January 17, 2003

Mr. Mark A. Peifer
Site Vice President
Duane Arnold Energy Center
Nuclear Management Company, LLC
3277 DAEC Road
Palo, IA 52324-0351

SUBJECT: DUANE ARNOLD ENERGY CENTER - RISK-INFORMED INSERVICE INSPECTION PROGRAM (TAC NO. MB4751)

Dear Mr. Peifer:

By letters dated March 29 and September 6, 2002, Nuclear Management Company, LLC (NMC), requested the Nuclear Regulatory Commission (NRC) staff's approval of a proposed risk-informed inservice inspection (RI-ISI) program as an alternative to the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for limited categories of Class 1 and Class 2 piping welds at the Duane Arnold Energy Center (DAEC).

The DAEC RI-ISI program was developed in accordance with Electric Power Research Institute (EPRI) Topical Report TR-112657, Revision B-A, using the Nuclear Energy Institute's template methodology. The results of the NRC staff's review indicate that NMC's proposed RI-ISI program is an acceptable alternative to the ISI requirements of the ASME Code, Section XI, and therefore, NMC's request for relief is authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety.

The enclosed safety evaluation authorizes application of the proposed RI-ISI program during the third 10-year ISI interval for DAEC, beginning with the current second inspection period.

Sincerely,

/RA/

Darl S. Hood, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM

NUCLEAR MANAGEMENT COMPANY, LLC

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated March 29, 2002 (Reference 1), the Nuclear Management Company, LLC (the licensee), proposed a risk-informed inservice inspection (RI-ISI) program as an alternative to a portion of its current Inservice Inspection (ISI) Program for the Duane Arnold Energy Center (DAEC). The scope of the proposed RI-ISI program is limited to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1 and Class 2 piping welds in Categories B-F, B-J, C-F-1, and C-F-2 only. The licensee provided additional information in a letter dated September 6, 2002 (Reference 2).

The licensee's RI-ISI program was developed in accordance with the methodology contained in the Electric Power Research Institute's (EPRI's) report EPRI TR-112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Revision B-A (Reference 3), which was previously reviewed and approved by the Nuclear Regulatory Commission (NRC) staff. The licensee submitted the application as an RI-ISI "template" application. Template applications are short overview submittals intended to expedite preparation and review of RI-ISI submittals that comply with a pre-approved methodology. The RI-ISI program proposed by the licensee is an alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i). The licensee is requesting the alternative for implementation during the second and third inspection periods of the current third 10-year ISI interval at DAEC.

2.0 BACKGROUND

2.1 Applicable Requirements

10 CFR 50.55a(g) requires that ISI of the ASME Code Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code*, "Rules for Inservice Inspection of Nuclear Power Plant Components" (hereinafter called Code), and applicable addenda, except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that the proposed alternatives would provide an acceptable level of quality and safety, or if the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements set forth in the Code, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of the Code, incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. DAEC is currently in the third 10-year ISI interval and the licensee plans to implement the proposed RI-ISI program to support the scheduled ISI activities during the next refueling outage in the Spring of 2003. The applicable edition of the ASME Code, Section XI, for the third 10-year ISI interval at DAEC is the 1989 edition.

2.2 Summary of Proposed Approach

The licensee has proposed a RI-ISI program as an alternative to the ASME Code, Section XI, requirements for limited categories of ASME Code Class 1 and 2 piping (i.e., Examination Categories B-F, B-J, C-F-1, and C-F-2 welds). The Code requires in part that for each successive 10-year ISI interval, 100 percent of Category B-F welds and 25 percent of Category B-J welds for the Code Class 1 non-exempt piping be selected for volumetric and/or surface examination based upon existing stress analyses and cumulative usage factors. For Category C-F welds, 7.5 percent of non-exempt welds are selected for volumetric and/or surface examination.

