Global Instrumentation and Control (I&C)

Solid State Protection System (SSPS) Refresh

Background

As nuclear power plants are reaching 50-year milestones, the aging of system components needs to be considered – including those that are part of a Solid State Protection System (SSPS).

If the SSPS is exhibiting system component, connectivity or performance degradation during preventive surveillance, the system infrastructure needs to be evaluated for replacement. Westinghouse's design engineering and replacement parts organizations have proactively employed the appropriate modern technology to design new SSPS components to enhance installed systems, while ensuring compliance and compatibility with the existing plant design and licensing basis.

Westinghouse's SSPS Refresh solution effectively resets the SSPS material aging clock. This approach builds on the proven success of our newly designed and licensed SSPS printed circuit boards employing Complex Programmable Logic Device (CPLD) technology. These circuit boards are embedded with self-test capabilities to perform a complete refresh of the system infrastructure components to help avoid the costs and risks associated with designing, qualifying, licensing and establishing training, maintenance and procedures for a system replacement.

Latest Generation SSPS Printed Circuit Boards (PCBs)

Maintenance Enhanced Relay Mounting

Description

The SSPS Refresh provides the benefits of a digital upgrade in an economical manner with minimal risk. Key attributes of the refresh are:

- Refurbishing SSPS system components resets reliability of the equipment to the beginning of its operating life
- Reduces potential for inadvertent reactor trips
- Easy implementation in a 15-day outage window when implementing the new design boards.
- Use of simple components permits SSPS life extension to the end of plant life – a total system replacement is never required.

The new system maintains technology, design diversity and licensing basis, while a digital upgrade incurs risks in all of these areas.

The refresh does NOT require development of new training programs, operational procedures or maintenance practices; instead it minimizes the risk and cost associated with changing the design.

Westinghouse

Customer-focused

Based on customer feedback, Westinghouse has responded by continuing support indefinitely for over 50 plants utilizing an SSPS.

- Extensive Operational Experience to assist in resolution of problems when they occur.
- Widely installed SSPS product amortizes the cost to address new obsolescence when it does occur.
- Large singular voice to address regulatory questions and challenges.

Scope of SSPS Refresh

- New SSPS printed circuit board features provide straightforward, on-board diagnostics; status LED indications; and self-test capabilities that simplify maintenance and diagnostic procedures and reduce the level of technician support required. The refresh approach effectively has similar benefits of a digital system replacement.
- Input Bay Relay Panel utilizes pre-wired relays and sockets, previously tested and ready to install. Termination strips are utilized and all wiring is clearly labelled to further simplify troubleshooting.
- Spray Test and Logic Test Panels implement the same panel design with new components that are ready to install. The Spray Test Panel includes a new general warning monitor circuit and Reactor Trip Breaker test switches.
- New card cages and interconnecting wiring accept new design SSPS Printed Circuit Boards (PCBs) using receptacle connectors that have solder tabs. They also eliminate termi-point connections, which have been problematic for maintenance and connectivity.
- Output Relay Test and Master Relay Panels implement the same panel design with new components and relay sockets. The output relay test panel utilizes new features such as improved lamp holders, LED indications, New Pushbutton test switch and New Mode Switch 5/6 switch
- Output Slave Relays replace original relays and can be outfitted for the same location.
- The System Power Supply mounts in the same location as original and maintains seismic, environmental and Electromagnetic compatibility (EMC) qualification. The supply is available in multiple configurations to address the logic and de-multiplexer cabinets.

The elements of an SSPS Refresh are easily extendable to serve as the core of a Reactor Protection System (RPS) for those utilities desiring to replace their RPS. Decades of positive operational experience, broad application and a supportable lifetime to the end of plant life are all benefits that make Westinghouse's product design so unique.

SSPS Re-Designed Sub-Assemblies

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Summary of SSPS Refresh

Benefits:

- Diversity requirements maintained
- Equipment Qualification (EQ) qualified (seismic, EMC, etc.)
- No licensing changes needed
- Minimal/no procedure changes needed
- Minimal/no training needed
- Implemented under your 50.59 program

Additional Benefits Similar to a Digital Upgrade:

- Fully Integrated Test in the factory to verify and validate system operability. The tests includes all new PCBs, Card Chassis, Power Supplies and test panels
- Refurbishing SSPS system components resets reliability to the beginning of its operating life
- Reduces potential for inadvertent reactor trips
- Reduces long-term wear on the system components

New Design Relay Panel

Switch Test Panel

Redesigned Logic Test Panel

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