

PAPTAC Bleaching Committee Spring Meeting 2015 Point Claire, Quebec

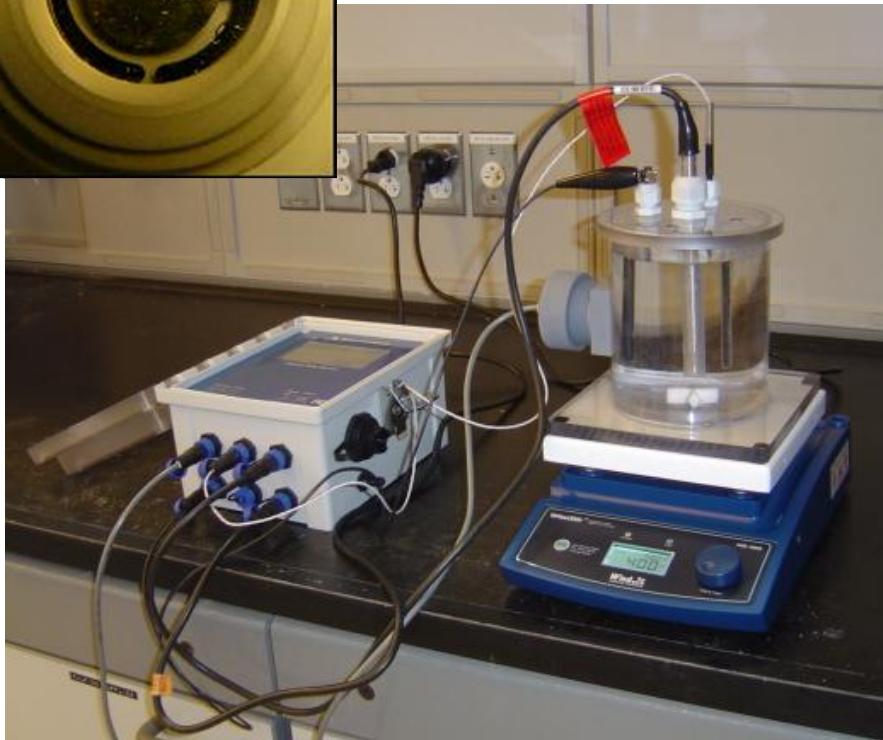
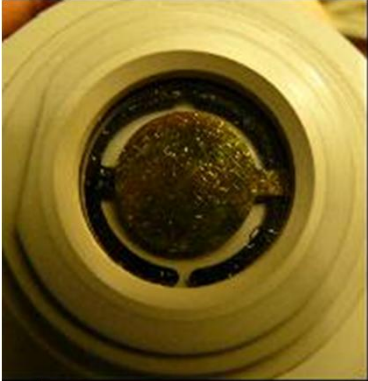
Nalco Scale Rate Monitor

by Jack Thomas

Industry Technical Consultant for Pulping, Bleaching and Recovery
Nalco and Ecolab Company



Scale Rate Monitor (SRM)



Benchtop SRM-3 instrument, patented technology

Quartz Crystal Microbalance

(QCM) technology:

- ▲ Quartz crystal sandwiched between two metal surfaces vibrates when electrical potential is applied (piezoelectric effect)
- ▲ Vibration frequency is proportional to the mass of a deposit on the QCM sensor and can detect accumulating mass in micrograms
- ▲ Local pH shift upward of 2 to 2.5 units near the QCM surface causes deposition on the vibrating crystal for calcium oxalate and calcium carbonate scale.
- ▲ Compares the relative activities of scale control chemistries for product development and for effective control treatment

Scale Rate Monitor (SRM)

▲ SRM Crystals



How does the SRM work?

