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Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
30 Day Post Outage Response to NRC Bulletins 2001-01 and 2002-01 for ANO-2
and Follow-up Response to Bulletin 2002-01 for ANO-1 and ANO-2

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 September 4, 2001, *30 Day Response to NRC Bulletin 2001-01 for ANO-2; Circumferential Cracking of VHP Nozzles* (2CAN090102)
3. 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)
4. Entergy letter dated May 14, 2002, 60 Day Response to NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity (0CAN050201)

Dear Sir or Madam:

On August 3, 2001, the Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2001-01, *Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles*. The bulletin requested information regarding the structural integrity of the reactor pressure vessel head penetration (VHP) nozzles. A 30 day response was provided for Arkansas Nuclear One (ANO), Units 1 and 2 in References 1 and 2, respectively. In addition, the NRC requested that licensees provide within 30 days after plant restart from the next refueling outage, information regarding the reactor head inspections performed during the outage. ANO-2 has completed the inspection of the ANO-2 reactor vessel head during our recent 2R15 refueling outage where the facility was returned to power on May 4, 2002. The response to the requested actions for the 30 day post-outage bulletin request is provided in Attachment 1 to this letter.

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In addition, by letter dated March 18, 2002, the NRC issued Bulletin 2002-01, *Reactor Pressure Vessel Head Degradation And Reactor Coolant Pressure Boundary Integrity* requiring licensees to provide 15 day, 60 day and 30 day post outage responses. The 15 day response for both ANO units was provided in Reference 3 and the 60 day response was provided in Reference 4. The response to the 30 day post outage report for ANO-2 is included in Attachment 1 of this letter along with the similar response for Bulletin 2001-01. In addition, the NRC provided a request for additional information (RAI) regarding the bulletin response for both ANO-1 and ANO-2 on April 19, 2002. The proposed response to these questions was discussed with the NRC during a conference call on April 25, 2002. The formal response to the RAI is provided in Attachment 2 for both ANO-1 and ANO-2, as appropriate.

This letter is being submitted pursuant to 10CFR50.54(f) and contains information responding to NRC Bulletins 2001-01 and 2002-01 for ANO-1 and ANO-2. There are no new commitments being made in this response.

If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 3, 2002.

Sincerely,

Sherrie R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/sab

Attachments
1. 30 Day Post Outage Response to NRC Bulletins 2001-01 and 2002-01 for ANO-2
2. Questions On Entergy's 15-Day Response To Bulletin 2002-01,

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30 Day Post Outage Response to NRC Bulletin 2001-01 and 2002-01 for ANO-2

NRC Required Information

In accordance with NRC Bulletin 2001-01, addressees are requested to provide the following information within 30 days after plant restart following the next refueling outage:

a. *a description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;*

b. *if cracking is identified, a description of the inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken to satisfy applicable regulatory requirements. This information is requested only if there are any changes from prior information submitted in accordance with this bulletin.*

AND

In accordance with NRC Bulletin 2002-01, within 30 days after plant restart following the next inspection of the reactor pressure vessel head to identify any degradation, all PWR addressees are required to submit to the NRC the following information:

a. *the inspection scope (if different than that provided in response to Item 1.D.) and results, including the location, size, and nature of any degradation detected,*

b. *the corrective actions taken and the root cause of the degradation.*

Response:

Boric acid visual inspections were performed while cooling down for the 2R15 refueling outage and again after the reactor head was placed on the head stand. These visual inspections were conducted per the ANO programs consistent with Generic Letter 88-05 guidance. The initial inspection performed while cooling down was performed to identify any boric acid on or around the vessel head flange. This inspection did not identify any boric acid. A more detailed visual inspection at and around the nozzles was performed from above the vessel insulation and shroud for boric acid deposits that could indicate nozzle leakage. No signs of boric acid leakage were detected protruding through the insulation or shroud area. Only very minor boric acid staining was observed at a few locations (likely from historical control element drive mechanisms venting).

The nondestructive examination (NDE) from under the head was performed by Westinghouse using their procedures with the oversight of Entergy Engineering and Quality Control specialists. The inspection plan for the 81 control element drive mechanisms (CEDMs) included the use of both a "demonstrated" eddy current (ECT) and an ultrasonic (UT) probe which included the area at a minimum of 1.5 inches above the J-weld to the inspectible extent of the nozzle below the weld. However, due to a problem with the eddy current detection circuit, the ECT signal was not available during a large portion of the examination. The 8 incore instrument (ICI) nozzles were similarly inspected using a comparable UT but modified for the larger ICI nozzle diameter. The single vent nozzle was inspected by a smaller UT probe. The ECT portion of the NDE equipment was available for the ICI nozzle inspections.

As a result of certain reflections that were not readily identifiable from the UT inspections, additional NDE was performed on three of the CEDMs from under the head for nozzles 30, 43, and 59. Nozzle 43 and 59 had J-weld reflections at the low side of the nozzles (~0°) that were further inspected by dye penetrant (PT). Nozzle 30 had subsurface reflections in the nozzle wall just above the threading for the CEDM guide cone. A separate ECT exam was performed from the OD of the nozzle. The results of the additional examinations from under the head revealed that there were no surface flaws on either the nozzle or nozzle J-welds, as applicable.

All 90 head penetrations were confirmed to maintain pressure boundary integrity with no indications of PWSCC cracking and no throughwall leaks that could cause head wastage. Therefore, no corrective actions were required to be taken for reactor head wastage.

