

CASE STUDY · PETROCHEMICAL · COMPRESSOR COOLERS · ROOT CAUSE · INDEPENDENT · NO CHEMISTRY SOLD

Every service report said "in control," and mild steel corrosion was under 0.1 mpy. Three compressor coolers were failing anyway.

The site team was chasing a mild steel corrosion rate under 0.1 mpy because the customer had seen it that good for so long that nobody wanted it to rise. They monitored every parameter the book tells you to, and still couldn't keep the compressor coolers clean. IWA found a deposit the lab report couldn't see, reset the control ranges, and eliminated the cleanings and shutdowns without giving up the corrosion rate.

ASSET	PROGRAM	LAB SAID	ACTUALLY	OUTCOME
3 compressor coolers	**Neutral-pH phosphate**	**Calcium phosphate**	**Calcium pyrophosphate**	**~$2.5M/yr recovered**

Challenge — What Was Happening

Three compressor coolers at a Gulf Coast petrochemical plant kept filling with deposits. The site ran **6 online cleanings a year** and, when those weren't enough, **3 short unit shutdowns** of about half a day each.

On paper the program worked: corrosion under 0.1 mpy and every routine parameter in range. The customer was **losing confidence** in the service team.

Intervention — What We Did

- A **one-year water quality and operational review**
- **Onsite system evaluation**, plus operator and service company **interviews**
- **Field and laboratory water analysis training**
- A full **root cause failure analysis**

Baseline — What We Found

The Program

- **Neutral-pH** cooling tower program
- **Orthophosphate and pyrophosphate** for mild steel; **chloro-tolyltriazole** for copper alloys
- A **terpolymer dispersant** for calcium phosphate control

The Symptoms

- Mild steel corrosion **consistently under 0.1 mpy** on coupons
- Compressor coolers **fouling with deposits**; lab analysis: **calcium phosphate**
- The usual calcium phosphate fixes weren't working

ROOT CAUSE FINDING

Faster reversion than assumed. Long residence time and temperature hydrolyzed pyrophosphate to orthophosphate faster than the 30–50% rule of thumb.

Feed creep. To hold the pyrophosphate residual, the team slowly raised pyrophosphate feed until the water reached a supersaturation point that drastically shortened induction time.

The wrong salt. Higher surface temperature and pH at the tube wall favored **calcium pyrophosphate**, not ordinary calcium phosphate.

Hidden by the lab method. The deposit procedure converts all complex phosphates to orthophosphate before measurement, so the report said "calcium phosphate."

The Fix — What Changed

- **Reset the pyrophosphate residual target and control range** for the actual reversion rate
- Calculated with a **proprietary speciation, saturation, and kinetics analytic**; **reduced pyrophosphate feed**
- **Increased terpolymer dispersant 15%** to inhibit calcium pyrophosphate and calcium phosphate at tube-wall temperature and pH
- **Mild steel corrosion held under 0.1 mpy** on coupons

RESULTS DELIVERED

~$2.5M a year recovered

Lost production, restart losses, and cleaning costs avoided, with no capital and no loss of corrosion control

ONLINE CLEANINGS	UNIT SHUTDOWNS	MILD STEEL CORROSION	CAPITAL REQUIRED
6/yr → 0	**3/yr → 0**	**<0.1 mpy held**	**None**

PLANT

- **Eliminated** 6 online cleanings and 3 half-day shutdowns a year
- **Identified** the real deposit the lab method couldn't report
- **Restored** confidence in the service team

SERVICE COMPANY

- **Kept its revenue** and improved profitability
- Polymer carries a **better margin** than phosphate
- Control ranges now match **actual system chemistry**

There's nothing wrong with chasing perfection, or even just improvement. But when complicated systems and complicated chemistry are running on the edge of control, an independent set of eyes helps make sure you're maximizing production and minimizing cost.

Value basis: unit valued at ethylene-cracker scale (~1.0 MMt/yr, ~2,740 t/day) at a 12¢/lb (~$265/t) long-run ethane cracking cash margin, ~$725K/day. Three half-day shutdowns (~$1.09M), restart and ramp losses (~0.75 day, ~$0.54M), shutdown cleaning crews (~$0.18M), online cleaning contractor and chemicals (~$0.21M), and a ~10% rate cut for 24 h per online cleaning (~$0.43M). Range ~$1.9M–$3.0M at 8.8–15¢/lb. Excludes fouling throughput penalty and tube or bundle replacement. Details generalized to protect client confidentiality. © Industrial Water Advisory — Independent, vendor-neutral cooling, boiler & process water consulting.