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

To offer our customers a solution to this problem, Westinghouse has developed 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.

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 increase the reliability of plant performance. The outer diameter surfaces of the heater sheaths. Together, the annealing and surface conditioning processes mitigate the heaters’ susceptibility to PWSCC. Westinghouse tests all completed, enhanced replacement heaters for straightness so that they provide proper heater well insert and heater support plate fit-up. Westinghouse also electrically tests the heaters for dielectric strength and insulation resistance.

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 (e.g., project oversight, implementation planning, interface control, vendor oversight and outage schedules)
- Installation services

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. 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

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 customer 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 Byron, Braidwood, Vogtle, Harris, South Texas, Sizewell, Doel and Tihange during the original nuclear steam supply system. The Seabrook, R.E. Ginna, Waterford and Wolf Creek head assembly upgrades were retrofit modifications to the existing RVCH and CEDM cooling system. Optimization projects have been completed for Sequoyah, Catawba and Almaraz.

• Designed and supplied component-handling equipment, including Department of Transportation-certified containers for storage and transportation of reactor coolant pump (RCP) internals, RCP motors and temporary reactor vessel covers. Westinghouse has also supplied component handling equipment for the successful implementation of the Qinshan lower internals refurbishment project.

**RVCH replacement and upgrade services have been or are being provided to:**

• ANO-2
• Indian Point 2 & 3
• Beaver Valley 1*
• Kewaunee
• Calvert Cliffs 1 & 2**
• Millstone 2*
• Comanche Peak 1*
• Point Beach 1 & 2*
• Farley 1&2*
• Prairie Island 1 & 2*
• Ft. Calhoun**
• Surry 2**
• H.B. Robinson 2*
• Waterford
• South Texas 1 & 2

*Includes head assembly upgrades
**Head assembly upgrade only