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1CAN090202

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Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
Entergy 30-Day Response to NRC Bulletin 2002-02, for Arkansas Nuclear One, Unit 1

REFERENCES:

1. Entergy letter dated September 4, 2001, *"30-day Response to NRC Bulletin 2001-01 for ANO-1, Circumferential Cracking of VHP Nozzles"* (1CAN090102)
2. Entergy letter dated August 23, 2001, *"VHS Presentation of ANO-1 CRDM Nozzle Inspections"* (1CAN080103)
3. NRC letter to Entergy dated February 14, 2002, *Closeout Of Bulletin 2001-01 Review For Arkansas Nuclear One, Unit 1* (1CNA020201)
4. Entergy Licensee Event Report 50-313/2001-002-00 dated May 8, 2001 (1CAN050101)
5. Entergy Letter dated April 1, 2002, *"15 Day Response to NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity"* (0CAN040201)
6. Entergy Letter dated June 17, 2002, *Submittal of Demonstration Report for Volumetric Examination of Vessel Head Penetration Nozzles* (0CAN060201)

Dear Sir or Madam:

On August 9, 2002, the NRC issued NRC Bulletin 2002-02, *Reactor Pressure Vessel Head And Vessel Head Penetration Nozzle Inspection Programs* (0CNA080203) requiring licensees to provide a 30-day response to the requested information. Specifically, the NRC requests that pressurized water reactor (PWR) addressees who plan to supplement their inspection programs with non-visual nondestructive examination (NDE) methods provide a summary discussion of the supplemental inspections to be implemented. For PWR addressees who do not plan to supplement their inspection programs with non-visual NDE methods, they are requested to provide a justification for continued reliance on the visual examinations. Further clarification of the NRC's expectations for response to the bulletin

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was provided during a call with Mr. Brian Sheron and other members of the NRC Staff on August 21, 2002.

Attachment 1 provides Entergy Operations Inc. (Entergy's) response for ANO-1 to the requested information of Bulletin 2002-02. Entergy believes that the qualified bare metal visual examination as previously committed is sufficient to ensure that any reactor vessel head nozzle or weld leakage due to primary water stress corrosion cracking will not become a safety concern within an 18 month inspection cycle. Entergy has effectively administered a bare metal visual inspection of the reactor vessel head for several outages on ANO-1. Entergy has demonstrated that leakage can be identified and corrected before it will become a safety concern when properly monitored. Entergy also strongly believes that any leakage identified on the ANO-1 head will not result in wastage conditions to the extent experienced at the Davis Besse facility within an operating cycle. However, in light of the uncertainties in conditions leading up to the Davis Besse event, Entergy will conduct volumetric examinations on the accessible vessel head penetration (VHP) nozzles using a sabre, or blade type probe in addition to the bare metal visual inspections already planned. This commitment is only applicable to the upcoming 1R17 outage. The VHP inspection scope will be further evaluated for the subsequent 1R18 (spring 2004) outage. It is Entergy's intent to replace the ANO-1 reactor vessel head in the fall 2005 outage.

This letter is submitted pursuant to 10CFR50.54(f) and contains information responding to NRC Bulletin 2002-02 for ANO-1. The above commitment is also denoted in Attachment 2.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 9, 2002.

Sincerely,

R Bernt for
Craig Anderson

CGA/sab

Attachments
1. 30-Day Response to NRCB 2002-02, *Reactor Pressure Vessel Head And Vessel Head Penetration Nozzle Inspection Programs*
2. List of Regulatory Commitments

cc: Mr. Ellis W. Merschoff
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Attachment 1

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30-Day Response to NRCB 2002-02, *Reactor Pressure Vessel Head And Vessel Head Penetration Nozzle Inspection Programs*

30-Day Response to NRCB 2002-02, *Reactor Pressure Vessel Head And Vessel Head Penetration Nozzle Inspection Programs*

Requested Information

1. Within 30 days of the date of this bulletin:

   A. PWR addressees who plan to supplement their inspection programs with non-visual NDE methods are requested to provide a summary discussion of the supplemental inspections to be implemented. The summary discussion should include EDY, methods, scope, coverage, frequencies, qualification requirements, and acceptance criteria.

   B. PWR addressees who do not plan to supplement their inspection programs with non-visual NDE methods are requested to provide a justification for continued reliance on visual examinations as the primary method to detect degradation (i.e., cracking, leakage, or wastage). In your justification, include a discussion that addresses the reliability and effectiveness of the inspections to ensure that all regulatory and technical specification requirements are met during the operating cycle, and that addresses the six concerns identified in the Discussion Section of this bulletin. Also, include in your justification a discussion of your basis for concluding that unacceptable vessel head wastage will not occur between inspection cycles that rely on qualified visual inspections. You should provide all applicable data to support your understanding of the wastage phenomenon and wastage rates.

