Clean-in-Process Technology
Continuous Fouling Mitigation in Heat Trains

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Our Key Technologies

- **Clean-in-Process Technology**
  - MORKO USP [Ultrasonic Scale Prevention]

- **Online Pipe Descaling and Debottlenecking**
  - M³ Technology (clamp on) apparatus with pre-select ultrasonic power output, to match with specified outcomes

- **Ultrasonic Immersion Cleaning Baths**
  - Multiple sizes & configurations
  - Variable powered units for purpose-built cleaning applications
Clean-in-Process Technology
The Technology: Where it Began

Immersion Bath Technology

Clean-in-Process Technology

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The very first heat exchanger cleaned by ultrasonic bath in November 2009, Fort McMurray, Canada
“The technology has proved to be a game-changer: providing energy savings, reduced environmental impact, improved heat transfer and measurable cost avoidance”.

Shell Chemical - Moerdijk, NL
What if the heat exchanger is too big for the bath or simply cannot be removed from the operating unit?

Can we use ultrasound to clean this in place?
Ultrasonic Scale Prevention (USP)
Online Fouling Mitigation

**Clean-in-Process**

- Ultrasonic transducers mounted to tube sheet externally
- Low-powered transducers use specialized pulse-ultrasonic generators to drive the system
Online Fouling Mitigation

*Clean-in-Process*

- Works on-line, 24hrs/7days/week
- Converts electrical into mechanical energy
Online Fouling Mitigation

*Clean-in-Process*

- Strategically positioned for optimal cleaning
Ultrasonic transducers propagate micro-pulses along the tubes.

Sends less than $5\mu m$ of mechanical energy into the tube sheet...

Less than $5\mu m$. Why is this important?
SAFE for all parts of the heat exchanger and surrounding equipment
Ultrasonic frequency is calibrated to the heat exchanger.
We’re looking for the exchanger’s **natural acoustic resonance**.
Calibration settings range from: 30-100 micro-pulses per second.

Based on certain characteristics of the flowing media:

- Process Type
- Temperature
- Viscosity
- Precipitant fouling material
AFTER 1 Year in operation (Power Generation Plant)

WITHOUT USP

WITH USP
Benefits of The USP System

- Increase Productivity
- Enhance Energy Recovery
- Shutdown Cost Avoidance
- Extend Asset Life
RUN-LENGTH

The key benefit. The USP system allows your processing units to continue in full operation as cleaning takes place.
Cost is based on:

- **How many sets** *(two Transducers and one Generator = 1 set)* are required for proper fouling mitigation?

- What are the KPI’s for the target candidates USP?
Factors affecting number of sets:

- Dimensions (Height, Diameter)
- Vertical/Horizontal Orientation
- Shell/Tube side: Fouling Media
- Media Temperatures
- TEMA characteristics
- Flow Rates
- Viscosity
Start with the Heat Exchanger Candidate Form

- Find out if your process qualifies
- Helps us give you a cost estimate
What if you could skip a cleaning interval?

What if you could skip more than one?
The Return on Investment For Implementation of USP

Increase product throughput, overall heat transfer, and reduced operating fuel costs.

Avoid bundle pulling, crane(s), scaffolding, cleaning contractor, water for cleaning, reclamation of the waste water, and more.

What is your opportunity gain by not having to shut the unit down?