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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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Treatment Devices

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Fact Sheet - Home Water Treatment Devices
Department of Human Services - October 1990

Growing public awareness of potential water quality problems, aided by increased marketing efforts by the industry, have resulted in a significant increase in the use of home water treatment devices. Many people believe that if they attach any type of treatment device somewhere in their water supply their water will be safe to drink from that point on. Unfortunately, this is generally not the case. There are potentially many different types of contaminants in drinking water and therefore different types of treatment devices. No single treatment device is capable of removing all potential contaminants and not all devices are equally efficient in their success at treatment. Also, like most things, treatment devices need periodic maintenance in order to continue to function properly. If you are considering purchasing a treatment device, there are several factors that you should consider before you make your decision.

1. First of all, water does not have to be pure to be safe. All natural waters are rather complex chemical mixtures owing to their being in contact with rocks and minerals below the ground surface. These components generally do not pose a health risk, and in fact, may contribute a desirable taste to the water. Most of the time, water quality is degraded by the unnatural addition of components through accidents, improper waste disposal or other surface and subsurface activities.

2. Just because there are reports of poor water quality in your area does not automatically mean that there is a problem with your water. Contaminants may be localized in their extent or may be restricted to a particular level beneath the surface. As a general rule, shallow wells are more likely to be contaminated than deeper wells. If your well is properly constructed and draws its water from a deeper aquifer, your water may be fine. In addition, if you are served by a public water supply, water quality is strictly regulated by State and Federal law, and unless you have been notified to the contrary, you can assume that your water meets mandatory water quality guidelines.

3. There are many types of potential contaminants in water: particulates such as sand, rust or dirt; microbes such as bacteria, viruses, *Giardia lamblia and Cryptosporidium*; dissolved inorganic components such as calcium, magnesium, lead, arsenic and nitrates; dissolved synthetic organic components such as pesticide residues and industrial solvents; and radiological pollutants including both natural and synthetic radioactive isotopes. As stated above, no single treatment device or method can remove all of these components. It is important, therefore, that before you purchase

any home treatment unit, you determine whether or not your water is in need of treatment and if so, for what contaminant(s).
The Department of Human Services recommends that this be accomplished by chemical analysis by a certified water testing laboratory. A list of approved laboratories can be obtained by contacting the Department of Human Services's Drinking Water Program at the address or phone number below. If you would like assistance in interpreting your water analysis and determining how the concentrations of components in your water compare to published standards, we urge you to contact the Drinking Water staff at the Department of Human Services or your local health Department.

4. Water Treatment units can be installed as point-of-use (POU) or as point-of-entry (POE) devices. POU treatment unites operate only at sources from which water will be consumed, for example, at the kitchen tap where water for drinking or cooking is collected. POE treatment operates on all waters that enter the house. The POU units have the advantage of lower initial and maintenance costs, however, the risk of accidental consumption of water from an untreated tap is high. The Department of Human Services recommends that POU devices be used as interim treatment solutions only.

5. Virtually all treatment devices require periodic maintenance, generally in the form of changing the filter. Many of the units may not provide any noticeable change in taste or flow rate as their treatment ability declines. Users should carefully follow the unit's instruction manual as to how often to change the filter element. The frequency of change is controlled by the amount of water that the unit has treated rather than how long the filter has been in the unit. If proper maintenance procedures are not followed carefully, individuals drinking the water may be exposed to untreated water.
6. The published literature on home treatment devices is voluminous. Useful summary information is provided in several articles: "Buying a Home Water Treatment Unit" published by the Federal Trade Commission; "Fit to Drink?", published in Consumer Reports, January 1990; "Fact Sheet on Home Drinking Water Treatment" distributed by the EPA (215 Fremont Street, San Francisco, CA 94015); "Water Treatment Handbook: A homeowners Guide to Safer Drinking Water", published by Rodale Press, Inc., Emmaus, PA 18049. An additional source of information on product quality is the National Sanitation Foundation (NSF). NSF is an independent, non-profit organization that evaluates and tests products, systems and services against standards in areas of concern to pubic health and the environment. If a water treatment unit has been approved by NSF, it implies

that the unit meets those standards. NSF may be contacted at 3475 Plymouth Road, Ann Arbor, Michigan 48105, (313)769-8010.
As indicated above, the type of treatment unit used will depend on the individual situation, particularly on what contaminant is found in the water. Below is a summary of the major treatment processes, how they work and what general types of contaminants they are able to remove. We further discuss operational and maintenance problems that have been encountered with some of the units.

