Entergy

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0CAN120201

December 19, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Arkansas Nuclear One, Units 1 and 2
Docket Nos. 50-313 and 50-368
Response to NRC Request for Additional Information Regarding NRC Bulletin 2002-01 for ANO-1 and ANO-2

REFERENCES:

1 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)

2 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)

3 Entergy letter dated November 21, 2002, *Response to NRC Request for Additional Information Regarding NRC Bulletin 2002-01 for ANO-1 Incore Instrument Nozzles* (1CAN110203)

Dear Sir or Madam:

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 and 60-day bulletin responses. The Entergy Operations, Inc. (Entergy) response for Arkansas Nuclear One, Units 1 and 2 (ANO-1 and ANO-2) to the 15-day response was provided on April 1, 2002 (Reference 1) and the 60-day response was provided on May 14, 2002 (Reference 2). The 15-day response was primarily focused on actions to address the recent events of Davis Besse, while the 60-day response was focused on the adequacy of licensee's overall boric acid control programs.

In addition, Entergy performed visual inspections of the incore instrument (ICI) nozzles while the unit was being cooled down for the recent ANO-1 refueling outage. The results of these ICI nozzle inspections were discussed with the NRC during the outage. As a result, the NRC issued a request for additional information (RAI) to Entergy for ANO-1 as

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part of Bulletin 2002-01. Entergy provided the response to the NRC RAI regarding the ANO-1 ICI nozzle inspection on November 21, 2002 (Reference 3).

On November 22, 2002, the NRC issued a letter to ANO regarding an industry-wide request for additional information to NRC Bulletin 2002-01 based on a review of licensees's 60-day boric acid program responses. The Entergy response for ANO-1 and ANO-2 to the NRC Bulletin 2002-01 RAI is contained in Attachment 1.

As discussed in the attached response, Entergy is aware of the recent recommendations from Framatome ANP for inspection of the ICI nozzles. Our 1R17 actions on this recommendation were provided in Reference 3. Entergy intends to work with Framatome and the other B&W Owners to better understand appropriate inspection techniques. The next ANO-1 outage is scheduled for the spring of 2004. Entergy will notify the NRC staff by January 2004 of any further inspection plans to address this recommendation. This commitment is provided in Attachment 2.

This letter contains information responding to NRC Bulletin 2002-01 for ANO-1 and ANO-2 and is being submitted pursuant to 10CFR50.54(f). 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 December 19, 2002.

Sincerely,

Glenn R. Ashley
for
Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/sab

Attachments:

1. Response to Request for Additional Information Related to Bulletin 2002-01 for ANO, Units 1 and 2
2. List of Regulatory Commitments

cc: Mr. Ellis W. Merschoff
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Attachment 1 to

0CAN120201

Response to Request for Additional Information Related to Bulletin 2002-01 for ANO, Units 1 and 2

Request for Additional Information Related to Bulletin 2002-01 for ANO, Units 1 and 2

NRC Question 1

Provide the technical basis for determining whether or not insulation is removed to examine all locations where conditions exist that could cause high concentrations of boric acid on pressure boundary surfaces or locations that are susceptible to primary water stress corrosion cracking (Alloy 600 base metal and dissimilar metal Alloy 82/182 welds). Identify the type of insulation for each component examined, as well as any limitations to removal of insulation. Also include in your response actions involving removal of insulation required by your procedures to identify the source of leakage when relevant conditions (e.g., rust stains, boric acid stains, or boric acid deposits) are found.

ANO Response to Question 1

The response to this question involves two aspects of the ANO Boric Acid Control Program for the removal of insulation. The first aspect addresses the considerations for removing insulation to identify potential boric acid leaks; the other involves actions taken to further evaluate a condition when boric acid has been discovered on a component or system. The identification of RCS boric acid leaks and considerations for insulation removal are typically contained in one of three ANO programs / procedures:

1. ANO-1 and ANO-2 ASME Section XI Inservice Inspection (ISI) programs (CEP-ISI-002 and CEP-ISI-004, respectively). These programs include the examination of welds, rigid restraints and pressure boundaries of components and piping on ASME Class 1, 2 and 3 systems. The weld and rigid restraint examinations are performed during specified periods within the ISI interval. The system pressure tests of piping are performed during regular 10-year intervals which include inspections every refueling outage for Class 1 piping and once a period for Class 2 and 3 piping systems. The ANO ISI programs identify the specific welds and rigid restraints that have been selected for examination during the 10-year interval. Insulation is removed for all volumetric and surface examinations performed in accordance with ASME Section XI.

