

Why? Many feel that Federal drinking water regulations don't provide enough protection and want an added measure of safety. The Safe Drinking Water Act (SDWA) permits small but safe levels of selected contaminants in treated water. In many cases, SDWA

non-enforceable health goals do not allow any level of contaminants. Advocates of home water treatment units argue that any level of contaminant may be damaging to your health. They add that many pollutants not covered by the Act pose health risks.

On the other hand, the impact of drinking water on human health needs to be put into perspective. Some say that fears about risks posed by pollutants in drinking water may be overblown because contaminants in drinking water may pose minor health risks when compared to other sources. Some studies show people absorb more contaminants by showering than by drinking water and the danger posed by chlorinated by-products in drinking water is probably much less than the risk of developing cancer from smoking cigarettes.

The policy of the Environmental Protection Agency (EPA) and the Texas Water Commission (TWC) isthat watersupplied by public systems is safe to drink and doesn't need more treatment, if contaminant levels are within standards set in the SDWA. The vast majority of public water systems in Texas consistently treat water to EPA standards.

Many consumers are being convinced that they need to improve water treatment because of aggressive and sometimes deceptive sales practices. Most of the allegations involved claims by salesmen that city drinking water is unsafe, and assurances that home water treatment units remove more contaminants than they actually can. Many of the charges have been investigated by the Texas Attorney General's Office and other State and Federal agencies. Consumer complaints about the units and tactics used to sell them jumpedby40%nationally inthepast 5years, according to the Better Business Bureau.

Some contend there wouldn't be so many consumer complaints if home water treatment units were better regulated. There are few federal lawsforthese systems. Unitsthat use silver to kill bacteria and chemical water purifiers that use chlorine or iodine as a disinfectant must be registered with the EPA. When people apply for federal mortgage insurance, the Department of Housing and Urban Development (HUD) requires that the home they buy is supplied with potable water. If water supplies do not meet EPA standards, home water treatment units can be used to comply with the HUD rules. HUD requires local health authorities to verify that the units adequately treat the water and to submit plans to monitor and maintain, and replace the units as needed.

The potential use of these units isn't limited to individual residences. Many small communities are now considering distributing point of entry treatment (POE) units to improve waterquality in problem areas. POE devices treat all the water entering a house. This could be more economical than improving water quality by expanding water treatmentplants. Recently, theEPAandtheTWC studied if it would be cost effective to utilize POE units in a subdivision in Burnet County.

How big is the home water treatment unit business? More than 400 manufacturers now produce home watertreatment systems. From 1985 to 1990, sales increased by 49% and nowtotal more than $1.8 billion annually. Sales are expected to increase by an additional 60% from 1990 to 1995. Consumers need to know if their water contains contaminants

that should be treated. Be careful when looking for a home water treatment unit. Check to see if complaints have been lodged with governmental agencies or groups like the Better Business Bureau. Try to find performance data. Keep in mind that the treatment ability of systems will vary. No single system will be effective for treating all water quality problems. Other systems are unsafe_one unit leached mercury into treated water. Properly maintain your system. If you don't, the units could degrade the quality of the treated water and make it unsafe. When carbon filters become saturated they can release high levels of organic chemicals which make the water less safe. Different units vary tremendously in terms of their water use and expense.

DO YOU NEED A TREATMENT UNIT ?

Obviously, consumers should find out whetherthey need additionalwatertreatment before buying a home water treatment unit.

Consumers served by public water systems can obtain information on levels of contaminants regulated by the SDWA by contacting their local utility or the TWC. Only a few public water systems in Texas have violated the maximum contaminant levels allowed by the Act in the past two years.

If you want to know about pollutants that are not tested as part of the SDWA or if you pump water from a private well, you may want to have your water tested. Water tests can be expensive, so you may first want to perform an inexpensive screening test to get an overview of what problems may be present (Stewart, 1992). A screening test for total organic halides (TOX) indicates if contamination is caused by synthetic organic chemicals, trihalomethanes (THMs), pesticides with chloride and bromine, and organic solvents. Screening tests for total organic carbon (TOC) will show if organic pollutants are present. If the results of the screening test suggest that your water may be contam inated, you may want to follow up the screening test with a full-scale water test performed by a qualified laboratory.

