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Duane Arnold Energy Center
Operated by Nuclear Management Company, LLC

July 27, 2005

NG-05-0412

U.S. Nuclear Regulatory Commission
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Mail Station 0-P1-17
Washington, DC 20555-0001

Duane Arnold Energy Center
Docket 50-331
License No. DPR-49

Response to a Notice of Violation Contained in Inspection Report 5000331/2005010

This letter and attachment are provided in response to the Notice of Violation transmitted with NRC Inspection Report 5000331/2005010.

If you have any questions, please call Steve Catron, Nuclear Safety Assurance Manager at (319) 851-7234.

This letter contains the following new commitments:

NMC will obtain an additional review of the specific effects associated with the less than 10% modal shift in the analysis performed on the HPCI Steam discharge line. The results of this evaluation will be documented in the DAEC Corrective Action Program. This action will be completed by August 19, 2005.

NMC will regenerate the hydrodynamic loads for the original MARK I analysis performed at the DAEC. Upon completion of these efforts the modified piping configuration of the HPCI Steam return piping will be reanalyzed for all applicable loading conditions including the MARK I loadings. This action will be completed by November 1, 2006.

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Enclosure

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Nuclear Management Company – Duane Arnold Energy Center
Response to a Notice of Violation
Transmitted with Inspection Report 5000331/2005010

VIOLATION

Criterion III, "Design Control," of 10 CFR Part 50, Appendix B, requires, in part, that measures be established to assure that applicable regulatory requirements and the design basis, for those systems, structures and components for which this appendix applies, are correctly translated into specifications, drawings, procedures and instructions. It further requires that the design control measures provide for verifying or checking the adequacy of the design. Finally, it requires that design changes be subject to design control measures commensurate with those applied to the original design.

Contrary to the above, in October 1996, the licensee installed a design change to the high pressure coolant injection system that was not subject to the same design control measures as the original design. The high pressure coolant injection system is a safety-related system which is governed by the requirements of 10 CFR Part 50, Appendix B, Criterion III. Specifically, the design change incorporated the results of a calculation regarding the acceptability of moving steam discharge check valve V22-0016 approximately 50 feet closer to the torus on the torus attached piping loads. The calculation used a simplified methodology which contained an assumption that frequency response changes within ten percent were insignificant. The original methodology, which was specifically reviewed and approved by the NRC, did not contain such an assumption. Furthermore, the licensee did not implement any measures to verify the adequacy of this design assumption or to otherwise show that the design basis for torus attached piping had been correctly translated into the modification's specifications, drawings, procedures and instructions.

This violation is associated with a Green significance determination process (SDP) finding.

RESPONSE TO THE VIOLATION:

1. REASON FOR THE VIOLATION

During late 1995 and early 1996, following several Surveillance Test Procedure (STP) runs of the High Pressure Coolant Injection (HPCI) system, water accumulation was found in the HPCI Exhaust line between Check Valve V22-0016 and Stop-Check Valve V22-0017. Upon further investigation of this condition, it was concluded that following HPCI turbine operation, steam condensation causes a vacuum in the exhaust piping. This vacuum was sufficient to initially draw water from the torus up into the exhaust line. Vacuum breakers V22-0063 and V22-0064 opening would eventually break the vacuum. If valve V22-0017 fails to fully close soon after the cessation of steam flow, water would be drawn through V22-0017 and get trapped between valves V22-0017

and V22-0016. Upon a subsequent restart of the HPCI turbine with this water in the exhaust line, a transient could occur causing pressure pulses due to the expulsion of the water slug. This pressure transient might cause a turbine trip on high exhaust line pressure. It was determined that the transient could also have caused significant transient loads on the pipe, the pipe supports, the turbine nozzle, and the torus nozzle.

