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Serial: RNP-RA/02-0122

AUG 1 2 2002

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

REACTOR VESSEL HEAD INSPECTION PLAN FOR REFUELING OUTAGE 21

Ladies and Gentlemen:

On August 3, 2001, NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," was issued requesting that licensees provide information related to the structural integrity of the reactor pressure vessel head penetration (VHP) nozzles, including the extent of VHP nozzle leakage and cracking that had been found to date, the inspections and repairs that had been undertaken to satisfy applicable regulatory requirements, and the basis for concluding that plans for future inspections would ensure compliance with applicable regulatory requirements.

H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, responded to NRC Bulletin 2001-01 by letter dated September 4, 2001, and provided supplements to this submittal to demonstrate that HBRSEP, Unit No. 2, was in compliance with applicable regulatory requirements and to provide assurance regarding the structural integrity of VHP nozzles. The HBRSEP, Unit No. 2, supplement dated November 12, 2001, committed that a plan for non-destructive examination (NDE) of the HBRSEP, Unit No. 2, VHP nozzles would be provided to the NRC staff at least 60 days prior to the start of Refueling Outage (RO) - 21.

The attachment to this letter provides the reactor vessel head inspection plan for RO-21, which is scheduled to begin on October 12, 2002. This plan was developed using careful consideration of vendor capabilities and industry standards for such inspections. Additional considerations included activities and recommendations of the Electric Power Research Institute's (EPRI) Materials Reliability Program (MRP), and the likelihood of a forthcoming NRC generic communication on this subject. HBRSEP, Unit No. 2, will perform NDE of the 69 VHPs during RO-21 using a combination of surface and volumetric techniques to assure the integrity of VHPs. Should new techniques or information become available, HBRSEP, Unit No. 2, may modify or revise the plan for performance of these NDE activities. Any substantive changes will be communicated to the NRC staff by a supplement to this plan, or by the HBRSEP, Unit No. 2, response to the forthcoming NRC generic communication.

Robinson Nuclear Plant
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Hartsville SC 29550

A088

If you have any questions concerning this matter, please contact Mr. C. T. Baucom.

Sincerely,

B. L. Fletcher III
Manager - Regulatory Affairs

CTB/ctb

Attachment:
Reactor Vessel Head Inspection Plan for Refueling Outage 21

c: Mr. L. A. Reyes, NRC, Region II
Mr. R. Subbaratnam
NRC Resident Inspector

H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

REACTOR VESSEL HEAD INSPECTION PLAN FOR REFUELING OUTAGE 21

Background

As described in the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, submittal dated November 12, 2001, non-destructive examinations (NDE) of the reactor vessel head penetrations (VHPs) will be performed during Refueling Outage (RO) - 21, which is scheduled to begin on October 12, 2002. As committed within the November 12, 2001, submittal, HBRSEP, Unit No. 2, is providing a plan for these NDE activities.

This plan was developed using careful consideration of vendor capabilities and industry standards for such inspections. Additional considerations included activities and recommendations of the Electric Power Research Institute's (EPRI) Materials Reliability Program (MRP), and the likelihood of a forthcoming NRC generic communication on this subject. HBRSEP, Unit No. 2, will perform NDE of the 69 VHPs during RO-21 using a combination of surface and volumetric techniques to assure the integrity of VHPs. Should new techniques or information become available, HBRSEP, Unit No. 2, may modify or revise the plan for performance of these NDE activities. Any substantive changes will be communicated to the NRC staff by a supplement to this plan, or by the HBRSEP, Unit No. 2, response to the forthcoming NRC generic communication.

In addition to NDE of the 69 VHPs, HBRSEP, Unit No. 2, will conduct a bare head visual inspection of 100% of the reactor vessel head surface and control rod drive mechanism penetrations during RO-21. The inspection will utilize a combination of direct and remote techniques, and may employ differing types of optical aids to accomplish the inspection. The inspection will be conducted using Special Procedure (SP) - 1500, "Visual Inspection of RPV Head Penetration Nozzles," which incorporates EPRI Document 1006296, "Visual Examination for Leakage of PWR Head Penetrations on Top of RPV Head," and the MRP Inspection Plan, "PWR Reactor Pressure Vessel (RPV) Upper Head Penetrations."

