Implementation of Smart Cycle Chemistry Alarms to Ensure Proper Response to Upset Conditions

Sample Point	pH	Conductivity (Specific)	Cation Cond.	Dissolved Oxygen	Sodium	Silica
Main Steam	-	-	↗	-	●	-
Boiler Blowdown (BD)	↘	●	↗	-	-	●
Economizer Inlet (EI)	↓	●	↑	●	-	-
Condensate Pump Discharge (CPD)	↓	●	↑	●	●	-
Makeup effluent	-	●	-	-	●	●

Example of Cycle Chemistry Parameter Interrelation during Acidic Contamination used to Develop Smart Alarm Logic

- Properly designed smart cycle chemistry alarms are a powerful diagnostic tool for operations personnel with minimal chemistry training and experience.
- Development and implementation of unit-specific, self-validating cycle chemistry alarm logic reduces nuisance alarms and ensures prompt operator response to actual excursions to minimize corrosion damage.
- Advanced smart cycle chemistry alarms can notify operators of an emerging problem faster than reliance on parameter alarms alone.

Key Research Question

Cycle chemistry monitoring is designed to minimize corrosion and deposition in the steam/water cycle of a power plant. Due to the nature of cycle chemistry monitoring, instruments to detect cycle chemistry upsets ("excursions") may be subject to measurement errors or non-critical issues causing parameters to be out of specification. Interpreting instrument readings to distinguish true problems from false indications can be a challenge for operations personnel with limited chemistry knowledge. In addition, parameter based alarms that result from non-critical reasons and/or measurement errors may de-sensitize operators to chemistry based alarms.

Techniques from EPRI's Cycle Chemistry Instrumentation Validation: Relationships of Cycle Chemistry Parameters (Report 1019641) may be used to develop smart cycle chemistry alarms which only activate when multiple independent cycle chemistry parameters meet pre-determined conditions indicating a true excursion.

Smart cycle chemistry alarms must be customized and tested for each specific generating unit based on the installed online instrumentation and water and steam flow path design (heat balance diagram). In some cases, more advanced smart alarm logic may be developed and tested based on the unit specific and operational priorities.

Objective

When smart cycle chemistry alarms are properly designed and implemented, the generating unit is at lower risk for significant excursions. Corrosion and deposition related damage may occur during such excursions. Smart cycle chemistry alarms may help operators respond, and correct excursion conditions, thereby improving the reliability, cost effectiveness, and safety of the steam/water cycle components. The expected public benefit is enhanced power system reliability and more affordable electricity.

Approach

This research project investigates methods to customize smart cycle chemistry alarms for conventional and combined cycle power plants. EPRI will review heat balance, water treatment, and online monitoring information specific to each unit. Based on the initial review, EPRI intends to customize specific smart cycle chemistry alarms based on validation techniques to help operators identify and correct true chemistry excursions. The alarm logic could then be programmed in the unit distributed control systems (DCS) by plant personnel.

Research Value

The development of smart alarms requires a detailed assessment of a specific unit's cycle chemistry monitoring parameters to establish unit specific protocols and logic to

validate that the excursion is occurring. When properly designed and implemented at a plant, the alarm scheme will promote confidence in cycle chemistry alarming and result in prompt actions to address excursions to prevent corrosion, deposition, and chemistry-related equipment damage. New, advanced smart alarm logic development and lessons learned with implementation from this project will add value to similarly designed units across the world.

Deliverables

- Technical report providing highlights of the plant visit and a detailed review along with smart cycle chemistry alarm logic that can be implemented into an operating unit's control system.

Price of Project

The cost of this project is dependent on location, size, and complexity. This project qualifies for Tailored Collaboration (TC) and Self-Directed Funding (SDF).

Project Schedule

Individual projects should be completed within 3 to 6 months following initiation.

Who Should Join

Organizations experiencing, or at risk for, cycle chemistry excursions that require costly recovery efforts and/or equipment repairs should benefit from this project. Customized smart cycle chemistry alarms should result in improved detection and response to cycle chemistry upset conditions.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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