

PRETREATMENT MONDAY · CASE STUDY

Softener vs. deaerator?

Softener AND deaerator.

Hard city water, no softener, a choked
DA vent. ~\$98K in new equipment avoided.

CASE STUDY · FOOD MANUFACTURING · BOILER PRETREATMENT · INDEPENDENT · NO CHEMISTRY SOLD

Softener vs. deaerator? Softener AND deaerator. Technical intervention saves a boiler system.

A growing food manufacturer moved into a new, larger plant and brought its firetube steam boilers. The mechanical contractor installed the boilers and a recommended deaerator, but no other pretreatment, on hard Chicago city water. The deaerator scaled over every few days, feedwater oxygen ran high, and no treatment residual held. The contractor blamed the water treater and voided the new-equipment warranty; the water treater said it was mechanical. The plant asked for an independent review.

ASSET

Firetube boilers + DA

THE DISPUTE

Mechanical vs. chemical

HIDDEN FINDING

**No softener, choked
vent**

RESIDUALS

0 → on target

OUTCOME

~\$98K avoided

Challenge — What Was Happening

Feedwater dissolved oxygen was high and the **deaerator scaled over every few days**, forcing repeated cleanouts. Blowdown showed no sulfite, phosphate, or polymer residual regardless of feed.

The contractor blamed the treatment program and **voided the warranty**. The water treater insisted it was mechanical. Each side had a position. Nobody had a root cause.

Baseline — What We Found

Chemistry Baseline

- Feedwater DO about **4 ppm**; deaerators are typically guaranteed to **7 ppb**
- Phosphate **0 ppm** in blowdown vs. **25 ppm PO₄** target
- Sulfite **0 ppm** in blowdown vs. **3 ppm** target; no polymer residual
- Makeup: Chicago city water, about **140 mg/L hardness as CaCO₃**

Intervention — What We Did

- Third-party audit from the **city water connection to the steam header**
- Checked the deaerator installation against basic **venting practice**
- Checked every **chemical injection point** against where that chemical has to work
- Inspected the boiler waterside when it was opened
- Wrote the engineering report on the evidence, **despite pressure from the installer to soften it**

Mechanical Baseline

- **No softener** upstream of the deaerator
- Deaerator vent with **two 90° bends** before leaving the building
- All chemicals injected **ahead of the deaerator** from one drum
- Skimmer as the **only automated blowdown**; **heavy scale in the bottom half** of the boiler

Root Cause

ROOT CAUSE FINDING

A mechanical and installation problem, not a chemistry failure. A deaerator removes gases, not hardness. Hard makeup heated in the deaerator loses CO₂, its pH rises, and calcium carbonate drops out on the sprays and trays. Phosphate fed ahead of the deaerator precipitated with the same calcium, so no phosphate or polymer ever reached the boiler.

Oxygen: the restricted vent could not release stripped oxygen and non-condensables, and sulfite fed upstream reacted with oxygen in the incoming water instead of polishing the storage section. At about 8 ppm sodium sulfite per ppm O₂, scavenging 4 ppm is not a program. **Mechanical deaeration does the work; chemistry polishes.**

Boiler scale: untreated hardness plus surface-only blowdown left settled solids in the bottom of the boiler. Only bottom blowdown removes sludge.

RESULTS DELIVERED

~\$98K equipment avoided

Not counting downtime, deaerator cleanouts, or boiler cleaning — corrections paid by the installer, warranties restored

EQUIPMENT AVOIDED

~\$98K

SULFITE

0 → 3 ppm

PHOSPHATE

0 → 25 ppm

WARRANTY

Restored

CORRECTIVE ACTION

- **Softener** installed upstream of the deaerator
- **Vent rebuilt** as a single vertical run out the roof
- **One drum to three:** sulfite by quill below the DA water line; internal treatment to the feedwater line; steam line treatment by quill into the steam header
- **Automated bottom blowdown** valve added alongside the skimmer

OUTCOME

- All chemical readings **hit target immediately and held**
- Deaerator scaling and cleanouts **stopped**
- Installation and equipment **paid by the mechanical contractor**
- Dispute ended with a **written root cause**, not a standoff

A deaerator is not hardness pretreatment, and a softener is not oxygen control. A boiler on hard water needs both, vented and fed correctly. There is never a reason to stay stuck in a technical or contract argument when an independent consultant can bring perspective, experience, and a definitive answer.

Hardness reflects published Chicago municipal water quality; deaerator performance reflects typical manufacturer guarantees. Equipment cost avoided as reported by the facility. Details generalized to protect client confidentiality. © Industrial Water Advisory — Independent, vendor-neutral boiler, cooling & process water consulting.