

Spent Fuel Pool Level Instrumentation System

Background

In March, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, directing U.S. utilities to install reliable, extended-range spent fuel pool level instrumentation in each spent fuel pool. The Nuclear Energy Institute (NEI) prepared report NEI-12-02 to provide guidance to utilities in complying with the order, and the NRC issued interim staff guidance (ISG) JLD-ISG-2012-03 for public comment.

Westinghouse has designed a spent fuel pool instrumentation system (SFPIS) that meets the requirements of NRC Order EA-12-051, ISG JLD-ISG-2012-03 and NEI guidance NEI 12-02 in providing the capability to reliably monitor the spent fuel pool water level under adverse environmental conditions. This monitoring capability is essential to understanding the water level in the spent fuel pool and the corresponding prioritization of actions that plant staff can take to mitigate water inventory loss.

Description

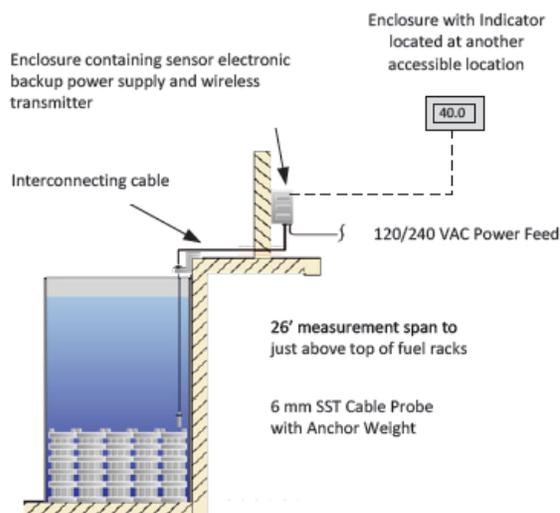
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The Westinghouse SFPIS solution uses primary and backup guided wave radar (GWR) sensors, both permanently installed. GWR is a proven level measurement technology for a wide variety of process media and conditions, including water at saturation (boiling) conditions. GWR is also becoming the measurement method of choice for many global industry applications, such as chemical, petroleum, off-shore rigs, submersibles, etc. GWR is a mature, robust technology, well suited to the adverse conditions that may arise from an extended loss of spent fuel cooling capacity.

Each measurement device consists of a flexible stainless-steel cable probe, suspended in the spent fuel pool from a seismic Category 1 bracket attached to the operating deck or to the raised curb at the side of the pool. The cable probe extends to nearly the top of the spent fuel racks. The electronics for the sensor are mounted in an adjacent room so that the instrument is not subjected to the radiation and high temperatures in the spent fuel pool building that could result from a postulated loss of water inventory in the pool.

The sensor electronics module is connected to a battery-backed uninterruptible power supply and a transmitter, which sends the value of the pool water level to a remote location where it is displayed. The installation scope of the SFPIS consists of installing two independent spent fuel pool level instrumentation systems, one as the primary and the second as a backup, preparation of the design change package, and design and fabrication of the seismic Category 1 mounting bracket.

The architecture of the system is depicted below.



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Why Westinghouse?

Westinghouse has decades of experience in the design, application, installation and commissioning of instrumentation for nuclear plant process measurements. Key among this experience in nuclear instrumentation and control is sensor application, environmental and seismic qualification, and licensing – each of these areas is critical for an SFPIS to meet the requirements of EA-12-051 and ISG JLD-ISG-2012-03.

Westinghouse has implemented spent fuel pool level measurement in European plants, as well as in the AP1000® plant design. Westinghouse can draw on many years of experience of innovative application of sensor technology to solve difficult measurement challenges, and has considerable experience with many other water level measurements in nuclear applications, such as in vessels and sumps.

A unique feature of the Westinghouse SFPIS solution is the wireless transmission of signal, offering plants the flexibility to install transmitters in desired accessible indicator location(s). Westinghouse is currently the only SFPIS design offering wireless technology. Westinghouse also offers a wired solution and both wireless and wired options satisfy NRC Order EA-12-051. As a full-service provider, Westinghouse capabilities also include any necessary support for licensing and regulatory compliance.

Benefits

Westinghouse can deliver a complete solution that includes the design, supply, installation and commissioning of a reliable SFPIS to meet the requirements of NRC Order EA-12-051.

Westinghouse has selected the GWR technology to respond to NRC recommendations, based on careful consideration of the following:

- Mature, robust and proven technology
- Technical and environmental suitability
- Impact to plant systems and structures
- Required plant modification packages
- Installation and maintenance efforts

Key advantages of the Westinghouse SFPIS solution include:

- Simplicity of the system and ease of installation
- No reliance on “open space” (i.e., no interferences between sensor and medium) to maintain operability and accuracy
- Readily accessible for maintenance/repair without safety risks
- Flexibility of the wired and wireless configurations
- Low power consumption for both the wired and wireless options
- Experienced vendors, able to meet demands and deliver outstanding customer satisfaction
- Availability of interchangeable spare parts and engineering/installation support
- Years of experience in field and installation services, providing a commitment to the delivery and installation of the product, through either complete installation or oversight support

GWR has also been identified as the preferred technology for spent fuel pool level measurement in a report commissioned by an industry leader. The report researched and ranked all SFPIS technologies available.

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