

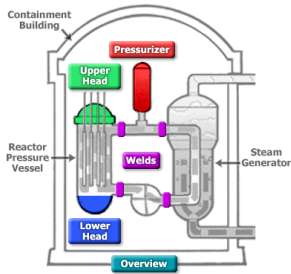


RIC 2013 Recent Operating Experience Reactor Pressure Vessel Upper Heads At Cold Leg Operating Temperatures

Jay Collins
Piping and Non-destructive Examination Branch
Office of Nuclear Reactor Regulation
March 13, 2013



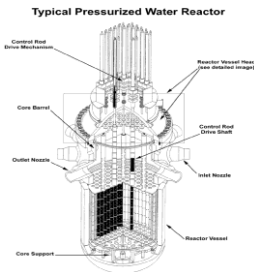
Typical Pressurized Water Reactor



2

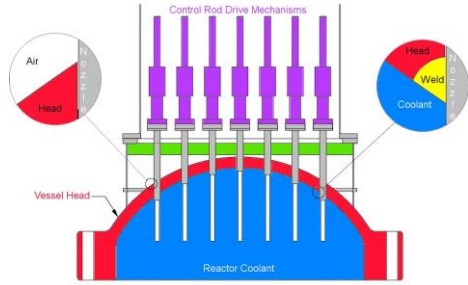


Reactor Vessel



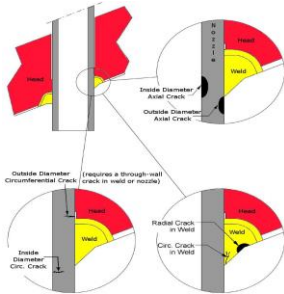
3

Upper Head



4

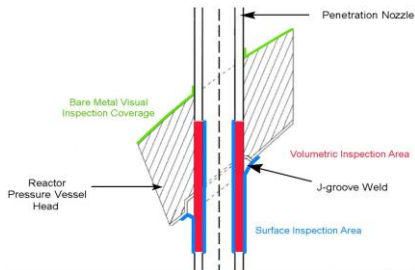
Stress Corrosion Cracking



Modified Image from Figure 2-1 of Reactor Vessel Closure Head Penetration Safety Assessment for US PWR Plants (MRP-110NP)

5

Inspection Types



6



Bare Metal Visual Exam



Performed every 5 years

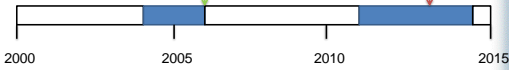
7



Volumetric Inspection Timeline

Initial baseline volumetric inspections were completed in 2006. One penetration nozzle at one plant had indications of cracking.

Second round of volumetric inspections is ongoing. Currently, cracking has been identified at four more plants.



8



Inspection Summary

- Inspection program results
 - No leakage
 - Only one crack reported greater than 50% through the nozzle wall thickness
- Each penetration nozzle with cracking was from the same manufacturer
 - All plants with this manufacturer’s nozzles have been through the second round of inspections

9



Inspection Concerns

- Multiple indications of cracking in the J-groove welds
 - No method to size flaws in the weld to determine maximum depth of cracks
 - Cracks grow faster in the welds than the penetration nozzles
 - Current inspection requirements may allow one or two refueling outages in which a detailed inspection is not performed

10



Inspection Plan Review

- NRC is reviewing adequacy of current inspection requirements
- American Society of Mechanical Engineer's Boiler and Pressure Vessel Code Committees are reviewing the issue
- Materials Reliability Program and Electric Power Research Institute are also reviewing the issue

11



Continuing Inspections

- Those plants that have not completed their second volumetric exam are scheduled to complete the inspection during their next refueling outage
- NRC recommends
 - review previous baseline inspection results
 - proactively ensure repair plans meet all regulatory requirements prior to the outage in order to avoid potential delays

12