Physical filters are simple units that are designed primarily to remove particles such as sand, dirt and rust from water. They are not effective at removing dissolved inorganic or organic contaminants and are inadequate at treating microbiologically unsafe waters.

Water Softeners are ion exchange (IE) units designed specifically to treat “hard” water, that is water that contains high levels of calcium and magnesium. The water passes through a tank filled with resin beads that have a large number of sodium ions attached to them. The sodium ions are exchanged for the calcium and magnesium ions, rendering the water “soft”. Although water softeners are often advertised as treatment devices, they are not intended to make the water any safer to drink. Water softeners do add sodium to the water making it somewhat corrosive. Periodic maintenance, involving back flushing with salt brine to replace the sodium on the resin is required. There are other IE units, using different types of resins, that have had some success at removing dissolved contaminants such as nitrate (anion exchange), arsenic and sulfate.

Activated carbon filters, in the form of granular activated, or processed charcoal, can remove many substances from water. Activated carbon (AC) can remove dissolved organic contaminants responsible for foul tastes and odors, as well as hazardous organics, such as pesticide residues. Activated carbon filters can also remove chlorine. Removal is accomplished by adsorption whereby the organic components are attracted to and held by the surface of the activated carbon. AC filters cannot remove most dissolved inorganic components such as nitrate, heavy metals or hardness minerals. Further, the AC is not effective at removal of microbial contaminants. In fact, unless the unit is operated properly, the AC filter may actually serve as a breeding ground for bacteria which can be passed on to the water as it flows through the unit. Flushing the filter after periods of nonuse is recommended. Changing the filter in accordance with the operating instructions will also reduce the impact of bacterial colonization. Some AC filters are impregnated with silver to reduce bacteria growth, although how effective this is is

a subject of debate. Changing the filter is also very important in terms of the efficiency of the contaminant removal process. It has been found that some filters may actually begin to "unload" previously absorbed contaminants when the filter is exhausted. AC filter work best when they are allowed to work slowly. As a result, high volume rated POE and POU filters are considerably more effective than are the small faucet-mounted POU models.

Reverse osmosis (RO) is a process which uses a semipermeable membrane that allows water, under pressure, to pass through, but prevents the passage of certain contaminants. RO is best at removing dissolved inorganic contaminants such as sodium, iron, fluoride, nitrate, iron, arsenic, mercury, sulfate and lead. Large organic molecules may also be removed. Waters that contain high concentrations of calcium, i.e. are "hard", may lead to problems in an RO unit because calcium can actually clog the pores of the membrane. Chlorine in water can also lead to deterioration of some types of membranes. RO is a slow process, often requiring several hours and high water pressure in order to produce one gallon of treated water. Further, there is considerable waste as only 10 to 25 percent of the water passing though the unit is forced through the membrane. Several units employ a small storage tank in order to provide drinking water to meet demand. RO membranes differ in terms of resistance to bacterial growth, sensitivity to the chemical characteristics of the water to be treated and to production levels of the treated water. Your dealer should be able to advise you as to recommendations for the type of membrane to use in your area.

Distillers remove impurities by the processes of boiling and condensation. The steam produced by the boiling rises into metal coils where it cools and condenses. The resulting liquid drips down into a collection chamber. Anything that will not boil or evaporate, e.g. sediment and dissolved inorganics such as metal, nitrates and salts, remain behind in the boiling water. Distillers are not effective at removing the volatile organic compounds and will not eliminate organic contaminants such as pesticides. The high temperatures associated with boiling the water can kill microorganisms, however in some units there is concern that unboiled water may occasionally splash into the collection chamber. The distillation process is slow, often taking as much as five or more hours to produce a gallon of water. It also requires considerable energy in doing so.

Combination of filter systems are used in many areas where more than one type of contaminant exists or where the chemical characteristics of the water require such as configuration. For example, consider a case where the water is hard, sometimes contains sand or other particulates, and is contaminated by pesticide

residues and by nitrate. In this instance, it may be necessary to use a combination of physical filter (to remove the particulates which will interfere with the AC unit), a water softener)to lower the calcium content which will interfere with the RO unit), an RO unit to lower the nitrate, and an AC unit to reduce the pesticide residue. We emphasize again that what filter or filters you need, and in what combination they are hooked up depends on the characteristics of your water. Do not purchase any equipment without an analysis and without talking to a local dealer and the Department of Human Services. Questions regarding home treatment devices can be directed to the Drinking Water Program, Department of Human Services at (971) 673-0405.