In order to prevent this transient, it was desirable to minimize the volume between the two valves to minimize the amount of water that would collect between the two valves, if V22-0017 did not close rapidly after system shutdown. Calculation CAL-M96-010 updated the structural design analysis of the HPCI turbine exhaust piping system to support the modified configuration with V22-0016 relocated closer to V22-0017. This calculation included pipe stresses, pipe support loads, valve accelerations, turbine nozzle loads and torus nozzle loads. Since the HPCI Exhaust piping system was a part of the Torus Attached Piping (TAP) analysis performed in 1983, several transient loads had to be considered. The normal loads and TAP loads considered were:

- Dead weight
- Pipe Pressure
- Operating Load
- Earthquake
- Thermal
- SRV Discharge
- LOCA Pool Swell
- LOCA Condensation Oscillation
- LOCA Chugging

One of the assumptions made for the transient load conditions was that frequency response changes less than 10% were not significant..

10CFR50.59 Evaluation, SE96-12, was performed for this modification. The conclusion of this evaluation was that no Unreviewed Safety Question was identified AND no Technical Specification revision OR a Basis change was involved.

A subsequent Request for Additional Information (RAI) (TAC No. M98274) was received from the NRC in 1997. This RAI was answered and CAL-M96-010 was revised to include changes due to DAEC's response to the RAI. No further correspondence concerning this modification was received from the NRC until the 2004 Safety System Design and Performance Capability (SSDPC) inspection. An unresolved item from this inspection included questions regarding the simplified methodology that was used in CAL-M96-010 in support of the modification. The NRC was concerned that the 1996 analysis included an assumption that frequency response changes that were less than 10 percent were insignificant and would not affect the system acceleration response for the modified piping. The NRC was concerned because this assumption was not properly verified.

Subsequent to the 2004 NRC inspection, DAEC obtained a one-page letter from Automated Engineering Services (AES) titled "Brief Review of DAEC Calculation CAL-M96-10." In this letter AES documented their brief review of DAEC's methodology used to justify the relocation of V22-0016. The letter stated that in general, they found that the calculation presented a competent and reasonable approach to addressing the Mark 1 containment loads absent availability of the licensing basis analysis methodology. The letter concluded that the methodology used in the 1996 calculation was a reasonable *alternative* approach. The letter went on to provide additional comparisons that could be completed if requested.

In June 2005, this unresolved item was reviewed by the NRC and determined to be a violation as a part of inspection report 2005-010 for DAEC. The NRC Inspection Report specifically stated that the AES letter did not provide any information that verified the adequacy of the design assumption and therefore, DAEC had not shown that the design basis for torus attached piping had been correctly translated in the 1996 design change.

The cause of the violation was DAEC's failure to adequately document (benchmark) that the assumptions used in the 1996 calculation bounded the original design assumptions made in the 1983 TAP analysis. The cause of the inadequate documentation was a lack of understanding of the need to complete a more thorough comparison to justify the alternative methodology used in the 1996 calculation.

2. CORRECTIVE STEPS TAKEN AND THE RESULTS ACHIEVED

Based on NRC staff review and NMC internal review, no immediate corrective actions were deemed necessary for this section of Torus Attached Piping.

A review of modifications made from 1995 to 2000 was conducted. The time frame was based on the time from before the issue arose and the time of the revision to 10 CFR 50.59, which provided specific analytic requirements concerning the use of alternative analytical methodologies. This review identified no modifications that modified torus attached piping, which relied upon an alternate methodology.

3. CORRECTIVE STEPS THAT WILL BE TAKEN TO AVOID FURTHER VIOLATIONS

Interim Corrective Action:

Regarding the 1996 calculation, CA 40624 has been initiated to obtain an additional review of the specific effects associated with the less than 10% modal shift in the analysis performed on the HPCI Steam discharge line. The results of this evaluation will be documented in the DAEC Corrective Action Program. This action will be completed by August 19, 2005.

Final Corrective Action:

CA 40626 has been initiated to regenerate the hydrodynamic loads for the original MARK I analysis performed at the DAEC. Upon completion of these efforts the modified piping configuration of the HPCI Steam return piping will be reanalyzed for all applicable loading conditions including the MARK I loadings. This action will be completed by November 1, 2006.

4. DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance will be achieved with the completion of the action to reanalyze the modified piping configuration for all applicable loading conditions including the MARK I loadings. This action will be completed by November 1, 2006.