

How to Manage Scale for Improved Evaporator & RO System Performance

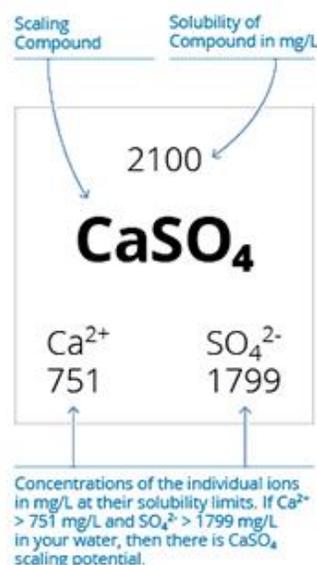
Scale is a crust that forms on membranes, heat transfer surfaces, and on the inside of pipes as salts precipitate out of solution. It blocks flow, disrupts heat transfer, and increases energy requirements for water treatment systems. Scale is bad news: it limits system performance and increases maintenance costs. You can protect your plant's productivity from scale armed with an understanding of scaling water chemistry and the right technology. You can also push and maximize performance of your plant, if you understand the scaling 'danger zone'. Download our [periodic table](#), which includes an easy to use guide and example. Keep reading to learn more.

Periodic Table of Scaling Compounds



2100 CaSO₄ Ca ²⁺ 751 SO ₄ ²⁻ 1799		120 SiO₂ SiO ₂ 120 pH <10	
15 CaF₂ Ca ²⁺ 7.7 pH >2 F ⁻ 7.3	6.17 CaCO₃ Ca ²⁺ 2.5 pH >5 CO ₃ ²⁻ 3.7	132 SrSO₄ Sr ²⁺ 63 SO ₄ ²⁻ 69	1.0 Al(OH)₃ Al ³⁺ 0.37 pH >3
9.6 Mg(OH)₂ Mg ²⁺ 4.0 pH >10		2.45 BaSO₄ Ba ²⁺ 1.4 SO ₄ ²⁻ 1.0	
20 Ca₃(PO₄)₂ Ca ²⁺ 7.8 pH >5 PO ₄ ³⁻ 12.2	24 BaCO₃ Ba ²⁺ 17 pH >5 CO ₃ ²⁻ 7.3	1.43 Fe(OH)₃ Fe ²⁺ 0.75 pH >3	1.43 Mn(OH)₂ Mn ²⁺ 2.0 pH >3

How to Use This Chart



Tips

- These values are based on solubility at 20°C—no ionic effects and no antiscalants present
- Well-designed antiscalants can increase solubility of scaling ions to maximize system recovery

Contact Saltworks to learn more: projects@saltworkstech.com

How do Scaling Ions Precipitate?

Scaling occurs when ion pairs form salts as they reach their solubility limits. Ion pairs are comprised of positive cations and negative anions, and most scale is caused by ions that are multivalent pairs. Multivalent ions, such as Calcium (Ca^{2+}) and Sulfate (SO_4^{2-}), are more likely to cause scale than monovalent ions since they have lower solubilities and will precipitate earlier. Watch out, however, for one particular mono-multi pair, Calcium (Ca^{2+}) and Fluoride (F^-), which can also cause scale. Our engineers use the above scaling periodic table of elements to easily check the concentrations where ions in water might precipitate and affect evaporator or membrane system performance.

The solubility of an individual ion pair is the most essential information to use when designing a scale management strategy. However, scaling concentration limits can be affected by the temperature, pH, and mixed ion chemistry of the water. Ions in mixed solutions tend to have higher solubilities than pure solutions, which can be difficult to predict, even with some of the software models that are available. We treat mixed ion effects as an extra buffer that prevents scale.



Scaling found on the inside of pipes

How Does Scaling Impact Evaporators & Membrane Systems?

Any heat transfer surface where scaling occurs will observe decreased efficiency and capacity. Although scaling is typically shown on metal surfaces, it can also form on membranes used in reverse osmosis systems and reduce membrane performance. In severe cases, scale can mechanically damage or rupture the membrane.

A plant that ignores scaling limits can experience equipment plugging and surface crusting, or be operating sub-optimally leaving room to increase freshwater recovery. Time and money are wasted on either low performance, or efforts to recover from a scaling event. Although carbonate scaling is easy to remove with acid, other scales take much more effort such as expensive chemical cleans or mechanical removal. It is best to know where you stand and prevent scaling, rather than try to deal with it after it forms.

How to Avoid Scaling in Your Industrial Water Treatment Process

- Get a complete analysis of your water chemistry to understand the concentrations of your potential scalant ions. For a few hundred dollars, you will receive analytical data that will help you understand low and high concentrations for your water. Ensure you sample during periods of both low and high concentration for better representation of your complete picture.
- Know the scaling potential of any scaling ions in your water using our Periodic Table of Scaling Compounds, or find a software package if you wish to get more advanced.
- Design and operate your process to push recovery, but avoid exceeding scaling ion solubility limits.
- Consider adding anti-scalants that may boost your scaling ion solubilities as much as 3-4x, but be sure to use the correct anti-scalant and consider testing.

There are many companies that will sell you anti-scalants and their performance may vary.

- Contact an expert today to optimize your process and prevent scale formation.

Is your Water Recovery Limited by Scaling? We can help.

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