The licensee’s proposed alternative follows the NRC-approved RI-ISI process and methodology delineated in EPRI TR-112657, Rev. B-A, which utilizes the industry piping failure history, plant-specific piping failure history, and other relevant information. By assessing piping failure potential and using supporting insights on piping failure consequences from the probabilistic risk assessment (PRA), safety significance ranking of each piping segment was established in determining the inspection locations. This proposed approach will result in a reduction of the required number of examination locations compared to the current ISI program requirements. However, the proposed RI-ISI program retains the fundamental requirements of the ASME Code, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements.

The licensee stated that the augmented ISI program for flow accelerated corrosion (FAC) implemented in response to NRC Bulletin 89-08, “Erosion/Corrosion - Induced Pipe Wall Thinning,” is not changed by the RI-ISI program. Likewise, the augmented ISI programs for intergranular stress corrosion cracking in piping welds in Categories B through G (Generic Letter 88-01), feedwater nozzle cracking (NUREG-0619), and high energy line break (Branch Technical Position MEB 3-1) are not subsumed into the RI-ISI program and, thus, remain unaffected. Other remaining augmented ISI programs are either unaffected or modified in accordance with the guidance of the EPRI report. For example, thermal fatigue is subsumed into the RI-ISI program since the issues raised by NRC Bulletin 88-08 are addressed as part of the RI-ISI program.

It is most desirable that the implementation of an RI-ISI program for piping be initiated at the start of a plant’s 10-year ISI interval consistent with the requirements of the ASME Code and addenda committed to by the licensee in accordance with 10 CFR 50.55a. However, the implementation may begin at any point in an existing interval as long as the examinations are scheduled and distributed consistent with the requirements of the ASME Code, Section XI in regard to the minimum examinations completed and the maximum examinations credited for each inspection period. Since Code Case N-598, “Alternative Requirements to Required Percentages of Examinations” was approved for use at DAEC by the NRC, the licensee may take credit for up to 50 percent of the examinations in the first period in lieu of 34 percent allowed under the Code. However, at least 16 percent of the examinations must be performed during the second period.

It is also the NRC staff’s view that the examinations under the proposed RI-ISI program and the examinations under existing ISI program that are not affected by the RI-ISI should be on the same interval start and end dates. This can be accomplished by either implementing the RI-ISI program at the beginning of the interval or merging the RI-ISI program into the ISI program for the balance of the inspections if the RI-ISI program is to begin during an existing ISI interval. This would eliminate the potential issue of having different Codes of record for the RI-ISI program and for the balance of the ISI program. In Reference 1, the licensee stated that 38.7 percent of the examinations required by ASME Code have been completed for Examination Categories B-F, B-J, C-F-1, and C-F-2 piping welds. The licensee further states in Reference 2, that DAEC plans to perform 32.8 percent of the RI-ISI program examinations during the second period and 28.5 percent of the RI-ISI program examinations during the third period of the third interval, for a total of 61.3 percent of the RI-ISI program examinations. The licensee also states in Reference 1 that the RI-ISI program implementation in the second and the third period would result in 100 percent of the selected examinations completed during the course of the third interval. Reference 2 also states that the licensee would continue to update and submit its ISI program consistent with the Code requirements in effect at the time such update is required (currently every 10 years), and would submit the revised RI-ISI program prior to the end of the interval if there is some deviation from the RI-ISI methodology described in the initial submittal or if industry experience determines that there is a need for significant revision to the RI-ISI program. Additionally, DAEC will ensure that the RI-ISI program is monitored and periodically reviewed for risk ranking as discussed in Reference 1.

The NRC staff finds that the DAEC RI-ISI program meets the ASME Code requirements in regard to the minimum percentage of examinations to be completed and the maximum percentage of examinations to be credited during inspection periods and targeted completion of all required examinations during the interval.

3.0 EVALUATION

Pursuant to 10 CFR 50.55a(a)(3), the NRC staff has reviewed and evaluated the licensee’s proposed RI-ISI program, including those portions related to the applicable methodology and processes contained in Reference 3, based upon guidance and acceptance criteria provided in Regulatory Guides (RGs) 1.174 (Reference 4) and 1.178 (Reference 5) and in Standard Review Plan (SRP) Chapter 3.9.8 (Reference 6).

