

BNL ALARA Center Data Base

U.S.A.

R-342

EVALUATION OF REACTOR PRESSURE VESSEL HEAD CRACKING IN TWO DOMESTIC BWRs

Keywords: COMPONENT RELIABILITY; REACTOR PRESSURE VESSEL;
IGSCC; STAINLESS STEEL; LOW-ALLOY STEEL

Principal Investigator:

Structural Integrity Associates

Project Manager:

R. Pathania
Electric Power Research Institute
3412 Hillview Ave., P.O. Box 10412
Palo Alto, CA 94303

U.S.A.

Phone: 415-855-2411

Objectives:

- 1) Determine the cause of cracking in the reactor pressure vessel (RPV) top head at two domestic BWRs
- 2) use structural analysis methods for assessing the consequences of cracking on continued top head operation

Comments: Two BWRs, Quad Cities unit 1 and Vermont Yankee, experienced cracking in the stainless steel cladding of the RPV top head. The following tests were done at Quad Cities:

- surface penetrant testing (PT)
- ultrasonic testing (UT)
- metallurgical failure analyses
- finite-element analyses

At Vermont Yankee, only visual analysis, PT, and UT were performed. In both cases, structural analyses were done to determine the consequences of cracking on the structural reliability of the RPV head.

Remarks/Potential for dose limitation: The cracking in the austenitic stainless steel cladding was a result of IGSCC. This was caused by the oxidizing nature of the BWR environment, which can be particularly severe in the top head region. The study also showed that cracking in low-alloy steel was not associated with the coolant environment, but rather it resulted from a reheat cracking mechanism that can affect certain low-alloy steels. Structural analyses demonstrated that both plants had considerable structural margin, meeting ASME Code Section XI requirements for continued operation without repair. The vessel head region can be made less susceptible to IGSCC by improved water chemistry controls, and by using hydrogen water chemistry wherever practical.

References: "Evaluation of Reactor Pressure Vessel Head Cracking in Two Domestic BWRs"
EPRI TR-101971, Final Report, February 1993.

Duration: from: 1992 to: 1993

Funding: N/A

Status: Completed

Last Update: September 3, 1993