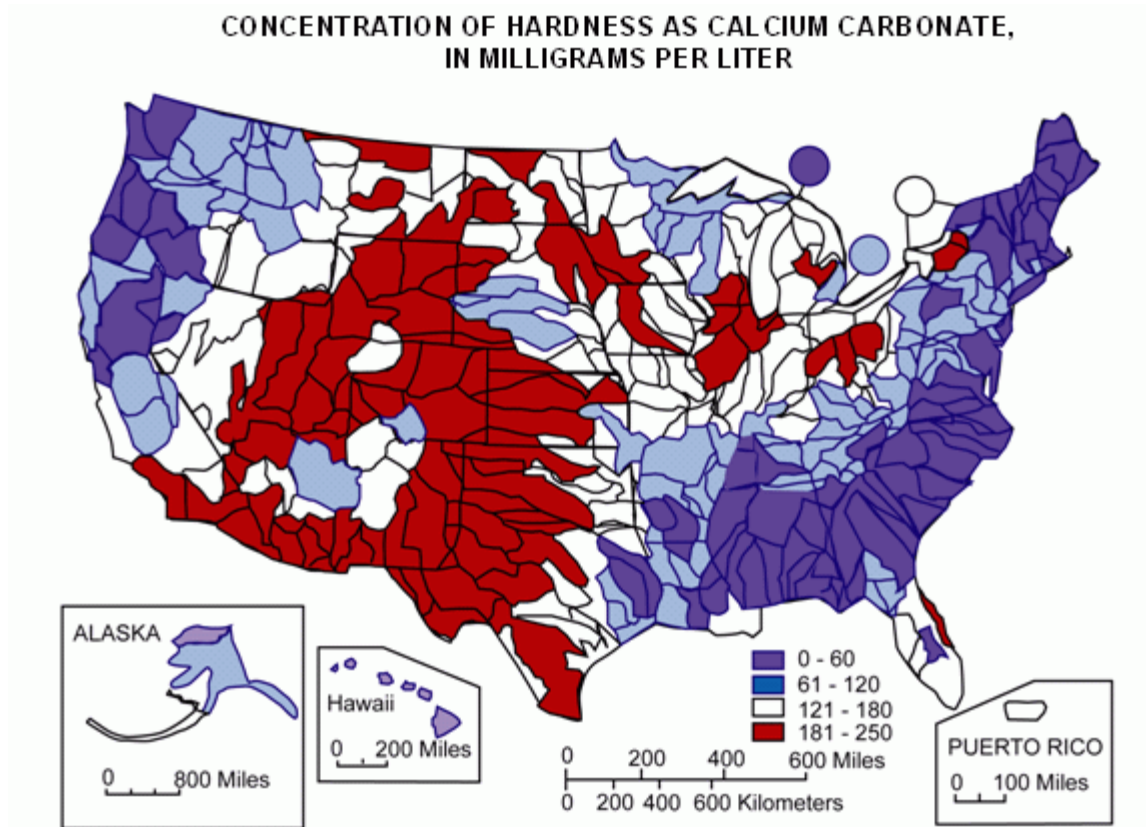
1.0 Deposit Rate Monitor SRM3 – General Information

The SRM3 is a proprietary Nalco instrument used in the field to test the propensity for scale formation in aqueous solutions, including colloidal solutions, and slurries to form deposits.

The measuring unit for the SRM is a metal-plated piezoelectric quartz crystal (quartz crystal microbalance, QCM) that vibrates at a particular resonant frequency dependent on the mass of the crystal newly formed. As the deposits accumulate, the crystal mass increases and causes the vibration frequency to decrease. The instrument registers the change, thus allowing both the mass and the rate of scale accumulation to be simultaneously monitored. The mass-frequency dependence is linear.