3.1 Proposed Changes to the ISI Program

The scope of the licensee’s proposed RI-ISI program is limited to ASME Code Class 1 and Class 2 piping welds for the following Examination Categories: B-F for pressure retaining dissimilar metal welds in vessel nozzles, B-J for pressure-retaining welds in piping, C-F-1 for pressure-retaining welds in austenitic stainless steel or high alloy piping, and C-F-2 for pressure-retaining welds in carbon or low alloy steel piping. The RI-ISI program is proposed as an alternative to the existing ISI requirements of the ASME Code, Section XI. A general description of the proposed changes to the ISI program is provided in Sections 3 of the licensee's submittal.

During the course of its review, the NRC staff determined that the proposed RI-ISI program is consistent with the guidelines contained in EPRI TR-112657, which state that industry and plant-specific piping failure information, if any, is to be utilized to identify piping degradation mechanisms and failure modes, and consequence evaluations are to be performed using probabilistic risk assessments to establish piping segment safety ranking for determining new inspection locations. Thus, the NRC staff concludes that the licensee's application of the EPRI TR-112657 approach is an acceptable alternative to the current DAEC piping ISI requirements with regard to the number, locations, and methods of inspections, and provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3).

System pressure tests and visual examination of piping structural elements will continue to be performed on all Class 1, 2, and 3 systems in accordance with the ASME Code, Section XI, program. The RI-ISI program applies the same performance measurement strategies as existing ASME Code requirements and, in addition, increases the inspection volumes at weld locations that are exposed to thermal fatigue.

3.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, an engineering analysis of the proposed changes is required using a combination of traditional engineering analysis and supporting insights from the PRA. The licensee has described how the engineering analyses conducted for the DAEC RI-ISI program ensures that the proposed changes are consistent with the principles of defense-in-depth. This is accomplished by evaluating a location's susceptibility to a particular degradation mechanism and then performing an independent assessment of the consequence of a failure at that location.

As previously noted, the licensee's RI-ISI program at DAEC is applicable to ASME Class 1 Categories B-F and B-J and ASME Class 2 Categories C-F-1 and C-F-2 piping welds. The licensee states in Reference 1 that other non-related portions of the ASME Code will be unaffected by this program. Augmented programs for IGSCC piping welds in Categories B through G (Generic Letter 88-01), feedwater nozzle cracking (NUREG-0619), FAC, (Generic Letter 89-09), and high-energy line break (HELB) (USNRC Branch Technical Position MEB 3-1) are not subsumed into the RI-ISI program and remain unaffected. The approach adopted for the augmented inspection programs is consistent with the EPRI TR-112657 guidelines, and therefore, is considered to be acceptable. Piping systems defined by the scope of the RI-ISI program were divided into piping segments. Piping segments are defined as lengths of pipe whose failure leads to similar consequences and that are exposed to the same degradation mechanisms. That is, some lengths of pipe whose failure would lead to the same consequences may be split into two or more segments when two or more regions are exposed to different degradation mechanisms. The submittal states that failure potential categories, presented in Table 3.3 of Reference 1, were generated utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in TR-112657. The degradation mechanisms identified in Reference 1 include thermal fatigue including thermal stratification, cycling and striping (TASCS) and thermal transients (TT), intergranular stress corrosion cracking (IGSCC), crevice corrosion (CC), and flow accelerated corrosion (FAC). The NRC staff concludes that the licensee has met the SRP 3.9.8 guidelines to confirm that a systematic process is being used to identify a component's (i.e., pipe segments) susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into appropriate degradation categories in regard to their potential to result in a postulated leak or rupture.

Section 3 of the submittal (Reference 1) describes a deviation to the EPRI RI-ISI methodology (Reference 3) for assessing the potential for TASCS that was implemented by the licensee for DAEC. The licensee states that the methodology used in DAEC's RI-ISI program for assessing the potential for TASCS is the same as the TASCS methodology provided by EPRI in a letter dated March 28, 2001 (Reference 7). The licensee has provided additional considerations for determining the potential for TASCS. These considerations include piping configuration and potential turbulence, low flow conditions, valve leakage, and heat transfer due to convection. The NRC staff finds these considerations to be appropriate for determining the potential for TASCS.

