

**SANTA CLARITA VALLEY JOINT SEWERAGE SYSTEM
CHLORIDE SOURCE REPORT
OCTOBER 2002**

SUMMARY

The following report is an abbreviated summary of a comprehensive background study prepared by the County Sanitation Districts of Los Angeles County (Sanitation Districts) on sources of chloride in their Santa Clarita Valley Joint Sewerage System (SCVJSS). The report was reviewed by an expert panel convened by the National Water Research Institute, to satisfy the provisions set forth in state law for local agencies seeking to control the use of residential self-regenerating water softeners.

BACKGROUND

The Sanitation Districts currently operate eleven wastewater treatment facilities in Los Angeles County, including two water reclamation plants in the Santa Clarita Valley of northern Los Angeles County. These two water reclamation plants, the Saugus and Valencia water reclamation plants, discharge treated wastewater into the upper reaches of the Santa Clara River. The Sanitation Districts are currently facing significant water quality and regulatory challenges regarding the concentration of chloride being discharged to the river from the Saugus and Valencia Water Reclamation Plants. The discharges contain chloride in excess of the water quality objective for the Santa Clara River of 100 milligrams per liter (mg/L), which was established by the state of California.

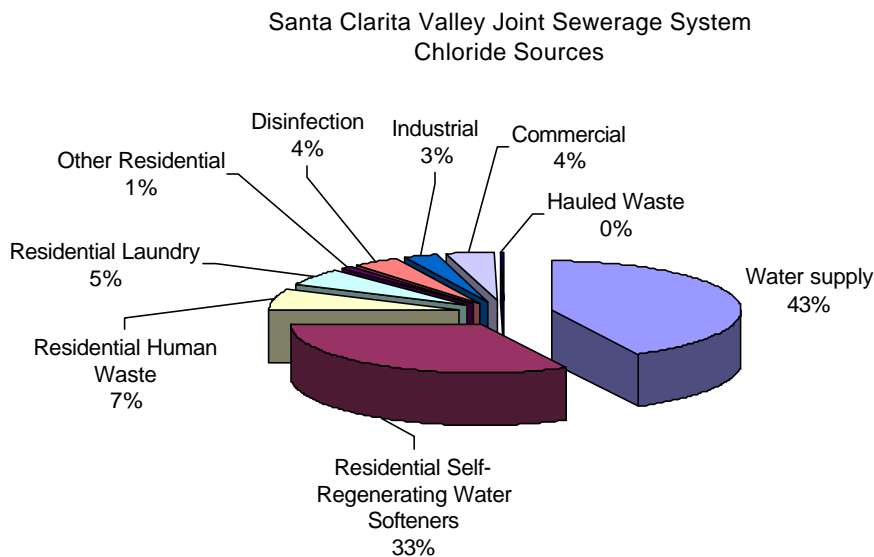
Previous studies have show that the two major sources of chloride in the Santa Clarita Valley area are the potable water supply and the residential sector, primarily from the use of self-regenerating water softeners. Self-regenerating water softeners are used to remove hardness (calcium and magnesium) from potable (drinkable) water via ion exchange resin beads. The resin beads are periodically "regenerated" through immersion in a sodium chloride brine. This brine is then discharged to the sewer system. To better quantify sources of chloride in the SCVJSS, the Sanitation Districts performed an extensive study of chloride sources in the SCVJSS. The year 2001 was used as a basis for the study. The information outlined in this report summarizes that study. A full copy of the report may be obtained, for reproduction costs, by contacting the Sanitation Districts' Monitoring Section at 562/699-7411, extension 2800.

OVERVIEW OF CHLORIDE SOURCES

The potable water supply currently contributes approximately 10,000 pounds of chloride per day, or 43 percent of the overall chloride concentration in the effluent discharged by the Saugus and Valencia Water Reclamation Plants. The potable water supply is a blend of local groundwater and imported surface water from northern California.