**Questions On Entergy's 15-Day Response To Bulletin 2002-01,
Arkansas Nuclear One, Units 1 And 2**

1. *It was indicated that 1 nozzle at ANO-1 has been repaired due to leakage. Please discuss whether there were opportunities to discover a cavity outside the nozzle during the repair process (through pre- or post-repair inspections, through preparation of the area for repair, etc.).*

Response:

After the repairs were made to nozzle 56 during the 1R16 outage in the spring of 2001, the reactor head on ANO-1 was again cleaned and inspected. There were no visible signs of wastage on the reactor head around the nozzle which was confirmed by video recordings. The repair process used by ANO for nozzle 56 was to remove a portion of the J-weld and to backfill the area with new weld material, thus isolating the leakage path. The annulus area between the nozzle and the head was not inspected below the surface of the head. However, as discussed in our response to Bulletin 2002-01 (Ref. 3), the leak detected on nozzle 56 created only a very small deposit of boric acid on the vessel head (i.e. ounces). There was clearly no visible wastage on the top of head at the annulus. Even though the annulus below the head surface could not be inspected, Entergy does not believe that the small amount of boric acid was of sufficient quantity to react with the carbon steel base metal to have created any significant head wastage in the annulus.

2. *Has the boric acid on the insulation at ANO-2 been cleaned? If not, are there any plans to clean it?*

Response:

The boric acid that was referenced in the 15 day response was suspected to be as a result of a historical venting of the ANO-2 CEDMs. The inspection that was performed from the top of the head while the head was on the head stand revealed that there was no boric acid powder remaining on the reactor head insulation. As noted in Attachment 1 of this letter, there was only an occasional staining on the shroud from what appeared to be a dried thin residue film of boric acid. A video recording was made of this top head inspection above the shroud and insulation and a copy was provided to the NRC Region IV inspector who was present during the 2R15 head inspections .

3. *Are any actions taken to prevent/minimize the amount of boric acid that is sprayed onto the head during the venting operation? Please describe these actions.*

Response:

The vent nozzle is hard piped and is directed into a holding tank during venting operations. ANO-2 had at one time allowed a small amount of CEDM vent water to spill on the head. It has been a long standing practice to direct CEDM vent water away from the head. As a result, we have no active boric acid on the ANO-2 head shroud from venting operations.

4. *With regard to future inspection plans, please define the type of evaluation that is stated in the following response to question 1.D for both ANO units: "If throughwall or throughweld cracks are found and a concentration of boron is found protruding through the annulus region of the penetration, an evaluation will be performed to determine if there is potential for wastage of the adjacent vessel material."*

Response:

There were no VHP leaks discovered at ANO-2 and there were no concerns of wastage from the ANO-2 head inspections performed during 2R15. The specific wastage evaluation actions that would be taken if throughwall or throughweld cracks are identified are dependant upon the circumstances of the leak and additional information available from the inspections performed to identify the condition. However, if RCS leakage was discovered, Entergy would take progressive evaluation actions to address wastage are described below:

Examination for Wastage Potential

(1) The initial approach to identify wastage would be to quantify the amount of boron that has created from the leak to determine the potential for wastage. This would primarily be through additional visual examination at the exit point of the leakage path. For ANO2, the insulation cannot be readily removed to allow top head visual inspection. However, Entergy would consider other ways to visually inspect a specific nozzle for potential head surface wastage. Depending on the nozzle location a boroscope could potentially be used to inspect and quantify the concentration of boron around the nozzles. A top head visual inspection for wastage can be readily performed for ANO-1 since the insulation does not lie directly on the vessel head.

(2) At the same time an additional UT examination of the ID of the nozzle will be performed using the existing zero degree UT probe along the full length of the nozzle for determining the extent of the flaw and acquire any additional data that may be useful in identifying wastage.

(3) If the above does not provide sufficient results for assessing wastage, Westinghouse is developing a "low frequency ECT technique" to examine for wastage between the nozzle outer diameter and the carbon steel head. The low frequency ECT inspection technique measures the magnetic field between the carbon steel vessel and nozzle. This NDE approach is performed from the inside surface of the nozzle. The ECT probe (designated WIPS-DB) has been tested with known annulus gaps. Based on the current demonstrations, the amount of corrosion/erosion that can be detected is about 0.06 inches in depth. Although there has been only a limited development time for this method of NDE to date, it is believed that this technology could better identify if there is significant corrosion to the carbon steel vessel

(4) Other NDE techniques may also be available by the next head inspection to better identify the potential for wastage at the top of the head around the annulus.

Proposed Actions if Wastage is Identified

(1) For minor wastage that is assumed to exist on the surface of the head on either unit, the engineering evaluation would be expected to be less rigorous and the condition would likely be acceptable as-is. More severe conditions would likely involve a finite element structural evaluation and establishment of appropriate means to comply with the ASME Code for repair and replacement.

(2) For wastage that would be identified in the annulus region, the evaluation would be more involved and would consider conditions where base metal is lost out to the edge of the J-weld.

5. *Since the insulation on ANO-2 cannot be easily removed, please address whether or not ultrasonic testing (UT) of the nozzles in ANO-2 alone (i.e. eddy current (EC) testing on only some of the nozzles) will identify reactor pressure vessel head wastage.*

Response:

The UT probe used by Westinghouse on ANO-2 has been demonstrated to be able to detect flaws through the wall thickness of the nozzle and at least 0.050 inches into the J-weld. This UT process will identify potential leak paths for any PWSCC type flaws that would be expected to occur in the nozzle or the J-weld. The ECT portion of the planned flaw detection NDE would have better quantified the extent of any ID initiated flaws and would not be capable of detecting RV head wastage. A "demonstration report" of the UT examination method is being provided under separate cover letter.