Additionally, the licensee states that the consequences of pressure boundary failures are evaluated and ranked based upon their impact on core damage and containment performance (isolation, bypass, and large early release), and that the impact due to both direct and indirect effects are considered using guidance provided in the EPRI TR-112657. The licensee reports no deviations from the consequence evaluation methodology approved by the NRC staff in the EPRI report. Therefore, the NRC staff considers the consequence evaluation performed by the licensee for this application to be acceptable.

3.3 Probabilistic Risk Assessment

To support this RI-ISI submittal, the licensee has used revision 4B of the DAEC Level 1 and 2 Probabilistic Safety Assessment (PSA). In Reference , the licensee states that the CDF and the LERF estimates from the DAEC PSA revision 4B model are 1.2E-5/yr and 9.0E-7/yr respectively. The licensee states in Reference 2 that DAEC's PRA is a "living PRA" and that the licensee maintains DAEC's PRA Model to conform to plant configuration and operating procedures. The licensee further states that the Level 1 4B model has been put into use since June 2000 and the Level 2 4B model since February 2001. The licensee submitted its individual plant examination (IPE) on November 30, 1992. The NRC staff evaluation report on the IPE, issued in November 1996, did not report any major weaknesses found in the IPE and concluded that the IPE satisfies the intent of Generic Letter 88-20. In Reference 1, the licensee states that a BWR Owner's Group (BWROG) PSA Peer Certification Review was performed in 1997 on Revision 3B of the DAEC PSA. The licensee further stated that the BWROG concluded that the DAEC PSA can be effectively used to support applications involving relative risk significance.

The NRC staff did not review the PRA analysis to assess the accuracy of the quantitative estimates. Quantitative results of the PRA are used, in combination with a quantitative characterization of the pipe segment failure likelihood, to support the assignment of segments into broad safety significance categories reflecting the relative importance of pipe segment failures on core damage frequency (CDF) and large early release frequency (LERF) and to provide an illustrative estimate of the change in risk. Inaccuracies in the models or assumptions large enough to invalidate the analyses developed to support RI-ISI should have been identified in the licensee's or the NRC staff's reviews. Minor errors or inappropriate assumptions will only affect the consequence categorization of a few segments and will not invalidate the general results or conclusions. The NRC staff finds that the quality of DAEC's PRA is sufficient to support this submittal.

The degradation category and the consequence category are combined according to the approved methodology described in the EPRI TR-112657 (Reference 3) to categorize the risk significance of each segment. The risk significance of each segment is used to determine the number of weld inspections required in each segment.

As required by Section 3.7 of TR-112657, the licensee has evaluated the change in risk expected from replacing the current Section XI ISI program with the RI-ISI program. The analysis estimates the net change in risk due to the positive or negative influence of adding or removing locations from the inspection program. The expected change in risk is quantitatively evaluated using the "Simplified Risk Quantification Method" described in Section 3.7 of EPRI TR-112657. Some of the systems show an estimated increase in risk while others show an estimated reduction in risk. The licensee estimates that the aggregate change in DAEC's CDF is about 2.67E-9/yr and the aggregate change in LERF is about 2.66E-9/yr, excluding any increased probability of detection (POD) due to the use of improved inspection techniques. Including the expected increased POD results, the aggregate estimated changes in DAEC's CDF and LERF would be -8.28E-9/yr and -8.27E-9/yr, respectively.

The NRC staff finds the licensee's process to evaluate and bound the potential change in risk reasonable because it accounts for the change in the number and location of elements inspected, recognizes the difference in degradation mechanism related to failure likelihood, and considers the effects of enhanced inspection. All system level and aggregate estimates of the changes in CDF and LERF are less than the corresponding guideline values in the EPRI-TR. The NRC staff finds that redistributing the welds to be inspected with consideration of the safety-significance of the segments provides assurance that segments whose failure has a significant impact on plant risk receive an acceptable and often improved level of inspection. Therefore, the NRC staff concludes that the implementation of the RI-ISI program as described in the licensee's application will have an impact on risk consistent with the guidelines of RG 1.174, and thus, will not cause the NRC safety goals to be exceeded.

