

On-Site Self Regenerative Water Softeners Use in California

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Some of the information in this paper was adopted from the White Paper prepared by the 2002 Recycled Water Task Force's Regulation and Permitting Workgroup (DWR, 2002)¹

Over the past forty years, the salt content of wastewater has become a topic of concern to water and wastewater agencies, because high salinity degrades water quality, and thus, impacts residential, commercial, industrial, and agricultural water users, as well as groundwater, wastewater, and recycled water resources, and utility distribution systems. Salinity, or total dissolved solids (TDS), is the concentration of mineral salts dissolved in water and commonly measured in milligrams per liter (mg/L). Sodium reduces soil moisture penetration, TDS reduces crop yields, and chloride is toxic to plants. The discharge of salts, i.e. calcium, magnesium, sodium, sulfate, and chloride, creates problems for the environment and salts are difficult to remove using traditional treatment processes.

Any salt added to waste water can push recycled water agencies using traditional water recycling treatment processes into non-compliance with their water quality permits and or make the recycled water unmarketable for irrigation use, the primary use throughout the state.

In many cases, the potable water is already high in TDS, and water softeners compound the problem, creating difficulties attracting customers for the higher saline recycled water.

At the same time, increasing numbers of residents in California have installed water softeners in their homes to reduce problems caused by hard water: water high in calcium/magnesium salts. While not a health concern, hard water can result in the formation of spots on dishes or vehicles, scaling of pipe walls and plumbing fixtures, and slightly higher soap requirements for laundry and dish washing. These salts are present in potable water, primarily from natural sources but also from discharges of agricultural, industrial, and municipal discharges into rivers. Hard water is especially prevalent in coastal areas and areas where hard imported water is used, such as Colorado River water, and areas with the highest population densities. Unfortunately, the use of softeners, particularly onsite, self-regenerative water softeners, has led to increased salt in the water that is recycled from municipal wastewater.

¹For more information go to:
<http://www.owue.water.ca.gov/recycle/docs/RegulationsWhitePaper.pdf>.

For this reason, concerned agencies have looked to source control as a method of dealing with salts. Residential self-regenerating water softeners — also known as automatic water softeners, rock salt water softeners, or “ion exchange” water softeners — are an easily identifiable and preventable source of salt. This is not because of the water softener itself, but because they use sodium chloride (rock salt) to regenerate the exchange capacity of the resin. After this regeneration the salt is discharged and has resulted in excessive amounts of salt ending up in the waste stream.

To deal with the problem, several recycled water producers banned self-regenerative water softeners within their area of influence. For instance, Irvine Ranch Water District (IRWD) placed a ban in 1966. Then the State Health and Safety Code added technical standards for self-regenerative softeners in the 1970s. In 1978, a state law (SB 2148, 1978) prohibited local bans on residential water softeners; even still, some local jurisdictions banned them. Some of these bans were challenged and overturned in court in 1992. Then in 1996 and 1997, the Court of Appeals upheld lower court rulings that local ordinances banning water softeners are invalid because state statutes exist that forestall new local water softener standards or regulations. To further restrict on-site residential water softeners, local agencies would have to change existing state statutes. In response, IRWD and the Association of California Water Agencies (ACWA) sponsored Senate Bill 1006 (Costa, 1999) which amended SB 2148 to set a framework for the restriction of self-regenerative softeners. Then in 2003, Assembly Bill 334² -Water Softening and Conditioning Appliances - amended SB 1006 to be less restrictive.

Existing state statutes governing residential water softeners are contained in the California Health and Safety Code, Sections 116775 through 116795³, which reflect the most recent legislations on this issue, SB 1006 and AB 334. The provisions are summarized as follows:

1. Effective immediately, any newly installed residential self-regenerative water softener must have its regeneration activated by a demand control device that detects imminent exhaustion of the softening material (salt).
2. Effective January 1, 2000, water softeners had to be certified by a third party to have a salt efficiency rating of 3,350 grains of hardness removed per pound of salt used. The previous code required efficiency of 2,850.
3. Effective January 1, 2002, the efficiency requirement increased to 4,000.
4. Local agencies may regulate water softeners by ordinance to limit or prohibit the use of a water softener if an independent study that shows such regulation is a “necessary means” of achieving compliance with the water reclamation requirements or the master reclamation permit issued by a California regional water quality control board.
5. In the study, other means of compliance must be measured as to their relative economic and technological feasibility, as compared to regulation.

²For a copy of the bill go to:

http://www.leginfo.ca.gov/pub/bill/asm/ab_0301-0350/ab_334_bill_20030804_chaptered.html.

³ <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=116001-117000&file=116775-116795>

6. The study must assess the potential saline discharge reduction of the ordinance.
7. Other non-residential sources of salt must be regulated, to the extent technologically and economically feasible, before a residential ordinance can be enacted.
8. Any ordinance adopted can only apply prospectively; existing water softeners are "grandfathered in."
9. No ordinance may be adopted until January 1, 2003.

The water softener industry met the challenge by designing new water softeners which meet the criteria: currently 4,000⁴ grains of hardness removed per pound of salt-used. Still, the salt generated from water softeners continues to challenge the recycled water industry. SB 1006 and AB 334 do not apply to existing water softeners produced and installed prior to the adoption of any ordinance. The appliances are "grandfathered in" and can operate as usual. Also, even the most efficient water softener system still requires a regular discharge of salt brine into local wastewater stream. Although some headway has been made, alternative strategies are still needed.

Local Agencies and the State have recognized and addressed the issue of salt in the wastewater and the role that the self-regenerative water softeners play.