Deciding who should perform yourwater test is difficult, but here are a few guidelines. Government labs perform some tests, but often have a slow turn-around time and usually cannot provide a comprehensive analysis. Some local governments provide free tests for bacteria and nitrates. Universities, including Texas A&M University, can perform routine tests for minerals and dissolved substances but cannot test for complex man-made contaminants. You can call the Texas A&M University Soil and Water TestingLabat409-845-4816fordetails. Local health departments usually only test for a few parameters such as pH and coliform bacteria. A list of full service laboratories that perform watertests in Texas is available from the American Council of Independent Laboratories at 202-887-5872.

Water testing can be expensive. It often costs more than $100 to testforsuch common contaminants as coliform bacteria, fluoride, nitrate-nitrogen, hardness, iron and pH. The cost to test for lead is often about $25, while it may cost $50 to check for radon. Tests for

pesticides and herbicides can cost up to $125 each. To save money, you may want to choose tests that supply the most information like indicator and screening tests.

After testing the water, you may decide that you need a home watertreatment unit. If so, get information f rom salesmen and manufacturers. Be surethe unit meetsthe standards of the National Sanitation Foundation orthat the manufacturer belongs to the Water Quality Association (708-505-0160).

BASIC FACTS: POU AND POE DEVICES

There are two basic types of home water treatment units. Most common are point of use or POU devices. POU units usually treat only water used for cooking and drinking.

POE devices treat all the water entering a home, regardless of how it will be used. POE units are recommended when watercontains high levels of radon or volatile organic chemicals that can dissipate into the air from showers, toilets, washing machines and dishwashers. Examples of POE units include sediment filters, water softeners, and chlorination systems used to control bacteria in wells. POU units include reverse osmosis, distillation and activated carbon systems. Activated carbon filters and distillation units can be used for both purposes.

Activated carbon adsorption filters, reverse osmosis units, disinfection units, water softeners, and physical filters remove tastes and odors. Reverse osmosis, ultraviolet (UV) lamps, and disinfection units remove contaminants and bacteria.

CARBON FILTERS: MAINTENANCE IS A KEY

Activated carbon is produced by heating coal or wood at a controlled temperature and pressure to create active sites where pollutants can be attracted to the carbon surface and adsorbed.

The basic types of carbon filters used for home treatment include faucet-mounted devices, line bypass systems, in-line systems, and f iltering pitchers or portable f low through units. Most of the small faucet-mounted devices are designed only to treat taste and odor problems and will not remove large levels of organic contaminants. Large capacity units installed under sinks are more efficient. Prices range from $100 to $500, and replacement cartridges cost $10 to $100. Generally, carbon filters should only be used with waterthat has already been disinfected.

The amount and type of activated carbon afiltercontainswill influence its effectiveness. Systems with large amounts of activated carbon are the most effective. Carbon made from lignite and bituminous coal contains large pore spaces that makes it ideal for removing contaminants with large molecules (LeMay, 1988). Granular activated carbon (GAC) is the most common type of carbon used. GAC particles are comprised of an intricate system of microscopic tunnels that provide a huge surface area. For example, less than an ounce of activated carbon has a total surface area of more than 1,000 square

feet; if you could unravel and spread out its internal surface area, it would stretch over 10 football fields. Activated carbon is also extremely absorptive. Many contaminants stick to the carbon when they contact it. The rate that water flows within the filter is also important. If the flows are too rapid, there is little opportunity for contaminants in the waterto contact the carbon. It's like trying to drop a letter in a roadside mailbox as you drive past it at30 mires en hour. Systemsthat allow water to slowly trickle through the units provide the longest contact times and increase pollutant removal. Because faucetmounted units often have too little contact time, they are not as effective as many under the sink filters.

Portable pour-through filters can be effective as long as adequate amounts of carbon and contact times are provided. Tests on GAC filters, when used with reverse osmosis units, show that small faucet-mounted units removed 76% of common contaminants while large capacity line bypass systems removed nearly all pollutants (Bell, 1991).