   Bolted connections in systems borated for the purpose of controlling reactivity are screened for boric acid corrosion susceptibility based on chemistry factors of the bolting material. These bolting chemistry factors are addressed in Entergy's ASME Section XI System Pressure Testing Program (CEP-PT-001). As currently applied at ANO in borated systems, insulation is removed from susceptible Class 2 and 3 bolted connections once each inspection period and once each refueling outage for susceptible Class 1 bolted connections (unless the component contains a leakage detection system). The bolted connections need not be pressurized. Insulated bolted connections require a four-hour hold time after attaining system operating pressure unless the system has been in operation at least four hours. No hold time is required after attaining test pressure and temperature.

   ANO Procedures 5120.242 and 5120.243 *Post Outage Pressure Testing for Unit 1 and Unit 2,* respectively, are used for the VT-2 inspection of the RCS pressure boundary (remote visual examination may be substituted for direct examination). Detailed listings of the inspection locations are provided in the procedure. Relevant conditions are evaluated for corrective measures in accordance with site and corporate procedures which meet ASME Section XI Code requirements.

2. ANO Procedure 2311.009, "*ANO Unit 1 and Unit 2 Alloy 600 Inspection*," facilitates inspections of all locations concerned with Alloy 600 primary water stress corrosion cracking (PWSCC) for both units. The Alloy 600 weld and nozzle locations at ANO have been identified in this procedure and walkdowns by ANO System Engineering personnel are required to inspect these locations on an outage basis unless otherwise specified. Attachments 1, 3 and 5 of this procedure are associated with vessel head penetrations (VHPs). Attachments 2 and 4 of the procedure contain guidance for inspection of the specific small bore and pressurizer nozzles that are susceptible to PWSCC for both units. Forms are provided as part of the procedure which lists each of these susceptible locations. The specific RCS locations are walked-down during refueling outages and the findings documented for potential leaks from Alloy 600 components. The only exceptions where Alloy 600 small bore penetrations do not currently receive a bare metal inspection by this procedure are those penetrations associated with the ANO-1 incore instrument (ICI) nozzles and certain ANO-1 RCS cold leg nozzle inspections. Details of the VHP nozzle inspection for NRC Bulletin 2002-01 were provided in Reference 1. The ANO-1 ICI nozzles are walked-down by Quality Control personnel per Procedure 5120.242 discussed below. The ANO-1 cold leg nozzles are specified by the program, but only received a remote visual inspection during 1R17 as further discussed in the response to questions 2 and 5 below.

   Procedure 2311.009 specifies that the Alloy 600 hot leg, cold leg and pressurizer penetrations be "visually inspected." The expectation of the procedure is that the penetration be visually inspected at the nozzle-to-base metal interface and 360 degrees around the penetration. The removal of insulation is not specified by the procedure. Insulation type varies from component to component, but the type of insulation is not a significant factor of whether the penetration surface is inspected. However, if insulation is present, the engineer has several options available to perform inspections:

   The first option is to determine whether the insulation actually impacts the ability to clearly inspect the penetration. If a visual inspection can be performed without removal of insulation, then the insulation will not be removed. Secondly, if inspection of the penetration can be performed, but less than 360 degrees around, then the engineer will determine if an adequate inspection can be performed to verify that no boric acid is present or whether boric acid could be masked. If acceptable, an inspection will be performed and the inspection results will be documented. There are only a few penetrations on the ANO-1 pressurizer and hot legs where this option is necessary. In these cases, the experience has been that approximately 180 to 270 degrees of the nozzle is inspectible. All other locations are generally accessible. The last option is to remove the insulation, perform the inspection and reattach the insulation.

3. ANO-1 and ANO-2 Procedures 1102.010, *Plant Shutdown and Cooldown* and 2102.010, *Plant Cooldown*, respectively. During refueling outage plant cooldown, an RCS walkdown is performed to inspect for leaks that have the potential for boric acid corrosion which could cause carbon steel wastage. These walkdowns are conducted by Operations Department personnel. During plant heatup another series of

walkdowns are performed similar to that performed for cooldown. These walkdowns are controlled by ANO-1 Procedure 1102.001, *Plant Preheatup and Precritical Checklist* and ANO-2 Procedure 2102.001, *Plant Pre-heatup and Pre-critical Checklist.* These inspections do not require the removal of insulation when conducting the walkdowns.

