

# 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 pressurized water reactor utilities have replaced or plan to replace their RVCHs. Replacements also provide an ideal opportunity to implement upgrades, significantly reducing outage duration and dose, and to address personnel safety issues that may exist during reactor disassembly and reassembly.

To offer its customers a solution to this problem, Westinghouse has established 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 are not prone to PWSCC, this is a risk-reducing option.

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. Westinghouse's proficiency in project integration frees the customer's staff to spend time on activities that have the most impact on plant operation. The RVCH replacement increases the reliability of plant performance, reduces

personnel exposure, and most importantly, eliminates safety concerns.

## Description

Westinghouse can provide the following:

- Design engineering and licensing support (design change packages, safety evaluations, etc.)
- Hardware, such as lifting and handling components for new and old RVCHs
- Control rod drive mechanism (CRDM)/control element drive mechanism (CEDM) upgrades
- Integrated project management (such as project oversight, implementation planning, interface control, vendor oversight and outage schedules)
- Installation services, including required rigging

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, which allows the entire head assembly to be removed as one unit.

## Benefits

Replacing the RVCH with a newer version that uses Alloy 690 and Alloy 152 will do the following:

- Reduce long-term operating and maintenance costs
- Reduce costly inspections and repairs as well as decrease the potential for extended outages due to repairs
- Reduce outage duration and personnel dose
- Provide an opportunity for head assembly upgrade
- Be included as part of the plant life extension

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)
- Reduce the amount of inspections and testing

## **Deliverables**

Westinghouse works closely with its customer to determine the level of support needed. To this end, Westinghouse has 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, simplified head assemblies, head assembly upgrade packages, and optimized projects for nearly four dozen customers in the United States and around the world.
- Designed and supplied component-handling equipment, including U.S. Department of Transportation-certified containers for storage and transportation of reactor coolant pump (RCP) internals, RCP motors and temporary reactor vessel covers.