EPA studies (Bellen and others, 1986) show that GAC filters can be very effective in removing THMs and chlorinated organic chemicals that contain chlorine and bromine. These units are also effective in removing mutagenic chemicals that can cause genetic damage. Some studies suggest that GAC filters can be effective at removing lead.

Activated carbon filters need to be properly operated and maintained on a regular basis to be effective. Use the slowest possible flow rate and flush filters before using the water. Carbon filters need to replaced on a regular basis because they lose some of their ability to absorb contaminants overtime. When all the active sites are used up, the water coming out of the filter may actually contain more organics than the water that entered the unit! A good rule of thumb is that most filters should be replaced at least once every three months, but this varies according to the type of filter, how often it is used, how much water is treated, and contaminant levels. You may wantto testthe water soon after a filter has been replaced to make sure the new filter is working.

Bacteria in these filters can build up to harmful levels (Reasoner, 1987). Studies in Houston in the 1970s ran 5 to 10 gallons per day through a GAC filter. After less than a week, bacteria levels in the treated water were 200 times greater than recommended limits for public health. One problem is that GAC units remove chlorine, which kills the bacteria, and add nutrients that provide an ideal breeding ground for bacteria to reproduce. Some studies suggest that the first few glasses of water drawn from a filter each morning may contain high levels of bacteria. The bacteria build up when the filters are not being used. GAC filters installed under sinks may be prone to bacteria build-up because kitchen appliances and hot water faucets increase temperatures. Some studies suggest choosing filters with fine membranes (LeMay, 1988) or using a disinfection system in combination with GAC filters. Other reports say that heterotrophic bacteria do not pose a health risk.

A way to reduce bacteria and microorganisms is to use filters which are laced with silver. Small amounts of silver are supposed to leach off the carbon as water passes through the filter, interact with the bacteria, and reduce their ability to reproduce. The trick is not to

allow too much silver into the treated water because silver may be toxic to humans. EPA studies (Bell, 1991) show that filters containing silver reduce fecal coliform bacteria levels, but are not effective against other types of bacteria likely to be build up in filters. If enough silver is leached into the drinking water, it may pose a health risk.

REVERSE OSMOSIS: HIGH WATER USE

Reverse osmosis (RO) systems use hyperfiltration to force water through membranes that separate contaminants from the water. Thefilters restricttheflowof everything but water. Water can flow through the filters but bacteria, particles, and salt cannot. Contaminants are trapped ahead of the membrane, producing high quality water.

RO units are more expensive than other technologies. Models that operate under the sink cost an average of $800 and may have to be installed by a licensed plumber. Some counter top models cost only $100. Replacement membranes often cost about $60. If yourwater is chlorinated, you should be aware thatthin film membranes will deteriorate when exposed to the chlorine. Instead, you may wantto select a chlorine resistant membrane. Keep in mind that water filtered by an RO system is at room temperature when it comes out of the tap. RO units also produce water that tastes like rain water.

RO units are designed to remove 90 to 99% of most dissolved pollutants including many kinds of bacteria, inorganic and organic contaminants, and suspended particles. Some studies suggest that RO systems remove 98- 100% of chlorinated pesticides, but they may be less effective at removing nitrates, THMs, or pesticides like atrazine and lindane (Stewart, 1992). When RO units are used intandemwithGACfilters,THMs, many pesticides and other pollutants are removed effectively. EPA studies suggest that RO filters are effective et removing fluoride (Bellen and others, 1986).

Consumers may want to look for RO units with the following features: automatic flushing of the water to clean and protect the membrane, a pre-filter to remove suspended particles that can clog the membrane, built-in methods to disinfect the unit and kill bacteria, and an automatic shut-off that stops treating water when the storage tank is full.

Like many other systems, RO units need to be maintained regularly. RO membranes usually need to changed at least once a year. Small leaks or holes in the membrane can allow large numbers of bacteria to grow in the units. A way to extend the life of a RO membrane is to use a pre-filter or a GAC unit to remove suspended solids.