Hardness in Ground Water

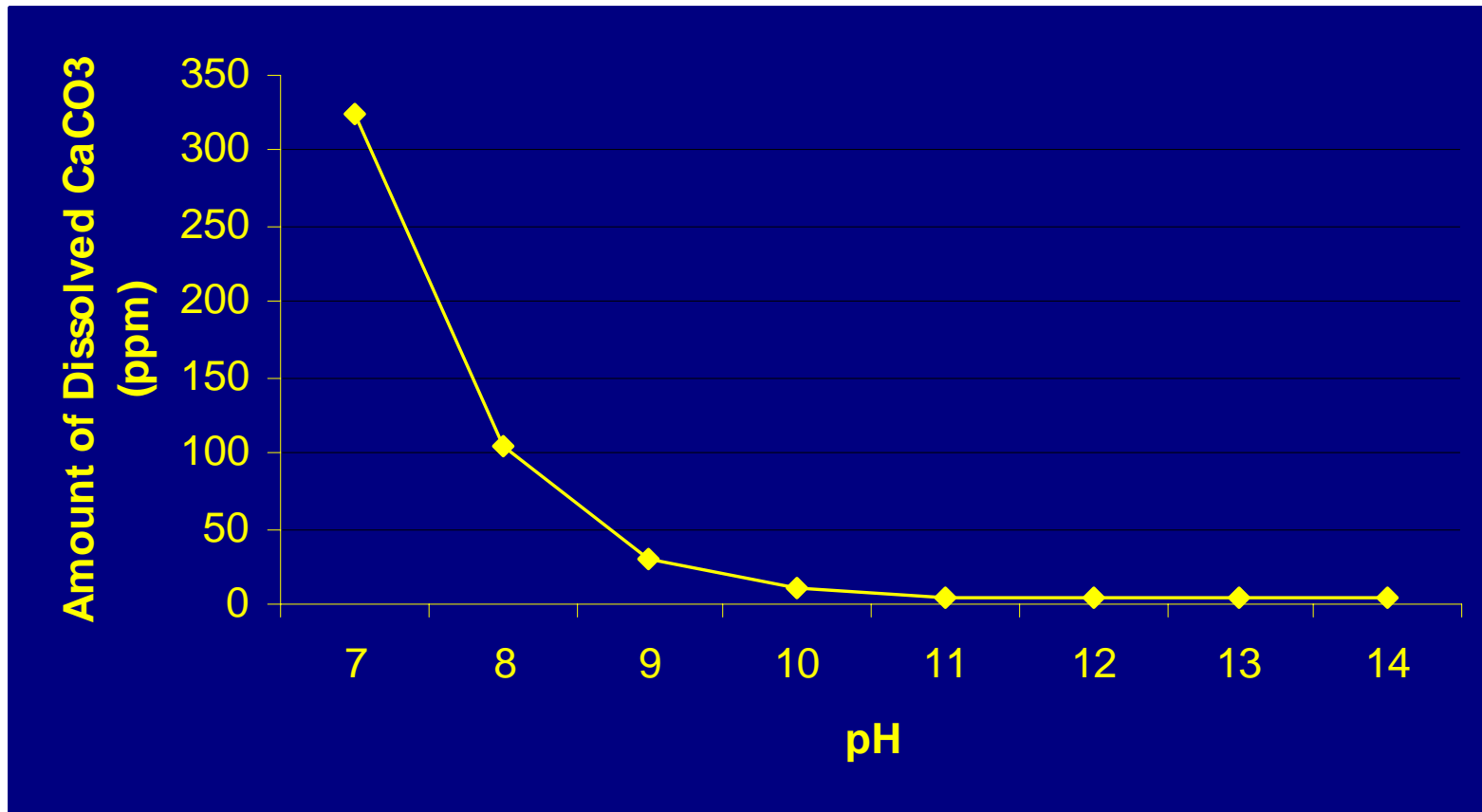


Mean hardness as calcium carbonate at NASQAN water-monitoring sites during 1975 water year.

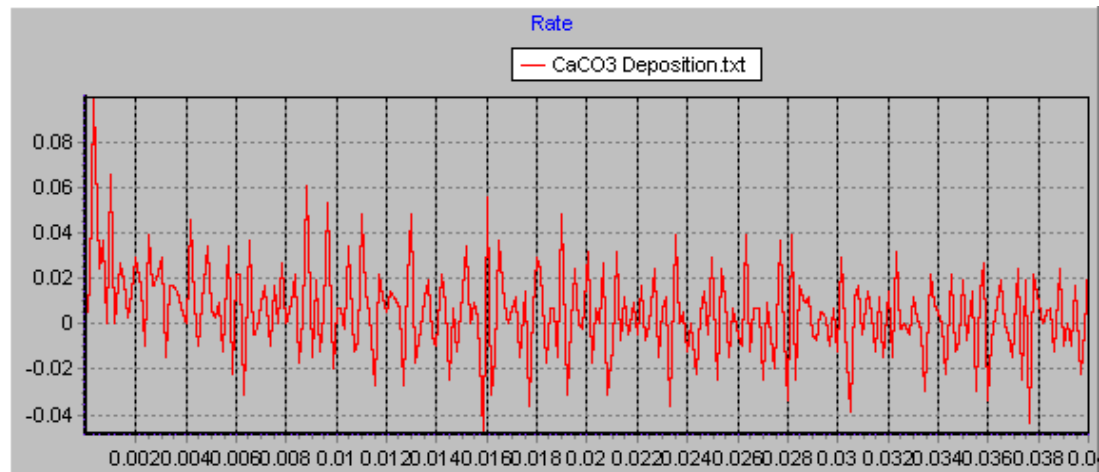
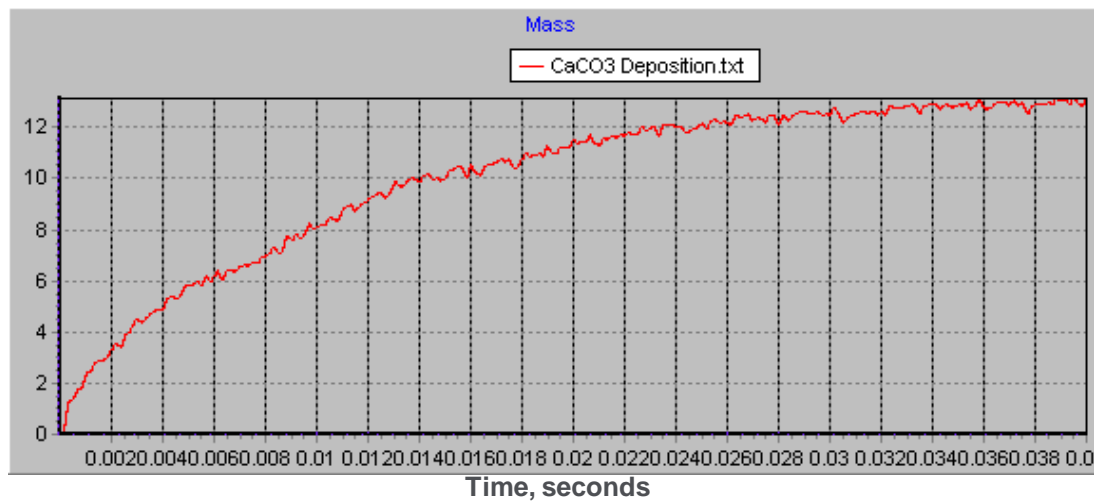
Colors represent site data representing streamflow from the hydrologic-unit rea.