Inspection Scope and Overview

The HBRSEP, Unit No. 2, reactor vessel head has 69 Alloy 600 penetration tubes that are shrunk fit in the reactor vessel head and are provided with Alloy 182 partial penetration J-groove welds. There are a variety of configurations associated with the 69 penetration tubes, with each configuration requiring special considerations for inspection. The penetration tube

configurations may be grouped as follows:

- 45 penetration tubes with thermal sleeves
- Seven penetration tubes with part length drive shafts
- 17 penetration tubes without thermal sleeves or part length drive shafts

Inspection of the 45 penetration tubes with thermal sleeves and the seven penetration tubes with part length drive shafts will be performed using eddy current techniques on the inside diameter surfaces, and eddy current techniques on the accessible outside diameter surfaces of the penetration tubes and J-groove welds. Areas of the J-groove welds that are inaccessible for eddy current will be inspected using liquid penetrant techniques.

Inspection of the 17 penetration tubes without thermal sleeves or part length drive shafts will be performed using ultrasonic and eddy current techniques from the inside diameter surfaces, and eddy current techniques on the accessible outside diameter surfaces of the penetration tubes and J-groove welds. Areas of the J-groove welds that are inaccessible for eddy current will be inspected using liquid penetrant techniques.

Indications detected by eddy current examinations on the penetration tube inside diameter surface will be further investigated using time-of-flight diffraction (TOFD) ultrasonic techniques.

Inspection Techniques

An eddy current gap scanner inspection system will be used for the inside diameter surfaces of penetration tubes with thermal sleeves and those with part length drive shafts. The system is capable of delivering an eddy current blade probe into the 1/8 inch annulus between the thermal sleeve or drive shaft and the penetration tube. Eddy current inspection of the penetration tube inside diameter surfaces will be performed using a differential eddy current probe with two pancake coils positioned at 45 degrees to one another. This provides the capability to identify circumferential and axial degradation. The scanning motion is in the vertical direction, moving from the bottom of the penetration tube to an elevation of approximately two inches above the uphill side of the J-groove weld.

Penetration tubes without thermal sleeves or part length drive shafts will receive multiple simultaneous inspections from the inside diameter surfaces using an open housing scanner end effector. The scanning motion is in the vertical direction, moving from the bottom of the penetration tube to an elevation of approximately two inches above the uphill side of the J-groove

weld. The inspections include:

- TOFD ultrasonic techniques with PCS24 probes in the circumferential and axial directions,
- Pulse-echo, straight beam ultrasonic techniques at 2.25 MHz and 5.0 MHz, and
- Eddy current techniques for detection of degradation on the penetration tube inside diameter surface.

Eddy current inspection of the J-groove weld surfaces and penetration tube outside diameter surfaces will be conducted using cross-point eddy current probes. The eddy current end effector is designed to conform to the geometry of the J-groove welds and nozzle surfaces to allow the eddy current probes to follow the contour of the assembly. This inspection is intended to determine if degradation exists in the J-groove welds or the penetration tube outside diameter surfaces, and is also intended to characterize indications as axial or circumferential.

In the event degradation is identified in the inside diameter of a penetration tube during eddy current inspection, ultrasonic techniques will be used to characterize the indication. The ultrasonic probes for crack sizing consist of undamped, broad band TOFD probes. By using TOFD probe pairs with different probe spacings, accurate sizing can be accomplished throughout the penetration tube thickness range. The vendor performing these inspections has also demonstrated TOFD blade probes for detection of circumferential and axial degradation initiating on penetration tube inside and outside diameter surfaces.

Inspection Technique Demonstrations

The inspection vendor has participated in several demonstration efforts to establish the effectiveness of the NDE technology to detect and size degradation associated with primary water stress corrosion cracking. These demonstrations included the EPRI-sponsored demonstrations associated with NRC Generic Letter 97-01 and NRC Bulletin 2001-01. Prior to conducting the HBRSEP, Unit No. 2, VHP inspections in October 2002, the inspection vendor intends to perform additional demonstrations beginning on August 26, 2002.

Reporting of Results

As requested by NRC Bulletin 2001-01, HBRSEP, Unit No. 2, will provide a report of the NDE results within 30 days after restart following RO-21. This report will provide, to the extent necessary, a description of the extent of VHP nozzle leakage and cracking detected, including the number, location, size, and nature of each crack detected.

If cracking is identified, this report will also contain a description of the inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions taken to satisfy applicable regulatory requirements. This information will only be provided if there are changes from the prior information submitted by HBRSEP, Unit No. 2, in response to NRC Bulletin 2001-01.