The second aspect of the ANO boric acid control program for removal of insulation would be when boric acid has been identified and actions are being taken to evaluate and return the pressure boundary integrity of a component/system. System Engineering personnel perform an evaluation of all identified locations from any of the above processes per Procedure 1032.037, "*Inspection and Evaluation of Boric Acid Leaks*" (see Reference 2 for more details). Each leak path evaluation is assigned an evaluation number and tracked to resolution. The boric acid evaluation requires consideration of staining, buildup, wastage, and corrosion effects as part of the evaluation. Even though insulation removal is not specified by the procedure, if the presence of insulation does not allow the engineer to make a conclusive determination of the affect of the boric acid on the component or neighboring system/component, the insulation will be removed.

NRC Question 2

Describe the technical basis for the extent and frequency of walkdowns and the method for evaluating the potential for leakage in inaccessible areas. In addition, describe the degree of inaccessibility, and identify any leakage detection systems that are being used to detect potential leakage from components in inaccessible areas.

ANO Response to Question 2

Inspections associated with the ANO ISI programs are in accordance with the period and interval frequencies established by the ASME Code as implemented at ANO. All other boric acid inspections and walkdowns of susceptible locations are currently performed on a refueling outage basis. The only exceptions to this frequency are those penetrations associated with the ANO-1 cold leg nozzle inspections associated with the cold leg temperature elements. These nozzles are significantly elevated above any floors and walkways and require significant scaffolding to be installed at several locations. It was determined that this inspection could be deferred from the 1R17 outage. A remote visual inspection of these nozzles was performed in 1R17 in lieu of a bare metal inspection. No boric acid was identified to be present on these nozzles. The evaluation for deferral of this inspection is further discussed in the response to question 5 below. There are no ANO-2 exceptions to this expectation.

There is currently no prescribed inspection frequency greater than every refueling outage. However, after 1R18 (spring of 2004), the inspection frequency for the ANO-1 cold leg nozzles will be changed to an alternating outage basis. This is considered acceptable based on the lower susceptibility of these nozzles.

Except for the ANO-1 ICI and certain cold leg nozzles, there are no other ANO-1 or ANO-2 RCS pressure boundary locations that are inaccessible for inspection.

NRC Question 3

Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in the bottom reactor pressure vessel head incore instrumentation nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. The NRC has had a concern with the bottom reactor pressure vessel head incore instrumentation nozzles because of the high consequences associated with loss of integrity of the bottom head nozzles. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path.

ANO Response to Question 3

The only ANO-1 bottom head nozzles are the ICI nozzles. There are 52 ICI nozzles which are visually inspected as part of our normal post outage pressure test walkdowns. These visual inspections are not a bare metal visual inspection since they are conducted from outside the insulation. For the 1R17 outage, Procedure 2311.009 was modified to document an effective 360 degree inspection of the ICI nozzles below the insulation; not a bare metal visual inspection. Entergy also videotaped the nozzles at and around the insulation. However, four of the nozzles received a bare metal visual inspection which required removing a portion of the insulation around the nozzles. A boroscope was used to inspect the annulus of these nozzles. No leaks or signs of boric acid buildup were identified. Details, and a description of the 1R17 acceptability of this inspection, were provided to the NRC in Reference 3. Similar to that performed during the 1R17 ICI nozzle inspection, if boric acid is identified as a result of future ICI nozzle inspections, it will also be investigated to sufficiently determine the boric acid source and evaluate potential impact of the boric acid leakage.

ANO-2 is a Combustion Engineering (CE) designed vessel; therefore, there are no penetrations associated with the bottom head of the reactor vessel.

NRC Question 4

Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in certain components and configurations for other small diameter nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path.

ANO Response to Question 4

Other than the ANO-1 ICI nozzles, all of the ANO-1 and ANO-2 RCS pressure boundary susceptible nozzles and components receive a bare metal visual inspection for visible leakage or the presence of boric acid deposits. Entergy at ANO does not use any online leak detection means other than those established for compliance with Regulatory Guide 1.45, *Reactor Coolant Pressure Boundary Leakage Detection Systems,* for maintaining a technical specification (TS) limiting condition for operation of one gallon per minute. However, TS RCS pressure boundary leakage limits are well in excess of leaks generally associated with PWSCC and Generic Letter 88-05 boric acid control program inspections. Small pressure boundary leakage experienced during an operating cycle, not identified by RCS leak detection systems, would be expected to be detected when performing the pre-outage walkdowns while the plant is being cooled-down per ANO-1 and ANO-2 Procedures 1102.010, and 2102.010, respectively. The units are still at elevated pressure and temperature and would continue to indicate RCS leaks, if present. A similar RCS integrity walkdown is performed for both units (Procedures 1102.001 and 2102.001) while the plant is at normal operating temperature and pressure prior to returning the unit to power after a refueling outage. Due to the high pressures experienced in the RCS, very small system leaks are able to be detected as a result of these walkdowns. Any boric acid identified from system leaks is evaluated and appropriately dispositioned.