Some local water and wastewater agencies are working independently to reduce salt in the waste stream. For instance, Monterey Regional Water Pollution Control Agency (MRWPCA)⁵ has been investigating the issue as it supplies recycled water for irrigating almost 12,000 acres of food crops. Although the five year Monterey Wastewater Reclamation Study for Agriculture⁶ did not see a decrease in soil health or crop yields, the long term effects of recycled water's salt content is a major concern to growers. As a result of growers' concerns, MRWPCA has examined the recycled water quality and found that sodium levels were nearing the upper limits of the acceptable range. In examining the source-water quality, the study found that 37 percent of the salt load was from residential, commercial and industrial water softener brine.

The State has also addressed the issue of salt from self-regenerative water softeners in the wastewater through the Recycled Water Task Force (RWTF)⁷ report. The RWTF

⁴In theory, the maximum efficiency of self-regenerative water softeners is 6,000 grains of hardness removed per pound of salt.

⁵Innovative Approaches To Salt Reduction by Tom Kouretas, Monterey Regional Water Pollution Control Agency (MRWPCA) Robert Holden, MRWPCA Patrice K.F. Parsons, MRWPCA James Heitzman, MRWPCA

⁶Monterey Wastewater Reclamation Study for Agriculture, Engineering-Science, Inc, (1986), Location: Monterey County Water Resources Agency Library CW-212. This study examined whether irrigating with reclaimed wastewater is safe for consumers and farm workers. The study examined the following issues: (1) whether irrigating with reclaimed water is harmful to soils because of accumulation of heavy metals and salts or because of impaired permeability; (2) whether irrigating with reclaimed water affects yield, quality or growth of crops; (3) whether consumer demand for crops will be adversely affected; and (4) whether irrigating with reclaimed water is feasible and economical. The secondary objectives of the project were to: evaluate wastewater treatment effectiveness, provide design criteria for the regional plant, develop design criteria for full-scale reclamation, and provide field operational experience.

⁷The creation of the Recycled Water Task Force was called for in Assembly Bill No. 331 (Goldberg, 2001) (Water Code Section 13578). The Task Force, convened by the California Department of Water Resources

recommended to the state legislature that local agencies be empowered through legislation to regulate the discharge of residential water softeners in the same manner as other sources of discharge into sewers. The RWTF also encouraged water softener studies to develop alternatives for salt reduction in recycled water. Another Task Force recommendation asked local agencies to educate consumers regarding the impacts of self-regenerative water softeners through publicity campaigns and to offer financial incentives to upgrade older inefficient appliances. Responding to the needs stated in RWTF recommendations, Assembly Bill 334 (Goldberg, 2003) Water Softening and Conditioning Appliances was adopted.

The State has also supported further efforts to reduce salt loading in the waste water stream. California Department of Water Resources (DWR) awarded Santa Clara Valley Water District (SCVWD) with a 2002 Proposition 13 Grant for their Pilot Water Softener Rebate Program. This award winning pilot program provided 400 residents with a rebate of \$150 for the replacement of their inefficient pre-1999 water softener system. The newer water models, demand-initiated regeneration water softeners, more efficiently sense when the resin must be recharged with salt and regenerate the resin as needed. Thus, these types of water softeners use less water and salt.

The following are several proposed actions to address the salinity increase in water recycling facilities:

1. Survey on-going or proposed studies on salinity and the role of water softeners play to determine if any outstanding issues exist. Fund research on these additional issues.
2. Promote new technology for residential water softeners, such as reverse osmosis.
3. Promote more use of service companies to regenerate softeners at centralized nonresidential facilities. These facilities should achieve higher salt efficiencies and maintain better brine control for treatment and disposal.
4. Promote brine collection systems to transport brine to appropriate discharge facilities.
5. Soften the entire potable water supply at water treatment plants. This has been done in some areas, using processes that do not generate chlorides.
6. Demineralize recycled water through desalination technologies, such as reverse osmosis, to reduce TDS and its components, including sodium and chloride.
7. If sodium is the critical element, restrict softeners to using potassium-based salts and or any other appropriate technology.
8. Utilize the enacted laws (i.e. AB 334, Water Softening and Conditioning Appliances) to allow local bans on self-regenerative softeners based on less stringent criteria. The bill allows local agencies such as cities and water districts, after conducting technological and economic feasibility studies of alternatives, to restrict the use of the self-regenerating water softeners. The bill also encourages districts to develop or broaden their information and

(DWR) functioned as a cooperative effort of DWR, the State Water Resources Control Board and the Department of Health Services, the three State agencies primarily responsible for planning and regulating water supply. The Task Force was to advise DWR and report to the Legislature by identifying the opportunities for increasing the safe use of recycled water and identifying the constraints and impediments to increasing the safe use of recycled water. Their report is entitled *Water Recycling 2030: Recommendations of California's Recycled Water Task Force*, June 2003.

- education programs on water softeners. These programs should provide homeowners desiring water softening with alternatives to self-regenerating rock salt water softeners. These alternatives could include filtration, activated carbon, or reverse osmosis treatment units, as well as switching from sodium chloride to potassium chloride, adding salt less often, purchasing more salt efficient water softeners; i.e. demand-initiated regeneration, and or contracting with a water softener service provider that utilize the exchange tank devices, which are recharged offsite and eliminate the need to discharge excessive salt in the local wastewater.
9. Within the current legal restrictions, local agencies should consider publicity campaigns to educate consumers regarding the impacts of self-regenerative water softeners and promote the use of off-site regeneration by service companies. They should also consider financial incentives to upgrade older inefficient appliances to the current standards.
 10. Workshops, such as this one⁸, should be organized to promote and further information dissemination, to exchange data, experiences, and technology advancement and implementation all which reduce or eliminate salt loading generated from water softeners and other sources.

⁸ “A salinity management strategy — water softener replacement rebate program.” A workshop sponsored by the California Department of Water Resources and the Santa Clara Valley Water District held on July 8, 2005.