3.4 Integrated Decisionmaking

As described in the licensee's submittal (Reference1), an integrated approach is utilized in defining the proposed RI-ISI program by considering in concert, the traditional engineering analysis, risk evaluation, and the implementation and performance monitoring of piping under the program. This is consistent with the guidelines of RG 1.178.

The selection of pipe segments to be inspected is described in Section 3.5 of the submittal using the results of the risk category rankings and other operational considerations. The licensee states in the submittal that, in accordance with the EPRI TR, 25 percent of high safety-significant (HSS) and 10 percent of medium safety-significant (MSS) elements are selected for inspection. Table 3.5 of the submittal provides the number of locations and inspections by risk category for the DAEC systems within the scope of the program. Table 5.1 of the submittal provides a summary table comparing the number of inspections required under the existing ASME Section XI ISI program with the alternative RI-ISI program. Table 3.6-1gives a summary of the proposed RI-ISI program versus the current Section XI program on a per system basis by each applicable risk category. The licensee states that the failure estimates and the selection of examination elements with high and medium risk ranked piping segments were determined using the guidance provided in EPRI TR-112657.

The methodology described in the EPRI TR requires that existing augmented programs be maintained, with the exception of thermal fatigue and IGSCC Category A piping welds, which the RI-ISI program supersedes. Also, the EPRI report describes targeted examination volumes (typically associated with welds) and methods of examination based upon the type(s) of degradation expected. The NRC staff has reviewed these guidelines and has determined that, if implemented as described, the RI-ISI examinations should result in improved detection of service-related degradations over that currently required by the ASME Code, Section XI.

The objective of inservice inspection required by ASME Section XI is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. The RI-ISI program is judged to meet this objective. Further, the risk-informed selection process is a technically sound "inspection for cause" program. This way the process not only identifies the risk important areas of the piping systems, but also defines the appropriate examination methods, examination volumes, procedures, and evaluation standards necessary to address the degradation mechanism(s) of concern and the ones most likely to occur at each location to be inspected. Thus, the location selection process is acceptable since it is consistent with the process described in EPRI TR-112657, which takes into account defense-in-depth and includes coverage of systems subjected to degradation mechanisms in additions to those covered by augmented inspection programs.

Chapter 4 of EPRI TR-112657 provides guidelines for the areas and/or volumes to be inspected as well as examination methods, acceptance standards, and evaluation standards for each degradation mechanism. Based upon the review of the cited portion of the EPRI report, the NRC staff concludes that the examination methods for the proposed RI-ISI program are acceptable since they are selected based upon specific degradation mechanisms, pipe sizes, and materials of concern.

3.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of RG 1.178 and the SRP 3.9.8. The objective of Element 3 is to assess the performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. Pursuant to 10 CFR 50.55a(a)(3)(i), a proposed alternative, in this case the implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

The licensee states in its submittal that upon approval of the RI-ISI program, procedures that comply with the EPRI TR-112657 guidelines will be prepared to implement and monitor the RI-ISI program. The licensee confirms that the applicable portions of the ASME Code not affected by the change, such as inspection methods, acceptance standards, pressure testing, corrective measures, documentation requirements, and quality control requirements would be retained.

The licensee states in Section 4 of the submittal that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of high safety-significant piping locations. Such relevant information would include major updates to the DAEC PRA model which could impact both the risk characterization and risk impact assessments, any new trends in service experience with piping systems at DAEC and across the industry, and new information on element accessibility that will be obtained as the risk-informed inspections are implemented. The submittal also states that, as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis and that significant changes may require more frequent adjustment as directed by NRC bulletin or generic letter requirements, or by industry and plant-specific feedback.