Beyond the potable water supply, the largest source of chloride to the sewerage system is self-regenerating water softeners used at residences. These devices discharge approximately 7,700 pounds per day of chloride to the treatment plants. Approximately 11 percent of the residential units serviced by the Saugus and Valencia Water Reclamation Plants operate self-regenerating water softeners. Other residential sources of chloride include human waste (1,700 pounds per day), laundering (1,300 pounds per day), other cleaning activities (165 pounds per day), and swimming pool filter backwash (110 pounds per day).

The combined chloride load from commercial, industrial and hauled non-industrial waste totals 1,700 pounds per day and represents seven percent of the overall chloride concentration in the water reclamation plants' effluent. Disinfection practices at the water reclamation plants contribute approximately 900 pounds per day, representing four percent of the total effluent chloride concentration. A liquid waste disposal station that accepts hauled septage and chemical toilet waste contributes less than one percent of the total.



WATER QUALITY ISSUES

The concentration of chloride in the water reclamation plants' effluent increased from approximately 129 mg/L in 1997 to 168 mg/L in 2001. This increase can be attributed to changes in the local potable water supply quality and increases in the use of residential self-regenerating water softeners.

The Saugus and Valencia Water Reclamation Plants collectively discharge approximately 17 million gallons per day of wastewater into the upper reaches (Reaches 7 and 8) of the Santa Clara River. These sections of the river have been assigned a chloride water quality objective of 100 mg/L by the Los Angeles Regional Water Quality Control Board (Regional Board) to protect downstream agricultural uses, including irrigation of chloride-sensitive crops. Based on the 2001 chloride concentration in the water reclamation plants' treated effluents of 168 mg/L, significant reductions in chloride concentrations are necessary. The treatment processes at the Saugus and Valencia Water Reclamation Plants do not have the capability of removing chloride from the wastewater. Therefore, these reductions can only be achieved by curtailing influent chloride loadings (if feasible) and/or by constructing advanced treatment at the water reclamation plants, such as microfiltration and reverse osmosis, and building a brine line to the ocean to dispose of the treatment byproducts.

In October 2002, the estimated capital cost for these treatment and construction projects was \$422 million, with an estimated annual operations and maintenance cost of \$9.7 million. Based on these numbers, the unit cost to remove chloride is estimated to be \$5.20 per pound of chloride removed. If these upgrades are necessary, the current sewer service rates for Santa Clarita Valley residents would increase from an estimated \$112 per year to more than \$520 per year per household, if the cost was spread evenly among all sewer users.

To put the estimated cost of \$422 million into perspective, a comparison of the cost to remove a pound of chloride from the water reclamation plants can be made to the cost of adding a pound of

chloride to operate a residential self-regenerating water softener. It is estimated that it costs a homeowner approximately 12 cents per pound of chloride used for regenerating a water softener, while it would cost the water reclamation plants approximately \$5.20 to remove that same pound of chloride through the use of microfiltration/reverse osmosis. The cost to remove the chloride from a single 40-pound bag of salt would be \$125 and the cost to remove the chloride from a single residential self-regenerating water softener operated for one year would be \$1,900.

The alternative to constructing advanced treatment at the water reclamation plants is to reduce the amount of chlorides entering the sewerage system. In addition to other means of source control, the Sanitation Districts are exploring the possibility of enacting an ordinance that would limit the availability or prohibit the installation of residential SRWS in the SCVJSS in accordance with the provisions of California Health and Safety Code Section 116786.

