ASHLAND’S AUTOMATION PORTFOLIO

A patented and proprietary Technology Platform that encompasses the latest innovations in:

On Line Performance Monitoring
• Using Extremely accurate water and process Performance Analyzers
• Offers “Proof of Performance”

Water Treatment Process Control
• State-of-the-art controllers
• Imbedded algorithms for PBC* and KBC*

Mobile and Cloud Computing
• Data Management Services

*Performance Based Control
*Knowledge Based Control
EVOLUTION OF WATER TREATMENT MONITORING

Manual Chemical Analysis

- Gives a ‘snapshot’ of your water chemistry

Corrosion & Scale Coupons

- Provides data on historical system condition

Real-time chemical monitoring

- Measures chemical levels and provides feedback if dosing problems

Real-time performance monitoring and control

- Most accurate and meaningful feedback on system condition
COOLING WATER PERFORMANCE MONITORING

Corrater

Fouling Monitor
ONGUARD™ 2-PLUS CONTROL SYSTEM

Patented
STANDARD CONTROL VS. PERFORMANCE CONTROL

Overfeed
Underfeed
Corrosion – KPI
Inhibitor Dosage (PPM)
Performance Based Control Setpoint

Cooling Water Chemical Control
Typical inhibitor feed program, based on tracer level set point or blowdown

Cooling Water Performance Monitoring & Control - Continuous process control responds to process key performance indicators
OPERATIONAL & PERFORMANCE MONITORING

**KPI’s**
- Fouling
- General Corrosion Rate
- Imbalance/Pitting Corrosion Index

**KOI’s**
- pH
- ORP
- Cycles
- Conductivity
- Water Consumption
- Chemical Concentration
COOLING WATER FOULING MONITORING

- HX design or operational values inputted
- Proprietary algorithms duplicate critical plant heat exchangers online
  - Using Heat Flux and Shear Stress
  - In compliance with NACE monitoring protocols

- Calculates Fouling Factor
  - Fouling Factor (FF) x 10^{-5} hr ft^2 °F / BTU
- Accounts for all types of fouling
  - Inorganic and bio-fouling
New England 19 MW zero liquid discharge power plant with 5 ppm iron in well water
Excessive condenser and tower fill fouling

Reduce frequency of shutdowns for condenser cleanings
Maintain peak power generation efficiency
Clean-up tower fill

OnGuard™ 2-plus proved fouling and ORP correlation
Relocated chlorination feed to oxidize iron. Prevented reaction with silica.
Established ORP target for halogen control, removing slime

Improved power generation 5%; revenue increased over $300,000 per year
Reduced outages and maintenance costs
Increased side-stream silica removal from 10%-90% via coagulant optimization reducing fouling tendency
**Background**

US independent power producer faced changing environmental discharge restrictions, which limited cooling tower water chemistry control.

**Customer Needs**

- Improve fouling and corrosion control
- Meet environmental discharge limits

**Ashland Solution**

Treatment program including OnGuard™ 2-plus analyzer performance-based monitoring and control equipment and augmentation with Drewsperse 7130 dispersant to eliminate organic fouling.

**Benefits**

- Increased power generation 6.7 MW; revenue increased over $1.6 million
- Reduced chemical spend 20%
- Exceeded corrosion and fouling control targets
- Improved condenser cleanliness by 15%
CONDENSER WATER BOX DP WITH DREWSPERSE 7130

- Biopenetrant added @ 60 ppm 1/24/11
- Biopenetrant added @ 200 ppm 3/4/11
- Adjusted CW flow to design
- STG Trip @ 200 MW
- Cell 2 Valved Out For Fan Repair
- Biopenetrant added @ 200 ppm 3/4/11
- Biopenetrant added @ 60 ppm
- Began Clo2 Treatment
- Towerbrom failed to dump
- Cell 2 Valved In Incorrectly
- Corrected Cell 2 Water Flow
- Began Cycling 0x0
- Design DP (11.7 psi)
ONGUARD™ ONLINE PLATFORM INFORMATION ARCHITECTURE

Chemical Feed and Control
DCS / Pi Interface
Ashland Applications Support

OnGuard™ Analyzer and Sensors

Tank Levels
Customer Access
Ashland Representative

Performance, Reliability, Cost Efficiency