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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Response to Follow-up Request for Additional Information on Mechanical
and Civil Engineering Issues Regarding ANO-2 Power Uprate

Gentlemen:

On August 23, 2001, Entergy Operations, Inc. submitted a response (2CAN080104) to a request for additional information from the NRC Mechanical and Civil Engineering Branch regarding the Arkansas Nuclear One, Unit 2 (ANO-2) power uprate license application dated December 19, 2000 (2CAN120001). In the response to Question 12 of the August 23, 2001, letter, Entergy stated that evaluations for Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves" were scheduled to be complete by September 30, 2001. During a telephone call on October 3, 2001, the NRC staff requested confirmation that the evaluations had been completed as well as additional information concerning the evaluations. The staff's four questions, and Entergy responses, are provided in the attachment.

This submittal contains no regulatory commitments.

I declare under penalty of perjury that the foregoing is true and accurate. Executed on November 9, 2001.

Very truly yours,

A handwritten signature in cursive script that reads "Glenn R. Ashley".

Glenn R. Ashley
Manager, Licensing

GRA/dwb
Attachment

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Response to Follow-up Request for Additional Information on Mechanical and Civil Engineering Issues Regarding ANO-2 Power Uprate

NRC Question 1

Discuss the effect of the power uprate on differential pressure, flow, temperature, and system pressure on safety-related air-operated valve (AOV) and motor-operated valve (MOV) functions.

ANO Response

The impact of power uprate on system parameters of pressure, flow, and temperature has been documented in revisions to the Pressure Temperature (P/T) calculations for ANO-2. These calculations define worst case pressure, flow, and temperature for various piping segments in the applicable modes of operation. In general, impacts on MOV and AOV functions due to power uprate were minor and rare.

Revisions to pressures, temperatures and flows were reviewed against existing Maximum Expected Differential Pressure (MEDP) calculations for MOVs. No unacceptable negative impacts were identified due to power uprate system changes. Steam generator replacement, which was done to enable power uprate, negatively impacted containment isolation MOVs. However, the containment isolation MOVs were evaluated and design calculations were revised under evaluations performed for containment uprate for the replacement steam generators. Revisions have been made to the associated MEDP and setpoint calculations. Revised setpoint calculations indicate that impacts to setup and design margins for these MOVs were minimal. All the containment isolation MOVs were found acceptable for containment uprate. The Containment Uprate license application dated November 3, 1999 (page 6 of Enclosure 5 to letter 2CAN119903), documents that evaluation results were acceptable. For all MOVs other than the containment isolation valves, existing MEDP calculations bounded the assumptions made in the P/T calculations revised for power uprate. No MOV modifications or field setup changes were necessary to address power uprate or containment uprate for steam generator replacement.

Few negative impacts on AOV functions were identified, and those that were identified were insignificant. AOVs have been evaluated for acceptability at containment uprate conditions due to steam generator replacement and for power uprate. Evaluations were performed only for AOVs found to be negatively impacted by pressure or temperature increases. Of the twenty-five (25) active, safety related valves (Category 1 and 2) in the ANO AOV Program, nine (9) were identified as being negatively impacted. Two (2) of the nine are the main steam isolation valves (MSIVs), which were impacted only by power uprate. The MSIVs were evaluated and determined acceptable for power uprate. The remaining seven AOVs were individually evaluated for impacts due to containment

uprate or power uprate, although only containment uprate affected the valves. The evaluations consisted of comparing the pressures and temperatures specified for valve procurement to those predicted in the P/T calculations revised for either containment uprate or power uprate. In some cases, impacted AOVs had previously been tested while subjected to a differential pressure and the demonstrated capability was compared to the revised pressure values. All the AOVs evaluated were found to have ample margin to accommodate the increases in pressure and temperature using bounding valve factors. As design basis and sizing calculations are produced to support testing of program AOVs, power uprate conditions and current design criteria are being incorporated in the calculations. No air operators were found to be unacceptably sized.

NRC Question 2

Discuss the necessary revision of the AOV and MOV capability calculations such as any changes in valve factor or Electric Power Research Institute (EPRI) performance-prediction-methodology (PPM) application.

ANO Response

The EPRI PPM is not used at ANO to justify design or setup margins for any program MOVs. ANO uses site-specific test data and bounding equations to conservatively justify the design and setup of program MOVs. This practice was deemed acceptable for closure of ANO's Generic Letter 89-10 "Safety-Related Motor-Operated Valve Testing and Surveillance" commitments as documented in NRC Inspection Report 50-313/96-23 and 50-368/96-23 (letter 0CNA119603 dated November 12, 1996). No valves in the MOV or AOV program will experience significant pressure, flow, or temperature changes under power uprate conditions. No valves previously judged to be in non-blowdown operating conditions were placed in a blowdown situation due to system changes related to power uprate. No system temperature changes occurred due to power uprate that changed the overall state of the system fluid, such as from cold to hot or liquid to steam. Therefore, the valve factors previously assigned, based on in-situ testing of sample valve groups, remain unchanged.

AOV sizing calculations were reviewed or revised for power uprate and steam generator replacement conditions; bounding valve factors were established. ANO does not have separate "capability" calculations. AOV capability is determined in the sizing calculations. No sizing calculations were revised due to inadequate AOV capability.