WATER SUPPLY CHLORIDE CONTRIBUTION

Chloride is present in the water supplied to homes and business for drinking, washing, and other purposes. This water is known as potable water. Potable water in the SCVJSS is a combination of local groundwater and imported water from the State Water Project. In 2001, 42 percent of potable water in the SCVJSS was local groundwater and the remaining 58 percent was State Water Project water. In 2001, the average chloride concentration of potable water supplied in the SCVJSS was 71 mg/L and the total chloride loading in this water was 10,000 pounds per day. During drought periods the level of chloride in both local groundwater and State Water Project water rises, because there is less of a dilution effect from rains. 2001 was a semi-drought period. The projected average potable water supply chloride concentrations for the SCVJSS are 55 mg/L for non-drought periods and 98 mg/L for drought periods.

IN-PLANT CHLORIDE CONTRIBUTION

Chloride can be added at wastewater treatment plants from the use of chemicals to enhance treatment and to disinfect wastewater. Previous chloride reduction efforts by the Sanitation Districts have eliminated the use of ferric chloride and ferrous chloride at the Saugus and Valencia Water Reclamation Plants, reducing effluent chloride concentrations by an average of 17 mg/L. Replacement of the only remaining in-plant source of chloride, sodium hypochlorite for disinfection of wastewater, with ultraviolet (UV) disinfection at both the Saugus and Valencia Water Reclamation Plants is an option to reduce chloride discharges. Modifying the water reclamation plants to operate with UV disinfection would result in an additional chloride reduction of approximately 3 mg/L. The capital cost of this conversion would be \$17.2 million, with an operation and maintenance cost of \$0.74 million per year. The unit cost to remove chloride would be \$7.60 per pound chloride removed.

COMMERCIAL AND INDUSTRIAL SECTOR CHLORIDE CONTRIBUTION

The Santa Clarita Valley is primarily a bedroom community and is home to a limited amount of industry. The Sanitation Districts permit 56 industrial wastewater dischargers in the SCVJSS. In the commercial sector, the majority of the businesses directly serve the residents, such as retail stores, dry cleaners and restaurants. The remaining businesses serve the business community, such as accounting firms.

Commercial and industrial use of self-regenerating water softeners have been banned in the SCVJSS since 1962, and there is only a small potential for further chloride reduction in the SCVJSS through increased commercial and industrial source control. In addition, an assessment of the impact on chloride levels if all businesses and industries were forced to stop discharging wastewater to the sewerage system revealed that chloride concentrations would actually increase.

For example, without industrial contributions, the flow in the sewerage system would drop to 15.4 million gallons daily from its current rate of 16.9 million gallons daily. The total chloride loading would drop by 1,600 pounds per day. The net result would be an increase in the concentration of chloride discharged from the sewerage system, from 168 mg/L to 172 mg/L. The net increase would occur because the average chloride concentration discharged from industries in the SCVJSS is less than the average chloride concentration from other sources.

The same scenario holds true if commercial businesses were forced to stop discharging wastewater to the sewerage system. Without commercial contributions, the flow in the system would drop to 14.2 million gallons daily from its current rate of 16.9 million gallons daily. Total chloride loading would drop by 2,539 pounds per day. The net results would be an increase in the concentration of chloride discharged from the Saugus and Valencia Water Reclamation Plants, from 168 mg/L to 179 mg/L.

Despite the low potential for commercial and industrial chloride source control measures to significantly impact the chloride situation, the Sanitation Districts have imposed limitations of 100 mg/L chloride on all industries for which this limit is technologically and economically feasible. In the cases where it is not feasible, the lowest limit that is economically and technologically feasible is being applied.

The Sanitation Districts are also continuing to work with commercial businesses to ensure that no self-regenerating water softeners are used and have required all commercial businesses in the SCVJSS to reduce or eliminate saline discharges to the extent technologically and economically feasible.

RESIDENTIAL SECTOR CHLORIDE CONTRIBUTION

The Santa Clarita Valley contains numerous residential bedroom communities, including the rapidly growing areas of the City of Santa Clarita, Stevenson Ranch, Fair Oaks Ranch, Valencia and the northern area of the region around Castaic Lake. The Saugus and Valencia Water Reclamation Plants provide wastewater treatment for the majority of residents of the Santa Clarita Valley. Based on records from the Sanitation Districts' service charge database, the SCVJSS contained approximately 30,000 detached single family homes and 22,000 non-single family housing units in 2001.

