

FEEDWATER: WELL WATER

APPLICATION: MUNICIPAL

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REVIEW

Avista® Technologies was contacted by a municipal water supplier in Ohio USA in June of 2012 to seek advice on their reverse osmosis (RO) system which had been experiencing increases in delta pressure and flow losses in a matter of days. The RO process has a well water feed producing approximately 300 gpm of drinking water for the city. The water treatment plant was experiencing a heavy buildup of scale on the RO plant's concentrate lines and transfer wells (see Figure 2, left). Maintaining the integrity of the RO performance proved difficult due to the continuous scaling condition present on the tail end of the RO system.



DIAGNOSE

Our applications specialist went to the site and conducted a system audit. After the audit, a tail element from the second stage was removed. During the membrane removal process, an orange foulant on the scroll end of the element (Figure 2, right) was discovered. A sample of the orange granular material was collected and returned to Avista for analysis. The sample was analyzed at the Avista lab and was identified as calcium sulfate scale combined with iron (Figure 3).



SOLVE

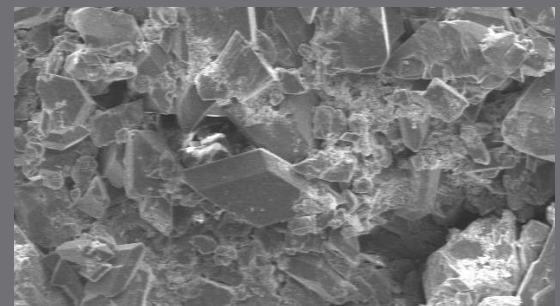
A water analysis was requested and entered into a saturation calculation program used to predict the scaling potential of brine streams called Advisor™. The program predicted sulfate (calcium, barium and strontium sulfate) as the primary scale and calcium carbonate as the secondary scale. Several Avista antiscalant products were examined to determine the best product for inhibiting both scales. Based on the saturation levels, the amount of product required and sulfate scale inhibition properties required, the antiscalant Vitec® 7000 was specified for this site. Vitec 7000 was placed online at a dose of 2.0 ppm. Normalized data had not been collected so the Avista application specialist assisted the plant in developing a procedure to collect, normalize and analyze data periodically to ensure the plant was running at peak performance.



Figure 1. Image of reverse osmosis system at the municipal water plant



Figure 2. Images of the transfer well (left) and scale sample removed from the second stage vessel (right). A sample of the orange granular material from the second stage vessel was collected and returned to Avista lab for analysis. The sample was analyzed and identified as calcium sulfate scale combined with iron. (Figure 2)



Element	Weight Percentage
Carbon	3.96
Oxygen	56.48
Silicon	0.41
Sulfur	15.26
Calcium	20.63
Iron	3.26

Figure 3. Scanning Electron Microscopy image of the sample removed from the second stage vessel showing distinct calcium sulfate crystals (top). Energy Dispersive X-ray confirms calcium sulfate and iron were the main components in the foulant.



## MONITOR

### THE NORMALIZED DATA SHOWS:

- 1 Only an 8.0% decrease in flow was observed in the first stage over 2 years (Figure 4).
- 2 The second stage of the RO system showed less than a 5% loss of permeate flow over the same 2 years (Figure 5).

**Normalized Permeate Flow—First Stage**

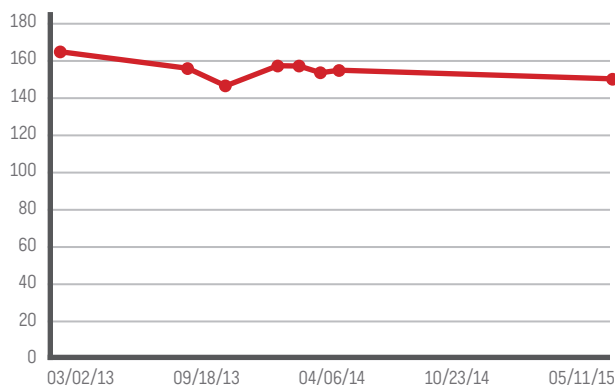


Figure 4. Normalized permeate flow of the first stage of the RO system after Vitec 7000 was put online

**Normalized Permeate Flow—Second Stage**

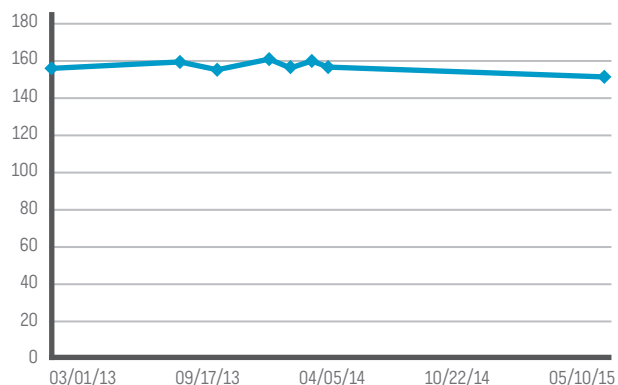


Figure 5. Normalized permeate flow of the second stage of the RO system after Vitec 7000 was put online

- 3 The delta pressures remained constant (Figures 6 and 7).

**Normalized Delta Pressure—First Stage**

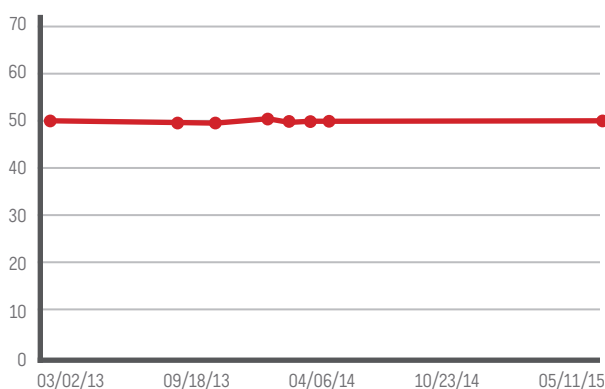


Figure 6. Normalized delta pressure of the first stage of the RO system after Vitec 7000 was put online

**Normalized Delta Pressure—Second Stage**

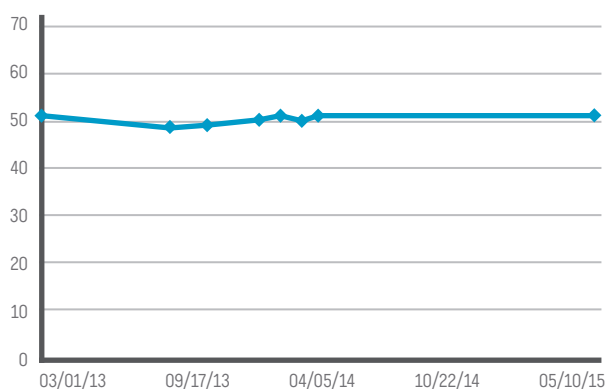


Figure 7. Normalized delta pressure of the second stage of the RO system after Vitec 7000 was put online

## SUMMARY

Analytical methods and onsite troubleshooting identified the cause for the rapid fouling of the RO system as calcium sulfate scaling in the second stage. In order to control the scaling events, the use of an antiscalant specifically formulated to control sulfate scales as well as calcium carbonate was implemented. The application and use of Vitec 7000 has stabilized the RO system performance and the plant has been running two years without cleaning.