Flow, temperature, and pressure increases due to power uprate were used to evaluate the ANO-2 MSIVs (which are AOVs). The MSIVs were found acceptable. The MSIVs are wye-pattern globe valves with flow over the seat. Therefore, the increase in flow and pressure due to power uprate changes will further assist the valves to self-close. Special vibration testing was also initiated to ensure no unacceptable vibration increases occur in the MSIVs due to increased steam flow at uprate conditions.

NRC Question 3

Discuss any loss of AOV or MOV capability margins from the power uprate, and any planned short-term or long-term actions to restore margins.

ANO Response

Because ANO's AOV Program is in the early stages of development, all of the current design-basis and sizing calculations completed to date assume power uprate conditions. Therefore, there was no "loss" of capability margins previously calculated using current design criteria. However, it is intuitive that the margins calculated for some AOVs will be less than would have been indicated prior to power uprate. The P/T calculations revised for power uprate and containment uprate were reviewed, and revised pressures and temperatures were compared to those originally defined for design of the impacted AOVs or demonstrated acceptable by in-situ testing. No AOVs were identified as having impacts to setup or design margins that required short-term or long-term actions to restore margin.

The setup and design margins of some containment isolation MOVs were impacted to a small extent due to increases in assumed accident pressures for containment uprate for steam generator replacement. The containment design pressure was increased from 54 psig to 59 psig to accommodate the effects of the increased volume of water contained in the replacement steam generators (see NRC Safety Evaluation dated November 13, 2000). The MEDP calculations for the containment isolation MOVs were revised accordingly. The setpoint calculations for the impacted MOVs were revised with inputs from the revised MEDP calculations. The revisions demonstrate the design and setup margins are acceptable for power uprate and steam generator replacement.

The ANO-2 AC undervoltage calculation was revised for some MOVs to address changes in high-energy line break evaluations revised for power uprate. The temperature derated torque factors and undervoltage values for several MOVs were reduced due to room temperature changes. The affected MOVs' torque capabilities were negatively impacted to a minor extent in some cases. However, no MOVs were identified as having impacts to setup or design margins that required short-term or long-term actions to restore margin.

NRC Question 4

The licensee states that the evaluation of the effect of the power uprate regarding Generic Letter (GL) 95-07 will be completed on September 30, 2001. Discuss the potential for thermal binding or pressure locking, such as caused by temperature increases, on the scope of power-operated valves under GL 95-07 or the performance of those valves. Discuss any modifications or procedure changes necessary as a result of the power uprate to preclude thermal binding and pressure locking. The licensee will need to submit an update of its August 23, 2001, letter notifying the NRC of the completion of the 95-07 review and its results.

ANO Response

ANO has reviewed the effect of ANO-2 power uprate on valves covered by the scope of Generic Letter 95-07. The objective was to review previously established gate valve thermal binding/bonnet overpressurization selection and evaluation criteria for power-operated, safety-related gate valves at ANO-2 against changes in the plant's design basis as a result of power uprate.

Valves within the scope of the ANO-2 Generic Letter 95-07 program were reviewed for the effect of power uprate on valve thermal contraction loads (body contraction), valve stem thermal expansion loads (stem elongation), hydraulic locking and boiler effect locking (liquid entrapment - proximity boiler effect due to heat conduction through the piping from a hot adjacent branch line and environmental boiler effect due to air temperature increases caused by plant events such as a LOCA).

The valves were reviewed for the effect that changes in system or ambient temperature would have on the valve's ability to open when called upon during accident conditions. Additionally, any changes in system hydraulic pressure were evaluated against the same criteria. Normal ambient and accident conditions listed in the latest ANO-2 environmental qualification/service condition calculations were compared to the evaluation criteria originally used for the ANO-2 Generic Letter 95-07 reviews. The latest revised Pressure/Temperature calculations for ANO-2 piping systems, including test configurations, were also reviewed during this process. Changes to ANO-2 calculations/design basis documents made as a result of power uprate conditions were evaluated against the ANO Generic Letter 95-07 screening and evaluation documents.

The ambient and accident temperature changes due to power uprate did not result in any additional valves in the ANO-2 Generic Letter 95-07 population being classified as susceptible to thermal binding or boiler effect locking. In many of the systems, the changes in maximum fluid pressure and temperature values due to power uprate were already bounded by design pressures and temperatures which were previously used in Generic Letter 95-07 evaluations. In those systems that did have a change that affected the design analysis of the piping system, the revised values were evaluated for impact.

No percentage changes in margin were identified for thermal binding, since the screening criteria used bounding system/valve temperature and disc configuration as guidelines. Valves are simply classified as susceptible or not susceptible.

Valves considered potentially susceptible to hydraulic and boiler effect locking, which were not previously modified, were reanalyzed using the Commonwealth Edison Pressure Locking Prediction Methodology (ref. NUREG/CP-0152). Seven (7) calculations were performed for this evaluation. Appropriate margins were applied between the calculated required pressure-locking thrust and maximum allowable actuator thrust on the valves to align the predicted results with actual valve test data and to account for variances in static

unwedging and equipment uncertainty. Previously, the ANO-2 potentially susceptible valves had been evaluated using the Entergy Pressure Locking Prediction Methodology (reference NUREG/CR-0146); therefore, percentage comparisons of pressure locking margin change due to power uprate alone are difficult to make. However, no additional valves were classified as susceptible to either hydraulic locking or boiler effect as a result of this review.

No modifications or procedure changes are necessary as a result of power uprate to preclude thermal binding and pressure locking of ANO-2 valves within the scope of Generic Letter 95-07.