Response to Requested Action 1.A:

Background Information for Establishing Reliability and Effectiveness of ANO-1 Reactor Vessel Head Inspections:

At the beginning of each refueling outage, the reactor pressure vessel head is inspected using remote video equipment. The inspection covers 100% of the reactor pressure vessel head and nozzles to identify any boric acid deposits. These inspections are then compared with the previous inspection baselines. ANO-1 began its enhanced video inspection program for the reactor vessel during 1R14 (spring 1998). The reactor pressure vessel head was cleaned during 1R14 to improve visual inspection capability (see Entergy response to NRC Bulletin 2001-01 in Reference 1). No degradation to the head or discoloration of boron crystals typical of corrosion/ erosion was observed. The head was inspected for any indication of material wastage and to establish a baseline condition using remote video equipment. No discernable material wastage was identified during this inspection. This inspection was repeated during refueling outages 1R15 (fall 1999) and 1R16 (spring 2001).

During the 1R16 inspection, a small boric acid flow path was discovered at nozzle 56 location. A root cause and repair of the flaw was performed as discussed in the Licensee Event Report (Reference 4). To facilitate the repair of the leaking nozzle a large opening (approximately 1 ft. by 2 ft) was added to the side of the service

structure. Following repair of the through-wall crack in this nozzle, the outer surface of the reactor pressure vessel head adjacent to nozzle 56 was cleaned, removing the boric acid residue and the base metal was inspected for material wastage. No attempt was made to quantify the amount of leakage from nozzle 56 but it is estimated that the boron accumulation on top of the head was less than a few ounces. There was no visual detection of material degradation or related surface corrosion caused by boric acid. Due to this small amount of accumulation, there is no reason to believe that there has been corrosion to the head either within the annulus or at the top of the annulus.

The complete reactor pressure vessel head assembly was again cleaned in 1R16 and a new baseline inspection performed using remote video equipment. 100% of the reactor pressure vessel head and nozzles were inspected utilizing two video inspection systems, a video robot developed for the 1R16 inspection and a boroscope. The only boric acid remaining after cleaning operations was a dry film (staining) at various locations on the surface of the reactor head. No degradation to the reactor pressure vessel head was identified. A copy of a VHS formatted presentation that shows the robotic inspection capability and the as-found boric acid deposits on ANO-1 nozzle 56 was submitted to the NRC via letter dated August 23, 2001 (Reference 2).

In summary,

- Only a few ounces of boron were found due to the primary water stress corrosion cracking (PWSCC) on nozzle 56 in 1R16; hence, no measurable corrosion is considered probable in the annulus region between the nozzle and vessel.
- The identification of only a small through-wall crack at nozzle 56 attests to the adequacy of our inspection program which has been closely managed since the spring of 1998.
- The ability to identify leakage of the reactor pressure vessel head has been established based on available gap in the nozzle annulus and the reactor head cleaning efforts.
- The ANO-1 reactor vessel closure head is accessible such that high quality video and boroscope inspections can be performed (for the B&W designed head, the insulation is up off the head, and the video equipment can be maneuvered under the insulation).
- No other CRDM nozzles have been found with PWSCC leaks, to date. Any potential for gross wastage is extremely remote given the as-found and as-left condition of the ANO-1 reactor vessel head.
- The repair of nozzle 56 restored the reactor vessel head to within regulatory requirements and subsequent bare metal visual inspections will confirm the repair integrity.

Scope of VHP Inspection for 1R17 (Fall of 2002)

ANO-1 is scheduled to begin the next refueling outage (1R17) in October 2002 at which time it will be at 19.5 effective degradation years (EDY). The reactor head inspection plan will be consistent with Entergy's response to NRC Bulletin 2001-01 and 2002-01 (References 1 and 5) and will be supplemented with a volumetric examination as described below:

Entergy will:

1. Perform a qualified bare metal visual (BMV) inspection of the outer surface of the reactor pressure vessel head looking for leaking CRDM nozzles indicated by boron buildup at the junction of the head surface and the nozzle tube.
2. Perform a volumetric inspection of 68 of the 69 reactor vessel head penetration (VHP) nozzles using a blade probe from under the head. The top nozzle (nozzle 1) contains a reactor vessel level monitoring (RADCAL) probe, which is not accessible by the blade probe.
3. Inspect the surface of the head for degradation. If throughwall cracks are found and a concentration of boron is found protruding through the annulus region of the penetration, further actions will be taken to determine if there is a potential for wastage of the adjacent vessel material.
4. Perform a more intrusive examination of nozzle 1 containing the RADCAL probe if the presence of boron on the head makes the visual inspection of the nozzle inconclusive (such as removing the RADCAL instrument and performing a volumetric examination using an open housing probe).

Entergy Approach to Volumetric NDE to be Used during 1R17 RV Head Inspection

Frequency: The proposed volumetric examination is to only be performed in 1R17, which is the fall 2002 refueling outage. The scope of the future reactor vessel head inspection for 1R18 will be based on the findings of the forthcoming 1R17 outage as well as findings at other facilities.

