

AP1000™ Fuel-handling Equipment

Background

Westinghouse, through its subsidiary PaR Nuclear, has designed AP1000™ fuel-handling equipment to improve the safety, reliability and efficiency of moving fuel, leading to shorter outages.

Description

Refueling Machine

The refueling machine uses the Westinghouse platform with a modified design that improves the safety and reliability of the equipment.

Operator console safety features the following:

- Lower overall height and reduced footprint provides a better view of fuel-handling operations and more space to move on the platform.
- Lower-voltage, higher-maintenance items are positioned in the front of the cabinet, where they are closer to the operators and more easily accessible. The higher-voltage components are at the back of the cabinet where they are at a safer distance from the operators.
- Removable console allows it to be stored outside of containment in a less abrasive environment when not in use.
- Second- and third-level platforms allow access to hoists and other elevated components for ease of maintenance and reduced foreign material exclusion (FME) concerns.

- Access doors are provided on all maintenance components, including under-deck cameras, for ease of maintenance.
- Cables are enclosed in duct work to protect operators.

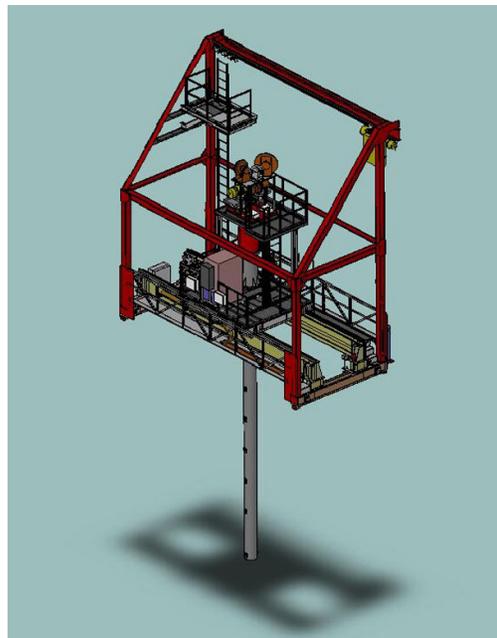
Transfer System

The transfer cart is controlled from the fuel-handling machine. The design of the cart features a single basket to prevent potential criticality issues.

Fuel-handling Machine

The AP1000™ fuel-handling machine handles spent fuel with the main hoist, and transfers new fuel, weir gates and other miscellaneous components within a two-ton capacity with the single-failure-proof hoist. The fuel-handling machine design features the following:

- Operator console can easily be moved into various positions to allow the operator to see the screen while more easily and safely changing tools.



AP1000™ refueling machine

- Console's smaller footprint allows better visibility of fuel-handling operations.
- Cabling is enclosed in duct work and positioned on the side opposite of where the operator changes tools, allowing an unencumbered work space.
- Second-level platform with enclosed ladder enables easy access to maintenance items.
- Control of the new-fuel elevator eliminates trip hazards, extra cables and potentially unsafe operator positions associated with using a pendant in this application.

New-fuel Elevator

The new-fuel elevator is designed to take on the added task of inspecting spent fuel assemblies in addition to its typical role of transferring new fuel assemblies into the spent fuel pool. It makes use of common safety devices found in other PaR Nuclear fuel-handling equipment such as:

- Programmable logic control (PLC) with DeviceNet™
- Redundant load weighing system
- Encoder for position feedback

Other design features of the new-fuel elevator include:

- Adjustable underwater proximity switches for travel-limit indications for normal operation and inspection modes
- Separate mechanical hard stops for both modes of operation to prevent exceeding the minimum water coverage over active fuel
- Adjustable mechanical stop to prevent spent fuel from being raised beyond a safe level

Benefits

The AP1000™ fuel-handling equipment is designed to address the human performance issues that can be associated with older equipment. Using proven designs and components, which are aligned with the Human Performance (HuP) and as low as reasonably achievable (ALARA) principles practiced by nuclear utilities, the AP1000™ fuel-handling equipment is designed with the operator's safety as the most critical design criteria. The



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operator's safety is improved by:

- Better visibility of fuel-handling operations
- Additional space on the platform for ease of movement
- Enclosed cabling on the platform
- Added safety interlocks
- Elimination of pendant control for the new fuel elevator

Reliability is an important design criterion. The high cost of unscheduled down time demands equipment that performs as expected when needed.

The AP1000™ fuel-handling equipment improves reliability with improved accessibility to maintenance items and inclusion of redundant systems. Improved accessibility also means less time required to perform maintenance activities, resulting in lower dosage for maintenance personnel.

Experience

The AP1000™ fuel-handling equipment design will be used in all AP1000™ plants and is available for existing equipment upgrades.