**Background**

As operating licenses are extended to 60 years, reliability and failure prediction of critical components (e.g., pumps) is an area of focus due to the maintenance costs associated with aging plants. Traditional preventive maintenance and more recent condition-based predictive strategies are being applied. Application of continuous component monitoring provides early detection of failures. The goal is to be more proactive to avoid the significant cost of a forced outage and reduce the costs of maintenance occurring during a planned outage. Westinghouse is using existing monitoring methods in combination with new technology to provide cost-competitive component monitoring with the end goal of anticipating failures to ultimately reduce maintenance costs and increase plant availability.

**Description**

**Component monitoring application**

Westinghouse has developed a scalable, open technology platform for component monitoring. It can be used to monitor a single component, expanded to monitor several components or scaled to monitor a complete fleet with multiple units. In its simplest form, data from multiple sensors (existing or installed by Westinghouse) can be continuously monitored for a given component, then sampled and compacted for transmission to a data server via network connections.
**Plant-wide application**

This same technology can be applied to monitor multiple components within a power plant and provide reliable component data to a central data server for additional processing and analysis. Westinghouse has developed wireless communication technology that can be used within a power plant to eliminate costs associated with new cable runs. The figure below shows a plant-wide architecture for monitoring multiple pumps but any component can be instrumented with sensors to be monitored with the Westinghouse open architecture.

Using a wireless network approach (as shown in the figure), it is also possible to connect a wireless tablet or similar mobile devices to the network. Component data can be evaluated real time in the field at the component of interest. When integrated with Westinghouse computerized procedures on a field tablet, maintenance personnel are provided standard actions tied to the component data indications. Our base technology platform can be expanded to meet your particular needs through customer-specific solutions and software.

**Fleet-wide application**

The described system can be expanded from a stand-alone component-level monitoring system up through multiple systems, units and/or sites, ultimately leading to the potential for a total utility fleet-wide approach. It can be further expanded to include two traditional product areas:

- Plant computer systems - typically process focused with moderate data sampling rates (< 1 sec updates)
- Vibration and diagnostic monitoring systems - typically component focused with moderate to high data rates (0.001 second updates or shorter)
Architecture specifically includes capability for:

- Continuous online monitoring
- Remote and mobile access to data
- Both low- and high-speed component data for event capture, archival, analysis and review
- Enterprise-grade server software for historian and advanced analysis features
- User interface with navigation and useful data presentation capabilities
- Broadened scope of plant measurements and calculated data
- Real-time and historical window to monitor condition and behavior of plant processes and components
- Support of post-event evaluation and reporting
- Direct support of operations, engineering and maintenance personnel
- Computerized procedures, including field and outage support
- Management of wireless and cyber-security concerns

Sensor types supported include:

- Temperature
- Strain
- Pressure
- Accelerometer
- Velometer
- Linear-variable differential transformer
- Proximity probes
- Thermography
- Radio frequency/partial discharge
- Motor current/voltage/phase

Benefits

- Provides continuous monitoring of multiple parameters for power plant components at a central location, allowing for greater predictability of failures
- Powerful, small-footprint data acquisition with optional wireless network capability to minimize total installed cost
- Modular cost-competitive approach that can be expanded to monitor multiple components for plant-wide or even fleet-wide monitoring
- Highly open architecture that can easily incorporate installed platforms while allowing new technology integration as it becomes available
- Centralized and mobile access to component data via wireless technology coupled with computerized procedures and integrated work management systems
- Improved maintenance planning and efficiency to reduce overall maintenance costs
- Through technology benefits, saves time from outage critical path while increasing plant efficiency and availability during operations

Experience

Westinghouse has over 50 years of experience providing products and services to the global nuclear power plant fleet including a complete range of applications such as protection systems, control systems, information and monitoring systems and operator training simulators. We have a track record in plant computer and vibration and diagnostic systems spanning decades for both domestic and international utilities for existing plants, as well as for new-build AP1000® plants.

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