Drawbacks of RO units are the amount of water and time they require to produce clean water. It takes four to nine gallons of water to produce one gallon of treated water, although this water can be recovered for other uses. In some homes, 38 gallons per day were wasted. This may be a concern if you live in an area where water supplies are scarce. Because of the high water use, RO units should probably be used as POU units, not POE units. Because it can take more than 30 hours to produce five gallons of treated water, many RO units include a holding tank.

Research at Rice University is evaluating the performance of RO systems. Mark Wiesner of the Environmental Science and Engineering Department is studying problems associated with the buildup of contaminants that are trapped near the membrane surface and may lead to fouling (Wiesner, 1992). He is modeling how raw water quality affects performance.

Wiesner is working on atheorythat uses the shape of the membrane and hydrodynamic conditions (cross-flow velocity, permeation rate, and particle size) to identify particles that are likely to build up on membranes. This could help predict when fouling problems are likely to occur.

DISINFECTION SYSTEMS

If microorganisms and bacteria are causing problems, disinfection units may be a good solution. UV light has shorter wavelengths and carries more energy than visible light. This increased energy gives UV light the ability to kill bacteria and microorganisms by changing their genetic structure. The effectiveness of UV units depends on the amount of radiation reaching the bacteria and the exposure time. UV devices does not remove giardia, particles or sediments. They will not change the inorganiccontent orsoften the water, but may reduce organic contaminants. Many units are equipped with an automaticshut-off switch or alarm that is activated when the water does not receive adequate levels of treatment.

Units using ozone should kill nearly all bacteria and inactive giardia cysts and may reduce odor problems if sufficient contact time is provided. Drawbacks are that viruses are resistant to ozone and high humidity may lessen the effectiveness of the units.

Chlorine can be added to home water treatment units as a disinfectant and may be used in rural areas. Chlorine must be mixed with the water and have sufficient contact time to kill disease-causing organisms. Consumersthatpumpgroundwaterfromshallow depths and use chlorine as a disinfectant should regularly test for THM levels.

REDUCING RADON RISKS

Radon is one of the pollutants consumers are most concerned about because, if large enough amounts are inhaled, it can cause lung cancer. A person exposed to 300 picocuries of radon per liter for a lifetime stands a 1 in 5,000 risk of developing lung cancer. The most common methods of removing radon are using GAC filters and aeration devices. Both systems can remove more than 90% of radon in water. Some lowlevel radon by-products will build up in GAC filter beds. Most experts suggest that such units be located away from high traffic areas.

Dennis Clifford, a researcher in the Civil and Environmental Engineering Department at the University of Houston, has been investigating many techniques that may reduce radium levels. Radon is naturally produced from radium and high levels of radium are found in several central Texas aquifers. He's developed a mobile laboratory equipped

with such technologies as RO, ion exchange, alumina absorption, and others. The lab has been used in the Houston area to test the eflectiveness of various home water treatment units to remove radon, and in Taylor to lower excess fluorides. His studies suggest that home water treatment units that utilize GAC following ion-exchange and softening can be an effective way to lower radon levels (Clifford, 1989). Other studies by Clifford show that RO units with spiral wound and thin film composite filters were extremely effectively at removing radium (1988).

GAC filters used to treat radium will probably continue to emit low levels of radioactive by-products, even after they've been taken out of service. Because Texas regulations treatthese units as low-level radioactive waste, they can't simply be discharged into sewers, rivers, or lakes, thrown in the trash or taken to a dump. Contact the Texas Water Commission at 512-834-6662 to determine how to properly dispose of spent filters.

LET THE BUYER BEWARE

Some of the major complaints about home water treatment units center around deceptive sales and marketing practices.

A 1991 study by the U.S. General Accounting Office (GAO) reports that many companies selling the units make fraudulent claims, without regard to the public health risk to consumers. The complaints fall into two broad categories: marketers use a variety of misleading sales practices and some treatment units are so ineffective that they don't remove pollutants and pose a health risk to consumers who are using them.

