MnTAP Industrial Chloride Project

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Organization Background

The Minnesota Pollution Control Agency (MPCA) is committed to ensuring every Minnesotan has healthy air, sustainable lands, clean water and a better climate. MPCA works with the Minnesota Technical Assistance Program (MnTAP), an outreach program in the School of Public Health at the University of Minnesota. This partnership provides pollution prevention technical assistance to businesses and organizations around the state to reduce pollution at its source to improve public health and the environment.

MINNESOTA POLLUTION CONTROL AGENCY

"This summer I had the opportunity to explore water treatment operations, water softeners in particular, and work on optimizing them to reduce chloride effluent. This allowed me to be an environmentally conscious engineer and gave me the tools and skills to do research in areas where I have a significant knowledge gap." ~ SL

Project Background

This project sought to develop Best Management Practices (BMPs) to reduce chloride discharge in industrial wastewater effluent from water softeners. This work compiled a list of BMPs and created a flowchart for operations that should be considered during a water softener audit. These BMPs and audit strategies were tested during site visits at five facilities with a goal of making recommendations to companies to implement the BMPs.

Incentives To Change

Chloride is toxic to aquatic life which is concerning given the widespread use of chloride salt in residential, commercial, and industrial settings. Even small amounts of chloride have the potential to pollute large amounts of water, with 1 teaspoon of salt enough to pollute 5 gallons of water. In 2020, there were 50 bodies of water in Minnesota listed as impaired due to chloride, 40 of these are in the seven-country Twin Cities Metropolitan Area. It is important that chloride discharge is reduced to preserve the health of our aquatic environments. While there are treatment options available for removing chloride from wastewater effluent, these options are not economically feasible. Optimizing water softeners ensures that salt is used efficiently, thereby reducing the amount of chloride discharged.

SOLUTIONS

Use Accurate Hardness Setting

Softeners may have the feed water hardness set higher than the actual hardness of the raw incoming water. Setting the feed water hardness to reflect the hardness of the incoming raw water leads to instantaneous water and salt savings. Accurately setting the water hardness has the potential to increase the capacity of the softener, thereby reducing the number of regenerations performed by the softener and in turn reducing salt and water use. This is a programming change with no implementation cost.

Lower Salt Dosage

Salt dosage refers to the amount of salt used per cubic foot of resin during regeneration. Decreasing the salt dosage allows the softener to operate at a higher salt efficiency. Increasing the softener efficiency allows the softener to use less salt to remove the same amount of hardness. Increasing the efficiency to a minimum of 4,000 grains/lb at a minimum salt dosage of 5 lbs/ft^3 is recommended. This change results in instant salt savings, but will increase water use due to the increase in regenerations. This is a programming change with no implementation cost but has the potential to significantly reduce the chloride discharge from the softener.

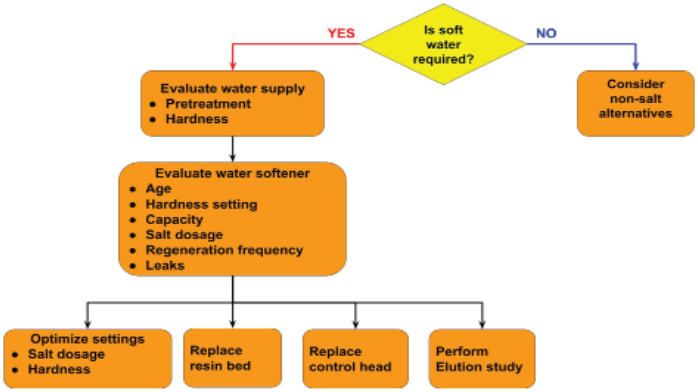
Solutions

Replace the Resin Bed

Water softeners experience 1% to 3% resin bed volume loss annually. This loss can be due to the force of the backwash phase during regeneration or foulants in the raw incoming water. When compounded across 10 years, this translates to a 10% to 27% decrease from the original resin bed volume. Typically, replacing the resin bed every 10 years is recommended. The resin loss reduces its overall softening capacity, meaning the amount of water it can soften before it regenerates is reduced. Increasing the number of regenerations increases chloride effluent and increases the rate of resin loss. Replacing the resin restores the original unit capacity, reducing the number of regenerations and allowing it to operate more efficiently.

Conduct an Elution Study

An elution study is a diagnostic tool that helps determine any problems with the regeneration cycle. Performing an elution study is recommended to analyze the effectiveness of the regeneration process. The elution study can help identify any problems in the regeneration process and guide users to proper optimization actions.



"Working with the MnTAP internship program has been such a wonderful experience. This valuable work has not only recommended ways to reduce chloride entering Minnesota's water resources from the facilities the intern worked with, but provided a process that many more facilities can learn and benefit from. It has also provided partners working toward chloride reduction with insights into how to help more facilities and businesses reduce chloride from water softening systems across the state. I look forward to a continued partnership with the MnTAP program to address the challenge of reducing chloride pollution at the source."

~ Brooke Asleson,
Chloride Program Administrator at MPCA

Company	Recommendation	Annual Reduction	Annual Savings	Status
A	Change Salt Dosage and Hardness Settings	Salt: 41 tons Water: 252,000 gal	$12,000	Recommended
B	Change Salt Dosage and Hardness Settings	Salt: 5.8 tons Water: 10,500 gal	$1,200	Recommended
C	Change Salt Dosage setting	Salt: 13 tons Water: 41,700 gal	$2,800	Recommended

MnTAP Advisor: Laura Sevcik, Pollution Prevention Specialist; Laura Babcock, MnTAP Director