(Map edited by USEPA, 2005)

CaCO₃ Solubility vs. pH



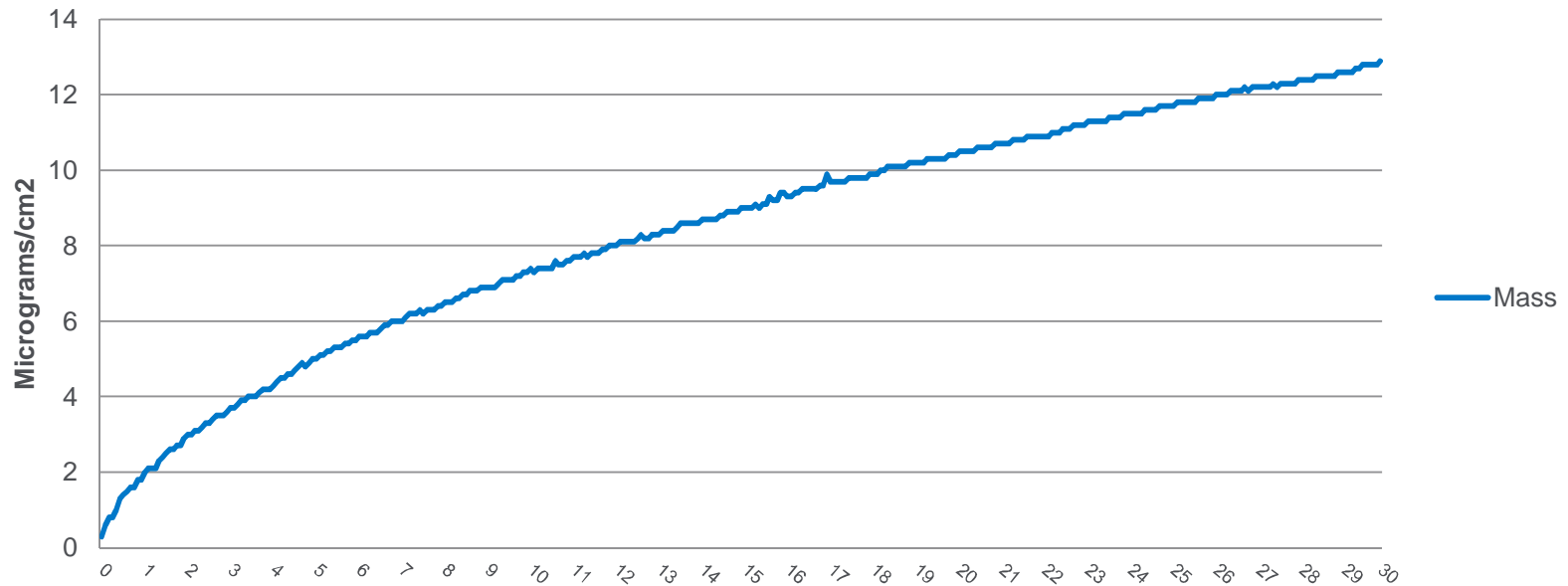
Typical SRM Test Results for CaCO_3 Scale



