IES
UTILITIES INC.

John F. Franz, Jr.
Vice President, Nuclear

September 15, 1994
NG-94-3144

Mr. William T. Russell, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Relief Request for CV 4421, "D" Outboard MSIV,
RR-002, Revision 2

References: 1) Letter from J. Franz (IES) to T. Murley (NRC) dated September 18, 1993 (NG-93-4013)
2) NRC Safety Evaluation for RR-002, Revision 1, dated September 24, 1993

File: A-100, A-286, B-21, N-11

Dear Mr. Russell:

During refueling outage (RFO) 12, a non-Code repair was performed on the "D" outboard main steam isolation valve (MSIV) body. We requested (Reference 1) and were subsequently granted (Reference 2) relief from Code requirements for this repair on the condition that we perform radiographic examinations (RTs) on the valve body during the next two RFOs. We have reviewed the basis for this relief and propose to modify the examination schedule. One RT would be performed in either RFO 13 or RFO 14, and another RT would be performed in either RFO 15 or RFO 16, with the interval between RTs not to exceed two cycles.

The basis for this revised schedule is discussed in Attachment 1. The revised relief request, RR-002, revision 2, is provided as Attachment 2.

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Should you have any additional questions or concerns regarding this submittal, please contact this office.

Very truly yours,

John F. Franz
Vice President, Nuclear

JFF/CJR/pjv~

Attachments: 1) Supporting Information for Relief Request RR-002, Revision 2
2) Relief Request RR-002, Revision 2

cc: C. Rushworth
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SUPPORTING INFORMATION FOR RELIEF REQUEST RR-002, REVISION 2

BACKGROUND:

In September 1993, relief was requested for indications on the upper bore of the 'D' outboard main steam isolation valve (MSIV), CV 4421 (Reference 1). This request was required since a Code repair would require post weld heat treatment, which is undesirable since excessive valve body distortion may occur and degrade the valve performance. Information was provided to demonstrate the acceptability of the repair technique used and the condition of the indications as-left. A fatigue crack growth analysis was also performed, in accordance with ASME Section XI, to demonstrate that growth of the indication by fatigue will not significantly impact the structural integrity of the MSIV body over the remaining service lifetime.

Relief was granted by the NRC Staff on the condition that a radiographic inspection of the MSIV body is accomplished during each of the next two scheduled refueling outages (RFOs) to ensure adequate structural integrity of the non-Code repair (Reference 2).

DESCRIPTION OF CONCERN:

Although radiographic inspection of the MSIV body to ensure adequate structural integrity of the non-Code repair is prudent, the schedule provided for these inspections in Reference 2 may not be appropriate.

This is based on reviews performed in the following areas:

1) The susceptibility of the indications to grow,
2) The welding technique used to perform the repair,
3) The inspection techniques required to perform the radiography,
4) The potential impact of valve disassembly, and
5) The ASME Code precedent for performing Section XI valve internal inspections only when disassembly occurs for maintenance.

Based on these reviews, IES Utilities Inc. proposes to revise the schedule for the radiographic inspections. A radiographic examination of the "D" outboard MSIV would be performed once during either RFO 13 or RFO 14, and once during either RFO 15 or RFO 16, with the interval between RTs not to exceed 2 cycles.

SUSCEPTIBILITY OF THE INDICATIONS TO GROW:

The probability of propagation of existing indications has been evaluated. We have concluded that the existing indications in the repaired area are acceptable and propagation is very unlikely based on the following.

After the weld repair, radiographs of the repaired area were compared with reference radiographs and construction radiographs. This comparison showed that the valve meets construction requirements and provided confirmation that the existing defects did not increase in size during the repair process; no new indications occurred. The radiographs of the repaired area also showed that CV4421 met the requirement of ASME Section XI paragraph IWB-3518 to be used inservice with acceptable internal defects and no defect open to the surface.

The probability for propagation of shrinkage defects to grow or cracking to occur is highly unlikely because of several factors:

- SA216 WCB is a mild carbon steel with very ductile properties (22 -33% elongation) and is not crack sensitive.

- In order for a crack to grow, there must be associated stresses.

    - This valve was stress relieved after casting. The stresses due to repair welding are insignificant due to the welding techniques utilized (discussed below).