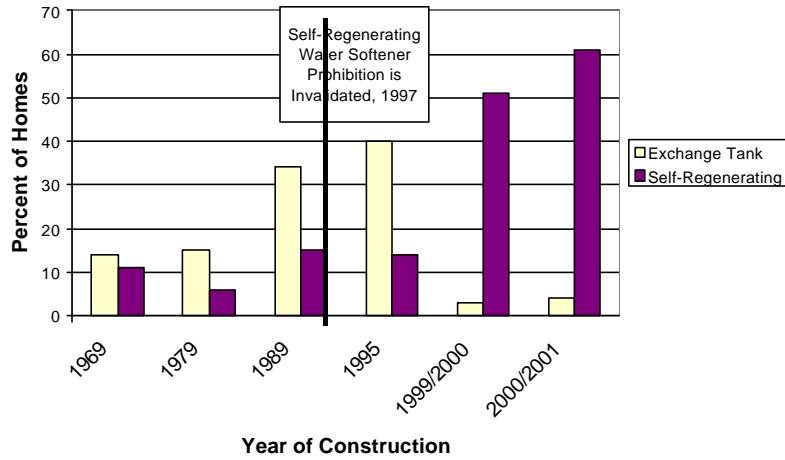
In 1962 the Sanitation Districts passed ordinances that prohibited sewer discharge of brines from self-regenerating water softeners. In 1997 the portions of these ordinances dealing with residential self-regenerating water softeners were overturned by court action, and residences in the SCVJSS were once again allowed to sewer brines from self-regenerating water softeners.

To determine the current water softening practices of SCVJSS residents, a door-to-door survey was conducted in six neighborhoods located in Saugus, Valencia, Stevenson Ranch and Fair Oaks Ranch. Two of the neighborhoods, in Stevenson Ranch and Fair Oaks Ranch, were built after the ordinances that prohibited the discharge of brine from self-regenerating water softeners were overturned. More than 80 percent of the households in each neighborhood completed the survey.

The survey results indicate that the two neighborhoods built after the ordinances were overturned had a significantly higher level of self-regenerating water softener usage than the four older neighborhoods, which had been constructed in 1969, 1979, 1989 and 1995. Only 6 to 15 percent of households in homes built prior to 1997 reported using self-regenerating water softeners, while 51 to 61 percent of households in homes in neighborhoods built after 1997 reported using them.

The occurrence of exchange tank softeners follows a reverse trend, with 15 to 40 percent of the households in the older neighborhoods reporting having exchange tank softening systems compared to three to four percent of the households in the newer neighborhoods.

Effect of Age of Neighborhood on Water Softener Ownership



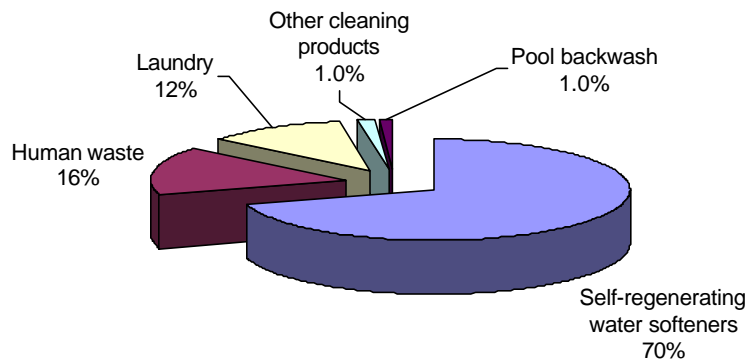
As a result, there are significant differences in concentrations and loadings of chloride in wastewater discharged from the newer neighborhood homes compared to the homes in the older neighborhoods. From February through August of 2001, the Sanitation Districts conducted an extensive field study to quantify the concentration and mass of chloride discharged from homes in each of the six study neighborhoods. Over a thousand chloride samples were collected and analyzed, and continuous wastewater flow measurements were taken during sampling periods.