Time, seconds

EOP Washer Calcium Carbonate

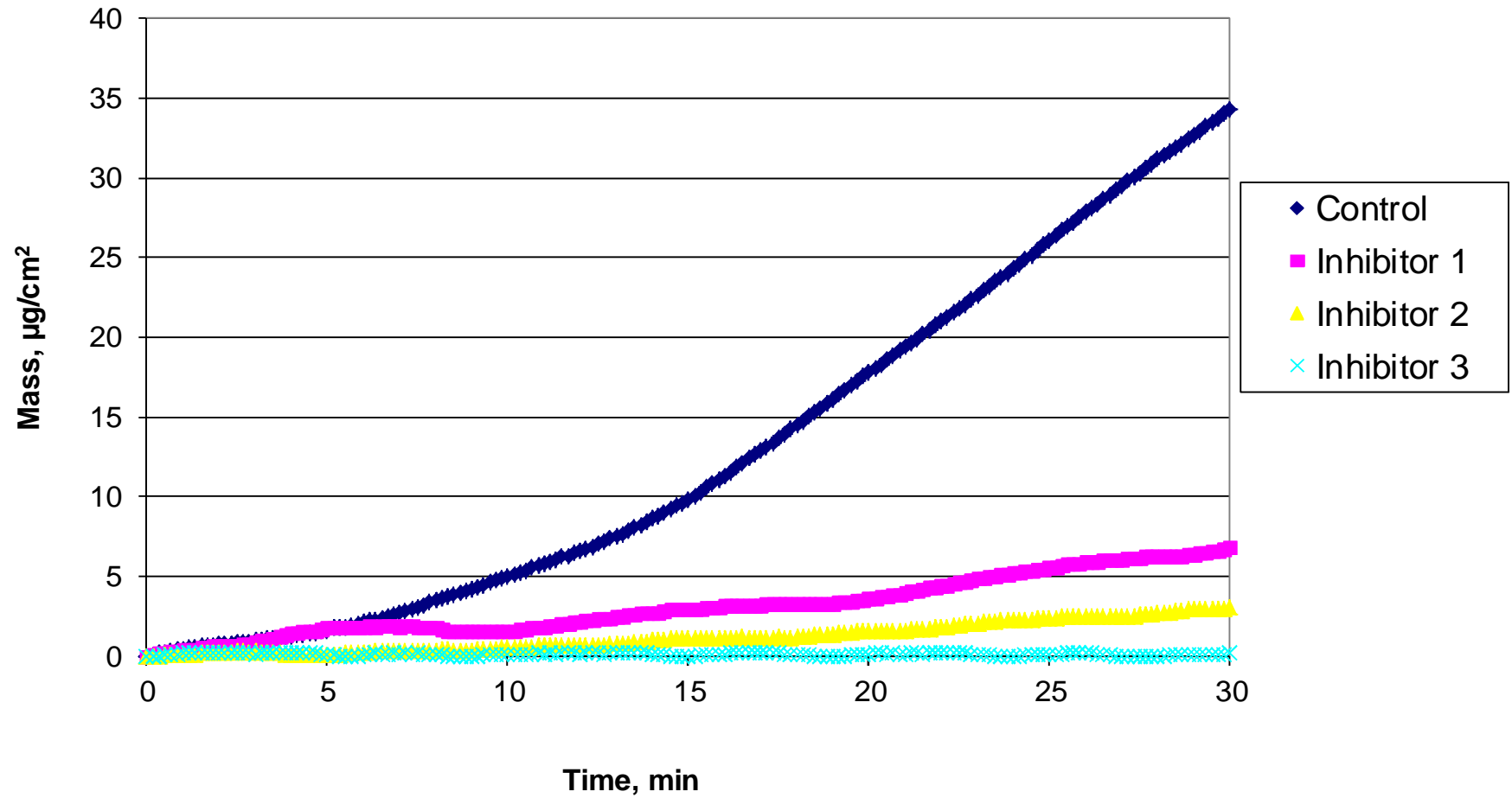
EOP
Oct. 24th



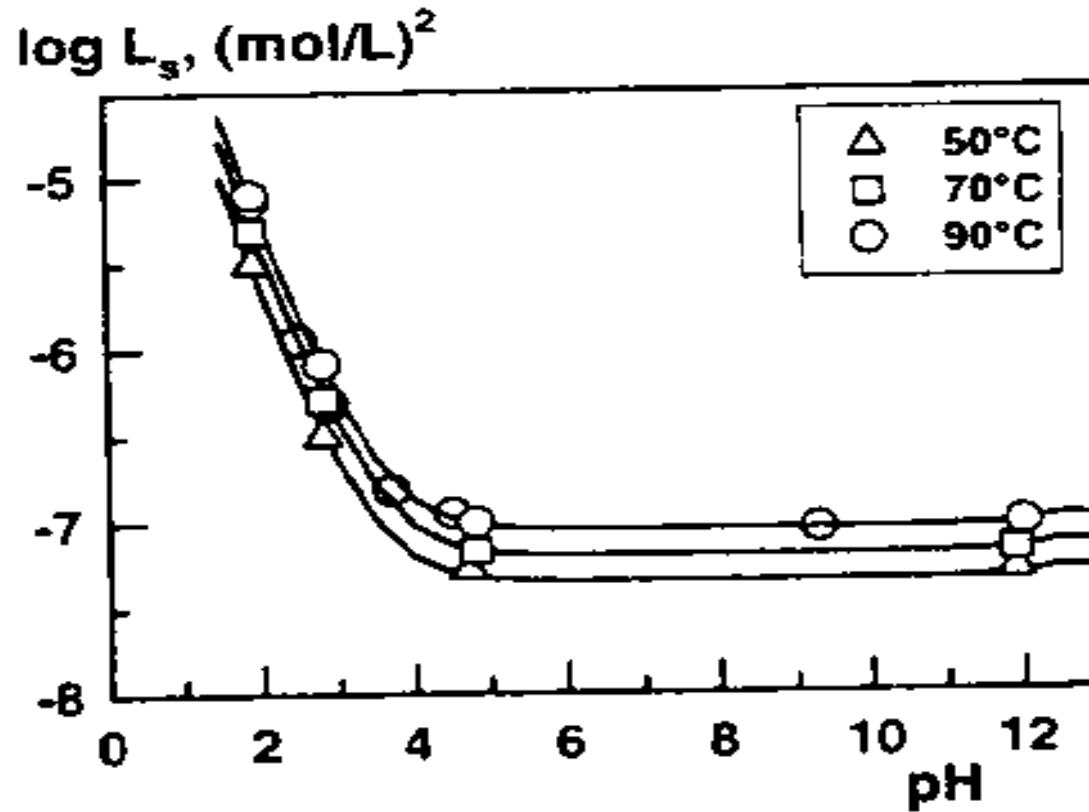
Mass Accumulated 12.9 μ g/cm²



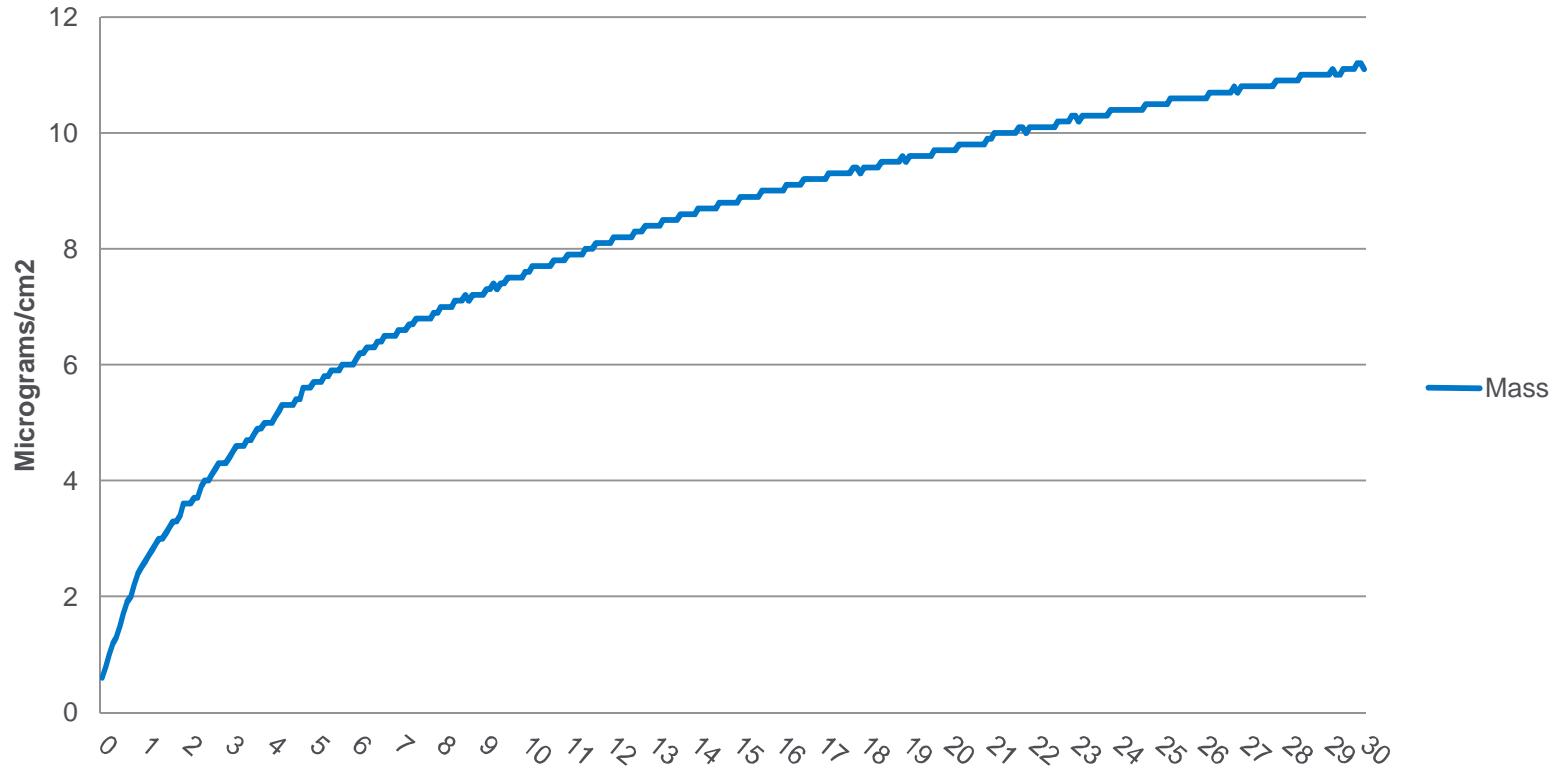
Scale Inhibition



Oxalate Solubility Vs pH

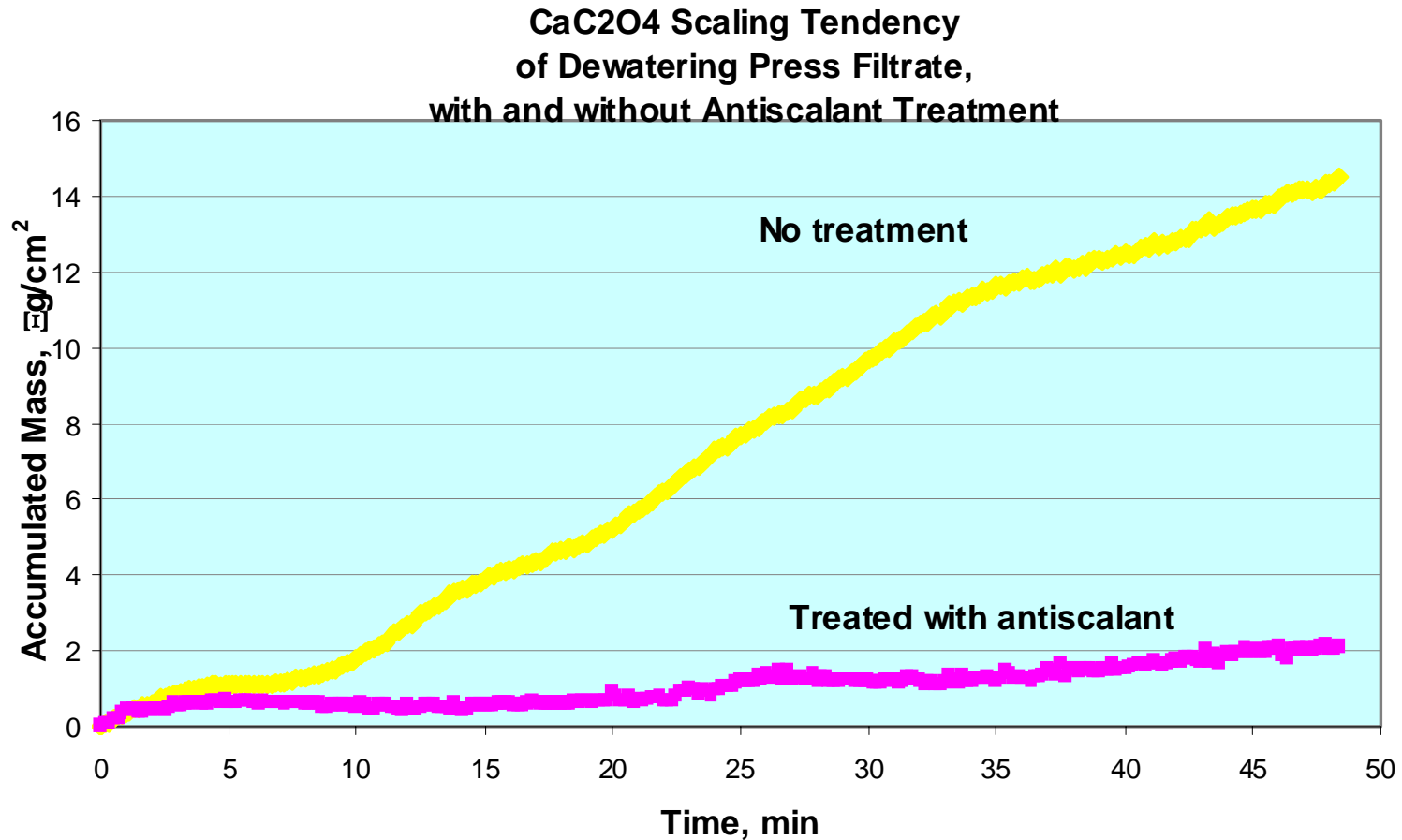


