

# Instrumentation and Control Field Services

## Background

A 1992 Electric Power Research Institute study identified nuclear instrumentation and control (I&C) systems as major contributors to plant operating and maintenance (O&M) costs as well as the leading cause of licensee event reports.

To address system performance and reliability, Westinghouse has provided nuclear field services for many years, supporting I&C system projects from design through development and implementation, with ongoing preventive maintenance. Westinghouse's field service personnel are highly trained and qualified professionals with worldwide experience, and the skills and abilities to perform a variety of quality-oriented field services.

## Description

Westinghouse provides a wide range of I&C services, including the following:

### **Analog Flux Mapping System (AFMS) Service**

This service incorporates AFMS preventive maintenance with system testing. Westinghouse personnel perform services in the three distinct areas of drives, five to ten paths switches and the console.

### **Digital Metal Impact Monitoring System (DMIMS) Maintenance and Baseline Acquisition Service**

Westinghouse's experienced and qualified personnel perform detailed maintenance service for the DMIMS. Routine activities are performed in and out of containment for component repairs. As an option, baseline data signature acquisition can be performed with the base-scope DMIMS maintenance service.

### **Rod Control Enhanced Maintenance Service**

This service maximizes trouble-free operation of the rod control system during normal plant operation. The service incorporates updated predictive and preventive maintenance technology of the rod control system individual printed circuit (PC) cards, power cabinets, DC hold cabinet and logic cabinet.

Westinghouse has the resources to supply qualified personnel to perform predictive analysis using thermographic studies system hardware, and trending data collected using PC card repairs. Preventive maintenance is done by using the Westinghouse automated board test system to verify PC cards, data collection and report generation. Westinghouse also provides personnel and necessary equipment – including test equipment – for preventive maintenance and PC “tin whisker” inspections.

### **Rod Drive Motor Generator Controller Maintenance Service**

This service incorporates detailed maintenance for the rod control motor generator set controller and its associated control and protection circuitry. It includes verification of proper relay settings, energized voltage regulator and synchronizer testing, adjustments of various system components, cleaning motor generator control cabinets, and general hardware maintenance.

### **Rod Position Indication (RPI) System Repair Service**

The RPI system repair service covers the inspection, repair and testing proposed for the plant. Westinghouse provides engineers and connector specialists experienced in troubleshooting the RPI system. Westinghouse also provides special test equipment needed to test in-containment cable and connector portions of the systems, along with documentation.

### **Solid State Protection System (SSPS) Maintenance Service**

Westinghouse now offers a comprehensive SSPS maintenance service designed to test PC cards, clean system cabinets, provide general hardware maintenance, confirm energized system performance and conduct thermography scans.

The Westinghouse automated board test system is a proven technology that has been used for over a decade to verify PC cards used in Westinghouse I&C systems. This technology has been expanded to include the Westinghouse SSPS. Preventative maintenance is done by verifying PC cards, repairing/replacing degraded or damaged board components, collecting data and generating reports. Westinghouse provides experienced and qualified personnel and procedures to complete energized and de-energized system testing as well as component replacement/repair, if needed.

### **Reactor Vessel Level Instrumentation System/Inadequate Core-cooling Monitor (RVLIS/ICCM) Maintenance Services**

The RVLIS/ICCM maintenance services consist of five steps to verify system operation. These steps include: calibration, isolator checkout, process electronics, resistance temperature device checkout and system function test. Westinghouse provides experienced and qualified personnel, procedures, test equipment and tooling to perform these services.

### **Disconnect/Reconnect Reactor Vessel Head Mounted Instrumentation Services**

Experienced, qualified personnel disconnect/reconnect the CRDM, RPI, in-core thermocouples and CRDM vent fan power cables. Westinghouse also provides pre-disconnect, disconnect, and reconnect testing under the Westinghouse disconnect/reconnect procedure.

### **Cable and Connector Upgrade Services**

Westinghouse offers unique customer-specific cable and connector upgrades for the different scenarios each customer may encounter.

- Analog rod position indication (ARPI) system
- Digital rod position indication (DRPI) system
- Control rod drive mechanism (CRDM)
- Nuclear instrumentation system (NIS)

Normal age degradation of materials and support components can lead to functional problems, increasing operation costs, as well as the probability and length of planned and/or unscheduled outage time. A variety of problems with ARPI, DRPI, CRDM or NIS systems directly attributable to cable and connector degradation have been reported.

### **NIS Services**

Westinghouse offers an installation service for NIS crimp-on style connectors that are used to replace the amphenol-insulated triaxial jacks and plugs. As an alternative, hands-on training for assembling the connectors can also be provided. Other services include installing the detector moderator and performing failure analysis for NIS detectors.

### **In-core Thermocouple Replacement and Connector Installation Services**

During plant outages, in-core thermocouples are frequently damaged and made inoperative. This usually occurs while thermocouples are being handled as the reactor head is assembled and disassembled. During reactor operation, thermocouples fail because of moisture ingress or excessive vibration. Using Westinghouse field service specialists experienced in reactor vessel thermocouple system problems to troubleshoot and repair the system is a good way of applying as-low-as-reasonably-achievable principles, minimizing outage delays, maximizing manpower resources and providing maximum system reliability.

### **Pressurizer Heater Connector Repair Service**

This service uses established methods to repair damaged, broken or otherwise inadequate pressurizer heater electrical terminations. The service includes change-out of broken insulating ceramics, replacement of the lugs on the heater pins, and partial or full replacement of the original rubber insulation boots. Westinghouse provides all necessary tools, test equipment and qualified personnel to perform this service.

### **AMSAC Calibration and Maintenance Service**

The AMSAC\* calibration and maintenance service includes calibrating process electronics and a system functional test. Westinghouse provides experienced and qualified personnel, procedures and tooling to perform these services.

### **Ultrasonic Level Monitoring System (ULMS) Advisory Service**

Westinghouse provides advisory services relating to the O&M of the ULMS. These services include a functional system check, verification of proper installation of the transducer unit for signal strength, checkout of the pulsar pre-amps, checkout of the processors electronics, and verification of the control room indicator.

## **Installation and Startup for I&C and Protection System Upgrade Services**

The following is a summary of the types of installation support provided by Westinghouse's field service group.

- DMIMS - DX
- Digital feedwater
- RVLIS/ICCM
- Westinghouse distributed processing family- and Ovation™-based I&C systems

Services range from advisory to full-scope installation and testing. Specifics for each customer's needs and situation can be provided.

### **7300 Process I&C System Service**

At Westinghouse, the field service engineers and technicians can upgrade field change notices and functionally check, troubleshoot and repair the 7300 Process I&C system equipment.

## **DRPI System Maintenance Service**

The DRPI system service includes cleaning, inspecting and testing all DRPI circuit boards, cabinets and power supplies to maximize system reliability. This service uses the Westinghouse automated board test system to perform detailed testing of the DRPI system circuit boards. The depth of this testing not only provides a detailed functional verification, but lets Westinghouse perform preventive maintenance by identifying component degradation that could eventually cause a failure if not replaced. Post-maintenance energized testing is also performed with the system configured normally. Westinghouse provides all necessary tools, specialized test equipment, qualified replacement circuit components and qualified personnel to perform this service.

*\*The "A" in AMSAC stands for "anticipated transient without scram."  
The "MSAC" stands for "mitigation signal actuation circuitry."*

*Ovation is a trademark or registered trademark of its respective owners.  
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