Global Engineering Services

Reactor Vessel Closure Head Replacement

Background

Nuclear power plants with reactor vessel closure heads (RVCHs) containing Alloy 600 base materials and Alloy 182 weld materials are susceptible to primary water stress corrosion cracking (PWSCC). In response to this concern, a number of PWR utilities have replaced their RVCHs. Replacements also provide an ideal opportunity to implement upgrades; this significantly reduces outage duration and dose, as well as addresses personnel safety issues that may exist during reactor disassembly and reassembly.

To offer our customers a solution to this problem, Westinghouse has created a program to develop and implement RVCH upgrades integrated with the design and installation of a new RVCH that uses Alloy 690 and Alloy 152. Because these alloys aren't prone to PWSCC, this is a risk-reducing option.

Description

Replacing the RVCH is a complex activity, involving the integration of multiple organizations concerned with the associated project management and control of numerous interfaces. Westinghouse has developed the expertise to manage these types of intricate projects, by utilizing lessons learned from previous successes. Our proficiency in project integration frees your staff to spend time on activities that have the most impact on plant operation and increases the reliability of plant performance.

Westinghouse can provide the following:

- Design engineering and licensing support (design change package, safety evaluation, etc.)
- Hardware, such as lifting and handling components for new and old RVCHs
- Control rod drive mechanism (CRDM)/control element drive mechanism (CEDM) replacement and/or upgrades
- Integrated project management (e.g., project oversight, implementation planning, interface control, vendor oversight and outage schedules)
- Core Exit Thermocouple Nozzle Assembly (CETNA™) upgrade, replacing the upper Conoseal joint, eliminating the lower Conoseal joint and seal weld entirely
- Installation services

Benefits

Replacing a RVCH which contain alloys susceptible to PWSCC provides the following benefits:

- Reduces costly inspections and repairs, as well as decreases the potential for extended outages due to repairs
- Reduces outage duration and personnel dose
- Provides an opportunity for head assembly upgrade

Westinghouse has led head assembly upgrade projects at a number of plants, ranging from ductwork reduction/optimization to implementation of integrated head packages (IHPs). IHPs eliminate the CRDM/CEDM ductwork, provide an integral missile shield, simplify cable configurations and offer a permanently attached head lift tripod. This allows the entire head assembly to be removed as one unit, thereby reducing long-term operating and maintenance costs.

Upgrades help to:

- Reduce outage duration
- Reduce personnel dose
- Decrease risks to personnel safety
- Improve equipment reliability, thus reducing outage delays and forced plant outages
- Reduce demand on critical outage resources (polar crane, labor and containment laydown space)

Deliverables

Westinghouse works closely with our customers to determine the level of support needed. To this end, we have created five levels of assistance:

- Level 1 – Position for future replacement with reduced lead time
- Level 2 – Engineering/fabrication of replacement RVCH
- Level 3 – Conceptual design of RVCH upgrade features
- Level 4 – Complete upgrade package
- Level 5 – Turnkey project

Experience

A leading provider of replacement RVCH services, Westinghouse performs detailed engineering and design studies, supplies integrated head assembly upgrade equipment, cooperates with global manufacturers on head and CRDM/CEDM supply, and completes the component handling and installation at the site for new RVCH components.

Westinghouse has achieved the following successes:

- Managed RVCH assembly optimization projects from duct work reduction/ optimization to implementation of simplified head assembly and IHPs.
- Provided IHPs to 12 plants during original plant construction; provided head assembly upgrades with retrofit modifications to the existing RVCH and CRDM/CEDM cooling system of two plants; and optimization projects have been completed for six units.

RVCH replacement and upgrade services have been provided to 19 plants.

RVCH during Fabrication

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