

Home Water Treatment System Discharges to On-Site Wastewater Systems

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Abstract

Septic systems or on-site waste treatment are used by 25 percent of American households as the primary treatment for household waste. Inside the system, aerobic and anaerobic bacteria work to digest the fats, food particles, solids and other 'nutrients,' turning them into gas and liquid which is then further treated and disposed of through a drain field.

There are experts on the subject that claim that the brine discharge and rinse waters from a home softener will 1) upset the quiescent flow within the septic tank, 2) disrupt the bacterial action and 3) cause more solids to float. All of these will result in more solids going to the drain field and hasten system failure. In addition, they also claim that the high sodium content of the brine will alter the soil characteristics, causing poor drainage and again leading to system failure. So avid are their beliefs that they have even convinced the lawmakers of some states to enact legislation that would ban the use of water softeners discharging into on-site wastewater treatment systems.¹

Another group of experts, which includes the Water Quality Association (WQA) and the U.S. EPA,

say that no such thing happens. So who's right?

This article explains the workings of a water softener and examines the range of a water softener's contributions to flow and brine concentration and assesses its impact on various on-site waste treatment systems through measurements and observation.

The scientific data that exists on this subject can clarify myths versus facts regarding:

1. Is the salt-brine discharge from water softener regeneration toxic to the bacteria in the waste treatment system?
2. Does the flow rate and volume of backwash and regeneration water discharged from a water softener have an effect on the settling and flotation process causing carry-over of solids into the drain field?
3. Does the water softener regeneration discharge reduce percolation of water through the soil in seepage fields by causing swelling of soil particles?
4. Do water softeners create calcium carbonate scale deposits in wastewater treatment systems?

5. Does the concentration of salts in the regeneration discharge from a water softener cause buoyancy in the wastewater treatment tank?

6. Would bypassing the septic system be a viable alternative for softener brine discharge?

Studies will be described and referenced that conclude it is better to discharge water softener wastes to septic tank systems than to separate dry wells or ditches. Finally discussed will be the serious dilemma created for homeowners when aerobic waste system manufacturers arbitrarily limit their equipment warranties to not cover discharges from home water treatment systems and by anecdotal assumptions that the water softener discharge must have something to do with waste system failures.

Household water and wastewater treatment systems

Many of the 25 million American families currently using on-site waste treatment to handle household waste are also using water softeners to eliminate the problems caused by hard water scale.

Water softeners periodically regenerate with a brine solution which is discharged to the septic system.

The preponderance of evidence shows this is not harmful to the septic system.

What is a home water softener?

Troublesome water hardness occurs in water supplies from the dissolution

Table 1. Discharge to wastewater

DIR—efficiency rated water softener (3,350 grains of hardness removal per pound of NaCl)

Water hardness grains per gallon (gpg) or mg/L	Total dissolved solids added mg/L	Gallons of total discharge per week
5 or 85.5	179	25
10 or 171	358	50
15 or 257	537	75
20 or 342	716	100
30 or 513	1,074	150

of calcium and magnesium minerals from natural geologic formations in our earth's crust. Common ion exchange water softening in the home removes water hardness. This results in remarkable benefits such as:

- Saves washing costs, helps control environmental pollution
- Saves water-heating energy, helps Water Using Appliances
- Better for bathing and household cleaning
- 20-30 percent savings in clothing
- 25-75 percent savings in soaps, detergents, and cleansers
- 21-29 percent improved water heating efficiency

The household water softener typically discharges about 50 gallons of regeneration water over approximately 70 minutes each three to seven days. Table 1 show the discharge characteristics of modern household water softeners when treating specific degrees of water hardness in the incoming water supply.

Myths versus facts

The salt-brine discharge from water softener regeneration is toxic to the bacteria in the waste treatment system.

