UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

February 4, 2005

NRC INFORMATION NOTICE 2005-02: PRESSURE BOUNDARY LEAKAGE IDENTIFIED ON STEAM GENERATOR BOWL DRAIN WELDS

ADDRESSEES

All holders of operating licenses for pressurized-water nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees to cracking and leakage indications found on steam generator (SG) bowl drain welds. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

BACKGROUND

On September 16, 2004, Duke Energy Corporation, the licensee for Catawba Unit 2, identified boric acid deposits from pressure boundary leakage in the vicinity of an SG bowl drain while conducting bare metal visual examinations of Alloy 600/82/182 components during the plant's refueling outage. These components are inspected because the Alloy 600/82/182 materials are susceptible to primary water stress corrosion cracking (PWSCC). Catawba Unit 2, which began commercial operation in 1986, is a four-loop pressurized-water reactor (PWR) unit designed and fabricated by Westinghouse Electric Company. The four SGs (2A, 2B, 2C, and 2D) are Westinghouse model D5. At 100% power, the average primary coolant temperature is 588 EF in the cold leg and 617 EF in the hot leg. This event is not applicable to Catawba Unit 1 because the SGs were replaced with ones that do not have bowl drains.

A similar event occurred in 2001 when the licensee identified boric acid deposits on the 2B SG drain line nozzle weld. Dye penetrant testing of the surrounding Alloy 82/182 weld metal confirmed cracklike indications. The licensee repaired the 2B SG drain line nozzle with Alloy 690/52/152 materials, which are more resistant to PWSCC. Visual and surface inspections of the remaining SG drain lines did not reveal any indications at that time.

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DESCRIPTION OF CIRCUMSTANCES

Catawba Unit 2 was completing reactor coolant pressure boundary examinations during its cycle 13 refueling outage. The examinations of the SG bowl drains were part of the licensee's Alloy 600 program. These areas are inspected because the SG bowl drains are constructed with Alloy 600/82/182 materials, which are susceptible to PWSCC. The licensee previously identified locations with Alloy 600/82/182 materials and, under its Alloy 600 program, removes insulation and conducts bare metal visual examinations of these locations each refueling outage.

Three of the four Catawba Unit 2 drain lines were fabricated from stainless steel nozzles attached at the bottom of the SG vessel using 82/182 weld materials in a J-groove weld configuration. Leakage was confirmed in the 2C SG drain line nozzle weld by the presence of boric acid deposits. The amount of boric acid deposited was approximately 0.25–0.50 cubic inch (4.1–8.2 cubic centimeters). The licensee also identified much smaller amounts of boric acid on the 2D SG drain line. To determine the extent of the problem, the licensee performed dye penetrant testing on the 2A and 2D SG drain lines. The licensee determined from the dye penetrant examination that the ASME code acceptance limits were satisfied for the 2A SG bowl drain line weld. However, the dye penetrant examination did confirm cracking in the Alloy 82/182 weld in the 2D SG drain line. The licensee submitted an event notification on September 20, 2004, pursuant to 10 CFR 50.72(b)(3)(ii)(A) (event #41048). Dye penetrant testing of the 2C SG drain line weld was not performed since leakage was confirmed through the presence of boric acid deposits. The licensee repaired all three drain lines, which will prevent any exposure of Alloy 600/82/182 materials to the reactor coolant water.

DISCUSSION

The design of the Catawba Unit 2 SG bowl drain allows primary water to directly contact the Alloy 82/182 weld materials that attach the stainless steel drain line nozzle. Consistent with industry operating experience, it seems likely that the most recent indications are a result of PWSCC. There was no evidence of boric acid corrosion of the surrounding ferritic material. It also appears that the safety significance of this particular event is low, given the leakage-limiting configuration of the drain lines. Some licensees have eliminated the potential for this issue by modifying the SG bowl drain in such a way that the susceptibility to PWSCC has been lowered or eliminated. Replacement SGs, which are in use at many plants, do not typically have bowl drains.

Bare metal visual examinations can be used to identify evidence of leakage. It is important to note that the problem would have gone unnoticed if the insulation had not been removed for the inspections.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Patrick L. Hiland, Chief
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Note: NRC generic communications may be found on the NRC public website, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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