Coverage: Unit 1 CRDM nozzles have the control rod drives (lead screws) protruding through the nozzles to the underside of the RPV head. A lead screw support tube is around each lead screw. The gap between the lead screw support tube and the inside diameter surface of the CRDM nozzle tube is relatively small (1/8 inch nominal, radially). Without complete removal of the control rod drive, the open-housing probe cannot be used to deliver the ultrasonic transducers for non-destructive examination.

Westinghouse/Wesdyne has developed special ultrasonic probes, which are configured for insertion in the gap between the lead screw/lead screw support tube and the inside diameter of the CRDM nozzle tube. The delivery tool is also designed to have the ability to move the lead screw support tube away from the penetration tube ID in order to open up the gap and allow proper insertion and movement of the UT/ET probe. Entergy will supplement the ANO-1 BMV inspection with a volumetric examination having this sabre or blade probe design. The supplemental examination of the ANO-1 RV head penetrations will utilize an axial shooting UT TOFD-24pcs (probe center

spacing) transducer that is being demonstrated to detect both axial and circumferential flaws. The examination distance will be approximately 2 inches above the top (1.5 inches ± 0.5 inches) of the J-groove weld to 2 inches (or the maximum achievable up to 2 inches) below the J-groove weld on the nozzle extension.

There is not an accessible gap on the center nozzle that contains the RADCAL instrument for performing the blade probe volumetric examination. In addition, the center nozzle is not readily accessible for performing a manual PT due to interferences with neighboring CRDMs, the RADCAL probe and the CRDM nozzles. Therefore, Entergy will only perform a qualified BMV inspection on this nozzle. As discussed previously, Entergy believes that the BMV inspection is adequate for detecting any leaking head penetration nozzles and will be effective in preventing significant wastage. However, if the presence of boron on the head makes the visual inspection of nozzle 1 containing the RADCAL inconclusive, a more intrusive examination of the nozzle will be performed.

Qualification (Demonstration): Testing of the Westinghouse/Wesdyne volumetric blade probe is currently being performed under the oversight of EPRI. The demonstration is expected to show that the blade probe will be able to examine the length of the nozzle up to two inches either side of the J-groove weld. In addition, the examination is expected to be able to see the OD surface of the nozzle up to the juncture of the J-groove weld. The demonstration is also expected to examine the triple point of the nozzle where the J-groove weld, the nozzle and the weld butter intersect. Results of this demonstration will be documented in an EPRI report, which will be available for review at a later date.

The procedures to be used for the NDE examinations will have been demonstrated to EPRI, the Material Reliability Program, and Entergy prior to being implemented at ANO. The procedure demonstrations are designed to identify the capabilities of the equipment and personnel to accurately detect and size PWSCC cracking. The personnel using the NDE procedures will be qualified Level II or Level III in the applicable NDE discipline. Those personnel performing analysis of the NDE data will have completed Westinghouse's flaw analysis training for the specific applications.

In addition, as discussed in Reference 6, Westinghouse/Wesdyne successfully performed a demonstration to detect OD initiated flaws as a result of the Oconee PWSCC flaw findings. This demonstration used TOFD transducers similar to that being employed for the ANO-1 examinations. The focus of the demonstration program was the examination for safety-significant cracking on the outside surface of the nozzle above or near the J-groove weld. The demonstration program consisted of demonstrating the capability to detect PWSCC using samples removed from Oconee 3 penetrations and also a full-scale mockup consisting of a penetration welded into a simulated section of a RPV head. The results of this demonstration indicated that these probes were satisfactory for performing volumetric examinations of VHP nozzles.

Acceptance Criteria: Any PWSCC flaws and any throughwall leaks will be repaired upon detection in accordance with IWA-5250 of the ASME Code. If during the conduct of the described examinations, flaws not attributed to leakage or PWSCC, will be evaluated and dispositioned in accordance with IWB-3600. Flaws not meeting

requirements for the intended service period will be repaired before returning them to service.

Conclusion: Entergy believes that the bare metal visual inspection has been sufficiently demonstrated on a cycle-to-cycle basis to ensure that leaking VHP nozzles will be identified and repaired prior to becoming a safety concern. However, as a result of the concerns identified at the Davis Besse facility, Entergy will also perform supplemental volumetric examinations of the accessible VHP nozzles using a blade probe developed by Westinghouse/Wesdyne. This probe is being demonstrated to examine the nozzle tube such that PWSCC flaws will be detected for repair. Entergy is confident that these examinations are adequate to identify reactor vessel head leakage and provide data to accurately assess potential material wastage of the head.

Attachment 2

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List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Entergy will conduct volumetric examinations on the accessible vessel head penetration (VHP) nozzles using the blade probe in addition to the bare metal visual inspections.	X		Prior to Startup from 1R17 (fall 2002 outage)