D100 Washer Calcium Oxalate



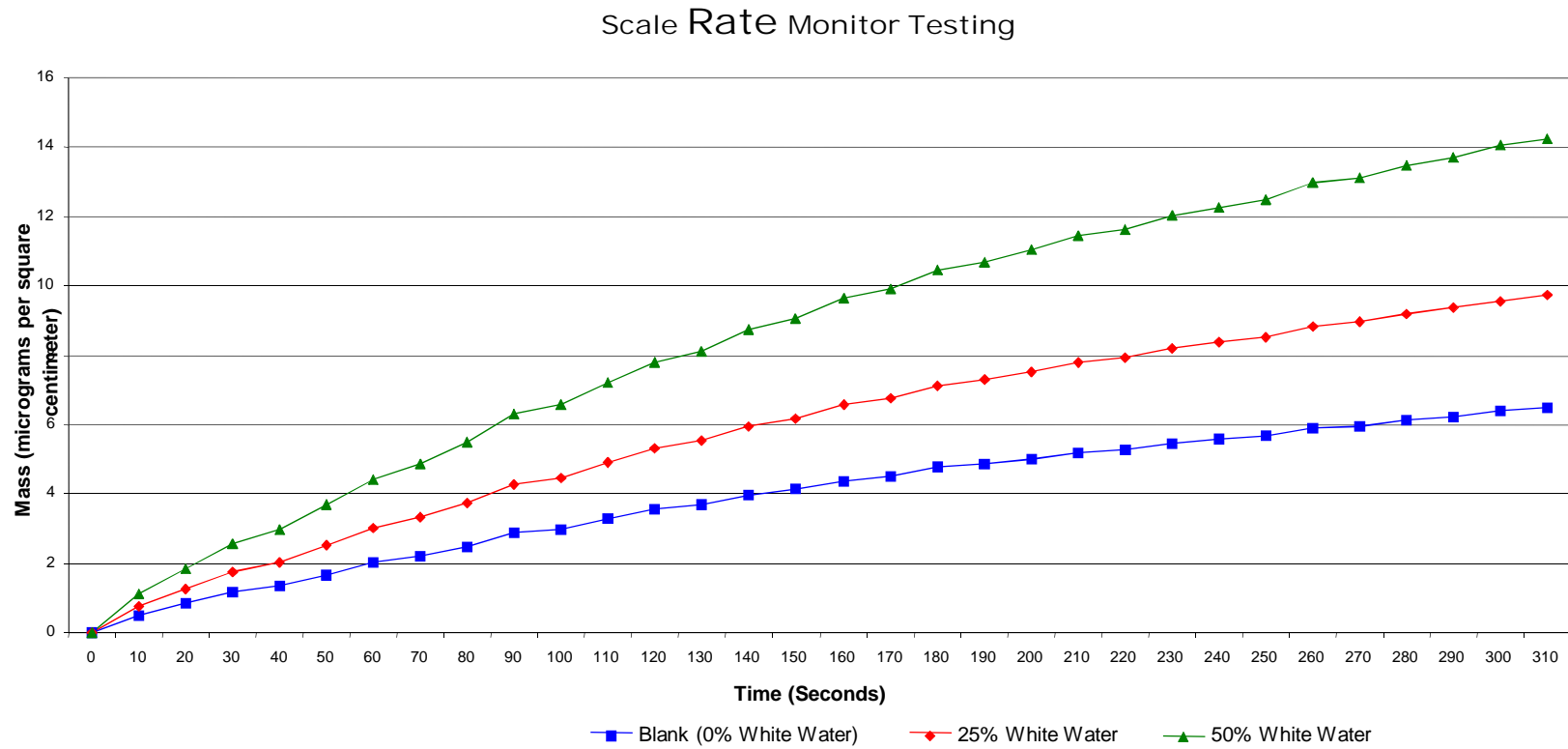
Mass Accumulation 11.2 μ g/cm²

SRM: Inorganic Scale, Electrochemical Mode



Calcium Oxalate, Bleach Plant, D100

Deposit Control: Example Case



SRM testing was performed on site to determine the impact of excess paper machine white water on scaling potential in the bleach plant

Summary

- ▲ Diagnostic field tool for determining the severity of scaling rates for calcium carbonate and oxalate scales in the BP
- ▲ Used for pH induced calcium scale
- ▲ Work from the solubility vs. pH curves for both calcium scales
- ▲ Used in R&D for scale control chemistry product development
- ▲ Used in the field to screen anti scale chemistries
- ▲ Used in the field to estimate dosage to manage the scale
- ▲ Program/system assurance program for the customer

- ▲ Questions?