Many consumers are concerned about whether home water treatment units perform as advertised. From 1988 to 1990, nearly a third of phone calls to the EPA Safe Drinking Water Hot Line involved complaints aboutthe units and 4,000 written complaints were filed.

Many complaints about deceptive marketing involve problems in Texas. The GAO study reported that a marketing firm claimed that its units were used in NASA's space shuttle and were endorsed by the agency when they were not. Another firm urged people to buy the units because it said Federal laws would soon be passed that would require every home to use a water purifier.

The Texas Attorney General's (AG) Office issued a business advisory in 1988. They charged that deceptive practices were being used to sell and market POU home water treatment units and that public health could be harmed (Farrell, 1990). According to the advisory, salesmen created and exploited fears of consumers by claiming that water from public supplies was not be safe to drink. The AG ruled that individuals are free to voice their concerns about the safety of drinking water, but those criticisms can not be misleading when products are being promoted. The position of the EPA and the Texas Water Commission is that public supplies meeting Safe Drinking Water Act standards are safe to drink. The performance of many units was also exaggerated.

Many products are pitched much the same way elixirs were in the Old West_as "cure alls" that will remove any and all contaminants. No one unit can do it all. Many salesmen lack the technical expertise to explain or u nderstand how and why the product works. Misleading practices include phony surveys, misleading in-home tests, and fraudulent sales literature.

IS MORE REGULATION NEEDED?

How could the problems be solved? The GAO study suggests that stronger efforts need to be made to certify individual units to make sure they meet national performance standards. Existing consumer laws could also be more rigidly enforced. The Consumer Product Safe ty Commission can act against manufacturers of consumer products that pose a substantial health risk and defective products that are not repaired or replaced.

The Water Quality Association (WQA), an industry group, has developed performance standardsfor many home watertreatment units. It has established voluntary guidelines for product promotion and truth in advertising that are mandatory for manufacturers that want to join WQA. The WQA also worked with the Texas AG Office to combat misleading marketing practices. Only 54 of the 600 manufacturers and assemblers of home water treatment units have certified products to WQA standards. The WQA program doesn't test the ability of these units to removal harmful pollutants, but only certifies mechanical performance and the ability to remove taste and odor problems.

The National Sanitation Foundation International (NSFI) has developed voluntary standards and testing protocols for many types of home watertreatment systems. NSFI has developed testing procedures that verify contaminant reduction claims made by manufacturers, and measures the amount of chem icals that leach f rom treatment units into finished waters. NSFI reviews sales literature and assesses the toxic effects of materials like silverthat are used in these products. One problem is that only a small percent of manufacturers have had units certified by the NSFI so far. Therefore, many units being sold now have not been tested.

SUMMARY

Home water treatment units are a potential way for many consumers to improve water quality. For many rural residents who are not supplied with treated water and who pump their own waterfrom private wells, such units may provide protection from harmful chemicals, radon, and bacteria. For rural and urban homeowners alike, home water treatment systems can improve the odor, color, and taste of water. For small communities or areas that are experiencing isolated water quality problems, POE devices may be more effective and less expensive than central water treatment plants.

Home water treatment units are probably not needed to protectthe health of Texans who receive waterfrom public water systems. The only exceptions may be if a city water treatment system did not remove contaminants to the standards specified in the Safe

Drinking Water Act or if pollutants not regulated by the Act were found in drinking water.

Unless consumers are careful, they may end up buying and using a home water treatment unit they don't need. Before considering a treatment unit, consumers should find out if their water contains harmful levels of contaminants. Do this by contacting your local utility or by having the water tested. Consumers should be especially wary of aggressive salesmen using questionable tactics. Try to find objective information on how well the units work. Check to see if complaints have been filed about particular units.

Many concerns could be addressed if Federal and State agencies were given the authority to aggressively regulate home water treatment units or if industry groups increase self policing efforts. Consumers should be able to feel confident that home water treatment units are safe and effective.

After you've purchased aunit, besureto operate it properly and maintain it regularly. In many parts of Texas, high temperatures and humidity levels provide ideal conditions for bacteria to grow in such units. If components are not replaced as needed, your unit may provide little or no treatment or may even worsen water quality.

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