The Facts:

NSF International research tests undertaken in response to a request from the Ohio Department of Health confirmed that water softener waste effluents actually exert a beneficial influence on a septic tank system operation by stimulating biological action in the septic tank and cause no operational problems in anaerobic or aerobic on-site waste treatment systems.²

The optimal osmotic potential for most bacteria is between -5 and -20 bars. Many bacteria divide and grow most rapidly at -14 bars. This osmotic potential corresponds to a sodium chloride concentration of 15,000 ppm as CaCO₃. Typical osmotic potential of septic tank effluents on systems without softeners is 0.36 bars. The osmotic potential on systems with softeners ranges from -0.51 to -10 bars. The salts added by a water softener regeneration actually reduce the stress on the bacteria by decreasing osmotic potential differences. According to this information, the softener discharge will not retard sludge digestion and may even stimulate the essential bacteria growth.³

The flow rate and volume of backwash

and regeneration water discharged from a water softener has an effect on the settling and flotation process causing carry over of solids into the drain field.

The Facts:

The volume of softener wastes (about 50 gallons per regeneration) are added to the septic tank slowly and are not of sufficient volume to cause any deleterious hydraulic load problems in septic tank systems. In fact, they are lower in volume and rate of addition than wastes from automatic washers.²

The water softener regeneration discharge reduces the percolation of water through the soil in seepage fields by causing swelling of soil particles.

The Facts:

University of Wisconsin Small System Waste Management Project Research has determined that water softener regeneration wastes not only do not interfere with septic tank system drain field percolation but actually could improve soil percolation in fine-textured soils.²

Water softeners create calcium carbonate scale deposits in wastewater treatment systems.

Connecticut-2000

- Do not run multiple full loads when using a washing machine or dishwasher.
- Do not run water continuously while rinsing dishes, thawing frozen foods or shaving.
- Do not dispose of the backwash from water softening or other treatment systems to the septic system.

Texas-2001

- Owners shall not allow water softener and reverse osmosis back-flush to enter into any portion of the on-site sewage facility (OSSF).

Montana-2002

- Backwash water from water softeners and other water supply treatment systems shall not be discharged into the septic tank.

Texas, Montana and New Mexico in 2004 have all ruled that the water softener drain line must be separately constructed to bypass the on-site wastewater treatment tank in AWT systems, as stated above.

The scientific data

The preponderance of evidence demonstrates that home water treatment

discharges do not harm on-site wastewater treatment facilities.

Many millions of home water treatment systems are operating and have been operating for decades with discharges to successfully functioning on-site household sewage disposal systems.

"The studies conclude that it is better to discharge water softener wastes to septic tank systems than to separate dry wells or ditches."⁵

Further research?

It is not possible to prove a negative. In other words, we can not prove that water softeners never cause even a sporadic or rare failure of an on-site wastewater treatment system. However, the preponderance of scientific evidence and objective data indicates that home water supply treatment discharges have no significant effects on properly designed private or public sewage disposal systems.

The WQA and the Water Quality Research Foundation (WQRF) are willing, however, to help support further cooperative research if such research can be defined to conclusively settle environmental health officials' and the wastewater treatment industry's anxieties about home water treatment discharges.

References

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The Facts:

Water softeners add no calcium or calcium carbonate to wastewater systems. Water softeners take the calcium (and magnesium) out of water supplies. The concentration of calcium in a tertiary de-nitrification filter, for example, would be the same with no water softener or with the softener discharge going into the waste system.

The concentration of salts in the regeneration discharge from a water softener cause buoyancy in the wastewater treatment tank.

The Facts:

Modern efficiency water softeners use less than eight pounds of salt to soften over 1,000 gallons of water. This results in less than 1,000 milligrams per liter (mg/L) of total dissolved solids (TDS) added to the liquid wastewater systems. This is less than the TDS amounts added naturally from many water supply wells, which are not restricted from on-site liquid waste system treatment.

French drains proposed by system manufacturers as an alternative are reasonable for water softener regeneration waste water disposal.

The Facts:

No. Constructing a separate waste line through the foundation of the building is unnecessary and disturbing. Separate trenches and disposal pits in peoples' yards will add very significantly to the cost for consumers to install household water treatment.

Such requirements will effectively deny the benefits of soft water to many homeowners. Many counties can be expected to not allow a permit for such substandard waste disposal systems.

Research report findings

Tests confirm that water softener wastes cause no operational problems in anaerobic or aerobic home wastewater treatment plants.*

Fifty gallons per regeneration—similar to one load of automatic clothes washing do not interfere with drain field soil percolation.

