Wahl H2O

Water Education
Real Life Experience
Treatment Advice

CASE STUDY
Water Softener "Creep"

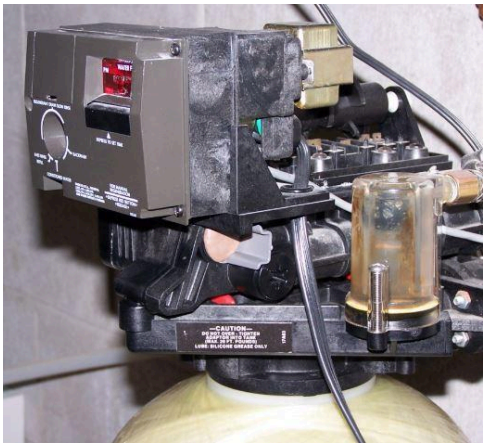
Drinking Water Education

Volume 8 Issue 3 - Wahl H2O © 2025 | Jeff Wahl | jeff@wahlwater.com

Case Study: Resin Failure in Aging Water Softener System

Overview

- **Location:** Manitoulin Island, Ontario. Canada
- **Property Type:** Residential Single Dwelling
- **System Installation Date:** September 1998
- **Service Call Date:** March 2025
- **Installed Treatment Equipment:** Cation ion exchange water softener
- **Reported Issue:** Heavy scaling / buildup on fixtures, shower doors and dishware



Background

A water softener was installed in a residential home on Manitoulin Island in 1998. The system was regularly maintained over the years and remained in service until the home was sold in February of 2025. The regular maintenance included checking motor operation, verifying the flow meter was metering, the screen and injector were cleaned and replaced when necessary. The system was last inspected in April of 2024 and there were no signs of any water treatment problems at that time.

After taking possession of the property, the new homeowners contacted our water treatment company to report persistent scaling on plumbing fixtures and dishware, despite the water softener being active and backwashing on schedule. It was evident that the softener was no longer achieving soft water and the problem was investigated.

Examining the Technology

A **water softener** removes **calcium and magnesium** (which cause hard water) through a process called **ion exchange**. Water passes through a tank with resin beads that swap the hard minerals for sodium or potassium ions, softening the water.

When the resin beads get full, a saltwater solution from the brine tank flushes out the minerals and recharges the system in a process called **regeneration**. The waste is then drained away, and the softener is ready to go again.

Replacing water softener resin is important because the **resin beads** are the core functional element of the system—they perform the **ion exchange** that removes hardness minerals (calcium and magnesium) from water. Over time, these beads become less effective due to fouling, degradation, or loss of ion-exchange capacity.

Diagnostic Findings

Upon inspection, it was found that the softener contained the **original resin from 1998**, which had **never been replaced**. To assess system performance, water samples were collected from both the raw water supply and the treated water line downstream of the installed softener.

Water Hardness

Raw Water: 18.9 grains per gallon (gpg)
Treated Water: 98.5 grains per gallon (gpg)
**** Sample Taken from the Kitchen Faucet*
**** Water Considered Unsafe by Canadian Drinking Guidelines*

Total Dissolved Solids (TDS)

Raw Water: 475 ppm
Treated Water: (TDS): 3012 ppm
*** *Sample Taken from the Kitchen Faucet*
*** *Water Considered Unsafe by Canadian Drinking Guidelines*

Total Iron (Fe)

Raw Water: 0.4 ppm
Treated Water: 1.3 ppm
*** *Sample Taken from the Kitchen Faucet*
*** *Water Considered Unsafe by Canadian Drinking Guidelines*

Treatment Equipment Can Contribute to Water Quality

The treated water sample revealed **hardness, total dissolved solids and iron levels significantly higher than the incoming raw water supply**, indicating complete resin failure. The resin was contributing higher amounts for each parameter back into the water supply entering the home. This “hardness creep” can occur when resin is not replaced and allowed to accumulate hardness without exchanging it during regenerations.

As the ion exchange process was no longer functioning, it was due to resin fouling, breakdown, and exhaustion from over two decades of use. This contributed to drinking water quality which was considered unsafe by the Canadian Drinking Water Quality Guidelines.

Equipment Highlight

Ion exchange media, often referred to as **resin beads**, is the heart of a water softener. These beads are small, porous spheres made from polystyrene cross-linked with divinylbenzene (DVB). Each bead carries negatively charged sites that attract and hold positively charged ions (cations).

In a standard water softener:

- The media is saturated with sodium (Na^+) or potassium (K^+) ions.
- As hard water passes through, the beads attract and exchange calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions—responsible for hardness—for sodium or potassium ions.
- This process is reversible and restored during the regeneration cycle using a salt (brine) solution.

Impacts of Iron on Softening
Iron in well water, especially ferrous iron (Fe^{2+}) can have a damaging impact on ion exchange media over time:

Iron oxidizes to form ferric iron (Fe^{3+}), which precipitates as rust (iron oxide).These rust particles coat the resin beads, blocking their active sites and reducing their ion exchange efficiency. This leads to decreased softening capacity and causes resin fouling. Iron sludge can clump in the resin bed, creating uneven flow and channeling, where water bypasses the resin altogether. This results in poor performance and inconsistent water quality.

Preventive Measures

Proper maintenance of a water softener is essential for operation, replacing resin every 10–15 years depending on water quality and usage. It is suggested to replace softener resin every 5 years on water hardness values greater than 30 grains per gallon (gpg).

It is a good practice to test treated water hardness annually to verify ion exchange performance for the resin. Installing a pre-sediment filter helps to protect resin from buildup, fouling and degradation. High levels of iron and sulphur in water should always be treated prior to the water softener.

Summary

This case highlights the importance of **resin replacement** as part of long-term water softener maintenance. While regular service can keep a system operational, **resin typically has a useful life of 10–15 years** under average residential conditions. In this case, the resin was in service for 27 years, well beyond its expected lifespan, leading to total softening failure and severe drinking water quality issues.

© Jeff Wahl | Treating Water Seriously Since 1995 | www.wahlwater.com