    - The minimum wall thickness by design in the area where the indications exist is 1.29" and the actual wall thickness is 3.175". The actual thickness is significantly more than required by design, consequently, the applied stresses are very low.

An analytical flaw evaluation was performed in accordance with ASME Section XI, IWB-3600 requirements. This analysis demonstrates that the flaws in the MSIV body are bounded by the postulated initial flaw geometries and were within the ASME Section XI, IWB-3612 requirements for normal and faulted conditions. The fatigue crack growth analysis demonstrates that growth by fatigue will not significantly impact the integrity of the MSIV body over the remaining service lifetime.

The analysis and reviews performed indicate that radiographic inspection to ensure adequate structural integrity of the non-Code repair is not urgent. Disassembly based on projected structural integrity failure is not warranted.

WELDING TECHNIQUE USED TO PERFORM THE REPAIR:

The welding technique used to perform the repair was selected to minimize the stresses associated with the welding process, to prevent the deposition of casting impurities, and to eliminate the introduction of hydrogen which could lead to delayed cracking.

The welding technique used compares favorably with the temperbead welding technique.

- The Shielded Metal Arc Welding (SMAW) process was used for weld repairs because the fluxing action of the electrodes allows the casting impurities to be deposited as slag which was removed after each pass.

- The welding electrode used to make the repair had been stored in a holding oven over 8 months at a temperature of 350 degrees. This time/temperature would be sufficient to bake out any existing hydrogen; therefore, it is not credible that these electrodes would contain enough hydrogen to attribute to delayed cracking.

- E7018 welding electrodes of 3/32" diameter were used, and the first layer was ground to remove the crown before the next layer was deposited.

- Magnetic Particle inspection (MT) was performed on each layer.

INSPECTION TECHNIQUES:

Possible techniques for inspecting the repair area without valve disassembly have been considered. These include radiographic inspection through two walls, radiographic inspection using an inserted source, and ultrasonic inspection.

Radiographic inspection through two walls would require a radioactive source strong enough to penetrate the upper valve bore at the indication location and opposite that location.

The valve configuration is such that about half of the repair area would be covered by the piston with the valve in the closed position or by the disk in the full open position. The source would then have to penetrate about 22" of metal. With the valve in an intermediate position, the source would have to penetrate about 14" of metal, including 8" for the neck of the disk/piston assembly. Standard industrial radiographic inspection sources, such as Iridium 192 and Cobalt 60, have practical thickness limits well below the minimum metal penetration thickness of 14" (Cobalt 60 has a practical thickness limit of 9"). Special radiographic inspection sources are impractical due to equipment size and steam tunnel space limitations. In all configurations, discrimination of this indication would be very difficult and unreliable with the valve assembled.

Radiographic inspection using an inserted source would require insertion of the source into the test connection, through a 90 degree elbow, through three globe valves, into the MSIV above the seat, around the disk and into the area between the disk and piston with the valve in an intermediate position. The source size and guide tube flexibility would not be available for this torturous path. In addition, there would be a high risk of the source becoming lodged in the valve.

Ultrasonic inspections from the external surface could be performed. However, due to the grain structure of the casting and the wall thickness of the material, this type of examination may not provide an accurate sizing of the indication.

These techniques, as well as other possible techniques, have been discussed with several industry experts with similar conclusions. External inspection is not practical. In order to perform a meaningful inspection, the valve must be disassembled.

POTENTIAL IMPACT OF VALVE DISASSEMBLY:

NUREG 1169, "Resolution of Generic Issue C-8 - An Evaluation of BWR MSIV Leakage and the Effectiveness of Leakage Treatment Methods," includes the following technical findings in section 6.1.

> "...By not having to open the valves and refurbish them for minor leakage, the utility may have avoided introducing the root causes of recurrent leakage problems. Industry experience suggests that by attempting to maintain these large, fast-acting valves to such a stringent leakage specification, utilities have conducted numerous disassembly and refurbishment operations on valves that have no substantive defects. By attempting to correct nonexistent or minimal defects in the valves under less-than-optimum field maintenance conditions, it is likely that some actual defects have been introduced that led to later leak test failures."

Although this finding is associated with leakage problems, it would be applicable to disassemblies performed for other reasons, such as for inspections. Disassembly of the MSIV solely to perform radiographic inspections could be detrimental to future MSIV performance.