Calcium and magnesium in water softener effluents counteract the effects

of sodium on both the biological action and soil in drain fields.⁴

Dehydration, such as plasmolysis of cells and high sodium adsorption ratio (SAR) or impermeability in soils, can be prevented when a balance of the electrolytes is maintained.⁴

No justification exists for banning the disposal of wastes from water softener regeneration in soil adsorption fields. Hydraulic conductivity decreases, when they occur, are caused by clogging due to particulate material rather than swelling.⁵

The swelling and dispersion of drain field soils appear associated with the expanding 2:1 layer silicate and montmorillonite clays.

The presence of sesquioxides (trivalent metal oxides) tends to limit swelling of montmorillonite and to stabilize aggregates at low SAR, but to destabilize them at high SAR. Lowered hydraulic conductivity might result from water softening if all of the house water were softened and if the regeneration wastes were not allowed to enter the seepage field, because almost all of the divalent cations would be removed resulting in high SAR and low soluble salt concentration.⁶

It is found to be a "difficult undertaking to determine the cause of a septic system failure." Ninety percent of homes were found to be equipped with washing machines and dishwashers, 65 percent equipped with garbage disposals, water softener installation existed in 30 percent of homes and the impact of appliances is a concern in only 15 percent of sites.⁷

"Experience and many studies have shown that wastewater from water softeners has no detrimental effects on either on-site or central wastewater systems."¹¹

Finally, the U.S. EPA states in the 2002 *Onsite Wastewater Treatment Systems Special Issues Fact Sheet 3-2002* that "the influent salty brine that enters the ion exchange water treatment tank, with its high concentration of sodium ions, is very different than the effluent that exits the tank as wastewater, which has a high concentration of calcium and magnesium ions. Consequently, the potential for chemical clogging of clay soil by sodium is reduced. The calcium and magnesium input may even help improve soil percolation."

Current regulatory trends

Wisconsin

Commerce Administrative Code 82.40 (8)(j)—2002.

Water Softeners. Ion exchange wa-

ter softeners used primarily for hardness reduction that during regeneration discharge a brine solution into a private on-site wastewater treatment system, shall be of a demand-initiated regeneration type equipped with a water meter or a sensor unless the design of the private on-site wastewater system specifically documents the reduction of chlorides.

Texas

Texas S. B. No. 1633—Revised 2003.

"...an owner may install or use a water softener that discharges effluent into an on-site sewage disposal system only if the installed water softener:

- 1) conserves water by design;
- 2) regenerates using a demand-initiated regeneration control device, commonly known as a DIR device; and
- 3) is clearly labeled as being equipped with an DIR device, with the label affixed to the outside of the system so that it may be inspected and easily read."

Montana

Department of Environmental Quality *Chapter 7 Regulations—Septic Tanks—Revised Adopted October 2004.*

"Backwash water from water softeners or other water supply treatment systems may be discharged (to the septic tank system) if the installed water softener...

- (a) conserves water by design, and
- (b) regenerates using a demand initiated regeneration control device."

However, recent regulations in Texas, Montana and New Mexico also inappropriately state, for example, that:

"This section does not apply to an advance waste treatment (AWT), aerobic, nonstandard or proprietary on-site sewage treatment systems unless the water softener drain line to the system bypasses the on-site wastewater treatment tank..."

The problem

• Aerobic waste system manufacturers arbitrarily limit their equipment warranties to not cover discharges from home water treatment systems.

• Sporadically, sanitarians will observe a water treatment installation to exist at the same location as a failing septic tank system.

• Anecdotal assumptions that the water treatment discharge must have something to do with the noted septic system failure—"I looked at everything else."

Present equipment warranties and anecdotal observations and assumptions lead to ill-proposed regulations.

* NSF International study on a Standard 40 certified aerobic home wastewater treatment plant.¹²

• Operated for six months at NSF's testing facility.

• Water softener regeneration wastes loaded at a rate simulating twice the average use rate—up to ten persons per household.

• Water softener regeneration wastes demonstrated no adverse effects on home aerobic wastewater treatment plant performance.

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