The field study indicated that the chloride concentration above water supply in the discharges from the homes in the older neighborhoods ranges from 32 mg/L to 72 mg/L, while it is 367 mg/L to 435 mg/L in newer neighborhoods. The chloride loading above water supply discharged from the homes in the older neighborhoods ranges from 0.12 to 0.22 pounds per day, while it ranges from 1.37 to 1.42 pounds per day in the newer neighborhoods.

Field study measurements were combined with tax record information on property values, property taxes, and home size to obtain an average wastewater flowrate and chloride loading from all residences in the SCVJSS. The total residential flow of wastewater in the SCVJSS is 12.7 million gallons daily, and it carries a loading of chloride above water supply of 11,000 pounds per day. The estimated residential sector loading represents 46 percent of the total chloride loading to the SCVJSS water treatment plants and is the largest single contributor of chloride to the system.

Besides self-regenerating water softeners, the chloride from residences in the SCVJSS comes from human waste (1,700 pounds per day), laundry products (1,300 pounds per day), other cleaning

Residential Chloride Sources



products (170 pounds per day), and swimming pool backwash (110 pounds per day). The balance of the chlorides in residential wastewater, 7,700 pounds per day, comes from residential self-regenerating water softeners. Self-regenerating water softeners contribute 70 percent of the residential chloride loading above water supply while other residential operations contribute 30 percent.

In addition to studying the chloride loadings from residential neighborhoods, the Sanitation Districts conducted a study of a typical home self-regenerating water softener. The concentration of chloride in the brine waste from the softener ranged from 7,000 to 13,000 mg/L, with an average of 10,300 mg/L chloride. The average volume of brine waste discharged was 47 gallons. These results indicate that, for each regeneration of the self-regenerating softener, approximately 4 pounds of chloride are used. Although homes with water softeners may be able to use less detergent and thus decrease chloride loadings from cleaning operations, this decrease is not enough to offset the increased chloride loading from regeneration of a self-regenerating water softener. Approximately 11 percent of the residences in the Santa Clarita Valley area currently use self-regenerating water softeners.

Elimination of all self-regenerating water softeners in the SCVJSS would reduce the effluent chloride concentration at the Saugus and Valencia Water Reclamation Plants by 55 mg/L, from 168 mg/L to 113 mg/L based on 2001 conditions. During normal non-drought years, when chloride concentrations in potable water supplies are typically 55 mg/L, elimination of discharges from all residential self-regenerating water softeners in the SCVJSS would result in an overall yearly average chloride concentration of 97 mg/L, which is below the Santa Clara River's chloride objective of 100 mg/L.

PROJECTIONS

The projected final effluent chloride concentrations for 2010, 2015 and 2050 were estimated considering two scenarios: (1) beginning January 1, 2003, all new residential self-regenerating water softeners are prohibited; and (2) no prohibition. The results, assuming a non-drought potable water supply concentration of 55 mg/L, are:

- If all new residential self-regenerating water softeners are prohibited beginning January 1, 2003, the SCVJSS final effluent chloride concentrations will decrease from the 2001 level of 168 mg/L to 138, 130 and 114 mg/L in the years 2010, 2015 and 2050, respectively;
- If residential self-regenerating water softeners are not prohibited, the SCVJSS final effluent chloride concentrations will increase from the 2001 level of 168 mg/L to 200, 215 and 245 mg/L in the years 2010, 2015 and 2050, respectively; and
- If all existing residential self-regenerating water softeners ceased sewer discharge and new self-regenerating water softeners were prohibited as of January 1, 2003, the 2010, 2015 and 2050 final effluent chloride concentrations would be 97 mg/L.