In response to an NRC staff question, the licensee has stated (Reference 2) that the ISI Program would be updated and submitted to the NRC consistent with the Code requirements in effect at the time such update is required (currently every 10 years). The licensee further stated that this may again take the form of a relief request to implement an updated RI-ISI Program depending on future regulatory requirements. In Reference 2, the licensee also stated that the RI-ISI Program would be resubmitted to the NRC prior to the end of any 10-year Interval if there was any deviation from the RI-ISI methodology described in the initial submittal or if industry experience determined that there was a need for significant revision to the program as described in the original submittal for that Interval.

The proposed periodic reporting requirements meet existing ASME Code requirements and applicable regulations and, therefore, are considered acceptable. The proposed process for RI-ISI program updates meets the guidelines of RG 1.174 that risk-informed applications must include performance monitoring and feedback provisions and, therefore, the process for program updates is considered acceptable.

4.0 CONCLUSIONS

Pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternatives to the ASME Code, Section XI requirements may be used when authorized by the NRC when the applicant demonstrates that the alternative provides an acceptable level of quality and safety. In this case, the licensee's proposed alternative is to use the risk-informed ISI evaluation process described in the NRC approved EPRI TR-112657. The NRC staff concludes that the licensee's proposed RI-ISI program which is consistent with the methodology described in EPRI TR-112657, will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to the piping ISI requirements with regard to the number of inspections, locations of inspections, and methods of inspection.

The NRC staff finds that the results of the different elements of the engineering analyses are considered in an integrated decision-making process. The impact of the proposed change in the ISI program is founded on the adequacy of the engineering analyses and acceptable change in plant risk in accordance with RG 1.174 and RG 1.178 guidelines. The licensee's methodology for DAEC also considers implementation and performance monitoring strategies. Inspection strategies ensure that failure mechanisms of concern have been addressed and there is adequate assurance of detecting damage before structural integrity is affected. The risk significance of piping segments is taken into account in defining the inspection scope for the RI-ISI program.

System pressure tests and visual examination of piping structural elements will continue to be performed on all ASME Class 1 and 2 systems in accordance with the ASME Code program. The RI-ISI program applies the same performance measurement strategies as the existing ASME Code requirements and, in addition, increases the inspection volumes at some weld locations.

The licensee's methodology for DAEC provides for conducting an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth and quality are not degraded in that the methodology provides reasonable confidence that any reduction in existing inspections will not lead to degraded piping performance when compared to existing performance levels. Inspections are focused upon locations with active degradation mechanisms as well as selected locations that monitor the performance of piping systems.

On the basis of its review of the licensee's proposed RI-ISI program, the NRC staff concludes that the program is an acceptable alternative to the current ISI program based upon ASME Code, Section XI, requirements for Class 1 and Class 2 welds. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety. This safety evaluation authorizes application of the proposed RI-ISI program during the third ten-year ISI interval for DAEC.

5.0 REFERENCES

1. Letter, Gary Van Middlesworth (Nuclear Management Company), to U.S. Nuclear Regulatory Commission, *Duane Arnold Energy Center, Docket No: 50-331, Op. License No: DPR-49, Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds, Risk Informed Inservice Inspection Program*, dated March 29, 2002.

2. Letter, Kenneth S. Putnam (Nuclear Management Company), to U.S. Nuclear Regulatory Commission, *Duane Arnold Energy Center, Docket No: 50-331, Op. License No: DPR-49, Request for Additional Information Regarding Risk-Informed Inservice Inspection Program Relief Request*, dated September 6, 2002.

3. Electric Power Research Institute, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*, EPRI TR-112657, Revision B-A, January 2000.

4. U.S. Nuclear Regulatory Commission, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, Regulatory Guide 1.174, July 1998.

5. U.S. Nuclear Regulatory Commission, *An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping*, Regulatory Guide 1.178, September 1998.

6. U.S. Nuclear Regulatory Commission, *Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping*, NUREG-0800, SRP Chapter 3.9.8, May 1998.

7. Letter, Pat O'Regan (Electric Power Research Institute), to Dr. Brian Sheron, *Extension of Risk-Informed Inservice Inspection (RI-ISI) Methodology,* March 28, 2001.

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Date: January 17, 2003

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