As discussed in Reference 2, ANO Procedure 1032.037 governs the process for investigating and evaluating boric acid leaks for both units. This procedure also establishes the boric acid corrosion coordinator within System Engineering. The coordinator's responsibilities include ensuring preliminary investigation of the cause and severity of the leak, overseeing resolution of the condition, determining the root cause of the leak, if necessary, and ensuring reports documenting the problem are prepared in a timely manner. A form contained in this procedure is completed to document the evaluation. Each boric acid leak receives an evaluation to determine the extent of impact on either the subject component or any neighboring component/system. Photographs are typically taken to support the as-found condition of the leaking component as well as the equipment on which the boric acid may have dripped. If there is a potential for significant impact or wastage, a condition report is written and action is taken to repair or replace the component, if required.

Since the inception of the boric acid corrosion program at ANO, RCS leakage has not gone undetected that would indicate a wastage or system integrity concern. Entergy believes that any RCS system leaks will be effectively identified and repaired on a refueling outage frequency.

NRC Question 5

Explain how any aspects of your program (e.g., insulation removal, inaccessible areas, low levels of leakage, evaluation of relevant conditions) make use of susceptibility models or consequence models.

ANO Response to Question 5

Susceptibility models are not normally utilized in the ANO boric acid corrosion program for establishing frequencies or for determining the extent of inspection. However, during 1R17, due to the inaccessibility of the cold leg nozzles, an engineering evaluation was performed to substantiate the basis for not performing a bare metal inspection of these penetrations during 1R17. In this case, a 1998 Framatome ANP susceptibility report was referenced. This report provided the relative time-to-failure for all nozzles as determined primarily by temperature, which is evaluated using the Arrhenius equation. Other input parameters were used to develop the relative time to failure such as material factors (including heat treatments), material yield strength, material chemistry, and fabrication. It is recognized that the cold leg nozzles have a much lower susceptibility to PWSCC than hot leg nozzles. This report was used to establish a lower potential of failure for the cold leg nozzles when compared to hot leg nozzles and pressurizer nozzles. Based on this report and since there have been no failures in any of the original ANO-1 hot leg nozzles and no recent failures in the ANO-1 pressurizer nozzles, it was concluded that bare metal inspections of the cold leg nozzles could be deferred from the 1R17 outage.

This model was also discussed in the recent Entergy response to NRC Bulletin 2002-01 (Reference 3) regarding the ANO-1 inspection performed during 1R17 for the incore instrument nozzles. Even though this model was not specifically used in justifying not performing a bare metal inspection of the ANO-1 ICI nozzles, the relative cold operating temperatures of the ICI nozzles provides a relative basis for its acceptability.

Susceptibility models have not been used for any other reduced inspections on ANO-1 or on any ANO-2 penetrations.

NRC Question 6

Provide a summary of recommendations made by your reactor vendor on visual inspections of nozzles with Alloy 600/82/182 material, actions you have taken or plan to take regarding vendor recommendations, and the basis for any recommendations that are not followed.

ANO Response to Question 6

Regarding ANO-1, Entergy is only aware of the recent recommendation from Framatome ANP for inspection of the ICI nozzles. Our consideration of this recommendation for 1R17 was provided in Reference 3. As stated, Entergy intends to work with Framatome and the other Owners to better understand needed inspection techniques and potential repair options. The next ANO-1 outage is scheduled for the spring of 2004. Entergy will notify the NRC staff by January 2004 of any further inspection plans to address this recommendation.

Regarding ANO-2, a review of recommendations was performed for CE plant owners for inspections of Alloy 600/82/182 materials in the reactor coolant pressure boundary. This detailed review of the various files indicated that visual inspection recommendations were made as the result of leakage caused by PWSCC in Alloy 600 pressurizer heater sleeves and instrumentation nozzles. The recommendations were to inspect pressurizer small bore nozzles and heater sleeves during each refueling outage for signs of primary coolant leakage. The inspections could be performed with insulation in-place or removed. In addition, it was recommended that the CE owners inspect low alloy steel components exposed to boric acid and promptly repair primary coolant leaks. It was concluded by CE (now Westinghouse) that visual inspection is the best method of detecting a leaking nozzle or heater sleeve or for detecting damage to the pressurizer shell as a result of boric acid corrosion.

Attachment 2 to

0CAN120201

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 (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONT. COMPL.	
Entergy will notify the NRC staff of any further inspection plans to address the Framatome recommendation for performing bare metal inspections of the ICI penetrations.	X		January 2004