The findings of NUREG 1169 are consistent with the findings of the Boiling Water Reactor Owners' Group (BWROG) as identified in the MSIV Leakage Closure Committee Report, NEDC-31858P, "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control Systems." Section 5.1 of this report summarizes the benefits associated with increasing the leakage rate limits and thus avoiding excessive disassembly. These benefits would also be applicable to maintenance performed for other reasons, such as for inspection. These benefits include:

1. An average savings of 350 man-hours.
2. A dose savings to personnel of one to two rem whole body.
3. An average labor cost savings to repair/refurbish an MSIV of $31,500.
4. A possible increase in plant availability as MSIV repair often extends outage length.
5. An increase in the service life of the MSIV seating surfaces, as machining on the seating surfaces is avoided.

These findings indicate that valve disassembly for reasons other than excessive leakage may be detrimental to the valve and can be a significant cost, dose, and schedule penalty.

PRECEDENT FOR PERFORMING VALVE INTERNAL INSPECTIONS:

Precedent has been established for performing valve internal inspections only when valves are disassembled for maintenance.

ASME Section XI, 1986 Code, 1988 Addenda, Table IWB-2500-1, item B12.50 requires visual (VT3) examination of the internal surfaces of a valve body exceeding 4" only if the valve is disassembled for maintenance.

IES has an approved relief request (NDE-002) based on the above Code requirements. The relief request is approved for use at the DAEC during the second ten year interval.

CONCLUSIONS:

The schedule for the radiographic inspection of the "D" outboard MSIV should be revised. IES Utilities Inc. proposes to perform radiographic inspections of the repair area once during either RFO 13 or RFO 14, and once during either RFO 15 or RFO 16, with the interval between RTs not to exceed 2 cycles.

The basis for this revised schedule is:

1. The analysis and reviews performed indicate that radiographic inspection to ensure adequate structural integrity is not urgent.

2. The weld technique used to perform the repair was selected to minimize the potential for crack growth.

3. External ultrasonic inspections may not provide an accurate sizing of the indication. Performance of the radiographic examination by other than valve disassembly is not practical.

4. Disassembly of the valve for reasons other than excessive leakage may be detrimental to the valve and can be a significant cost, dose, and schedule penalty.

5. The precedent exists for performing valve internal inspections only when the valve is disassembled for other reasons.

IES UTILITIES INC.				
DUANE ARNOLD ENERGY CENTER TEN YEAR EXAMINATION SUMMARY ASME SECTION XI SYSTEMS - REQUEST FOR RELIEF	CEDAR RAPIDS, IA	MAJOR ITEM: REQUEST FOR RELIEF NUMBER RR-002, REV. 2 TABLE: SECTION 7.0 & 8.0 PAGE 1 OF 1		
COMPONENT OR SYSTEM	ASME XI CODE CLASS	PROGRAM TABLE	CODE CATEGORY	CODE ITEM
MAINSTEAM ISOLATION VALVE "D" OUTBOARD, CV-4421	1	N/A	N/A	N/A
CODE REQUIREMENTS IWA-4120 "REPAIRS SHALL BE PERFORMED IN ACCORDANCE WITH THE OWNER'S DESIGN SPECIFICATION AND CONSTRUCTION CODE OF THE COMPONENT OR SYSTEM". THE MATERIAL SPEC. (ASTM A216 GR. WCB) REQUIRES THE REMOVAL OF UNACCEPTABLE DEFECTS PRIOR TO PERFORMING ANY WELD REPAIRS. ALSO CASTINGS CONTAINING ANY REPAIR WELD THAT EXCEEDS 20% OF WALL THICKNESS OR 1" WHICHEVER IS SMALLER OR WHICH EXCEEDS 10 IN^2 AREA SHALL BE STRESS RELIEVED AFTER WELDING. THE GE PURCHASE SPEC. 21A9230 REQUIRES WELD REPAIRS ON CASTINGS TO BE EXAMINED BY MAGNETIC PARTICLE (MT) OR LIQUID PENETRANT (PT) METHODS AND REPAIR WELDS OF DEPTH GREATER THAN 10% OF THE WALL THICKNESS TO BE EXAMINED BY RADIOGRAPHY (RT).				
BASIS FOR RELIEF THE SPECIFICATIONS FOR THE MSIVs REQUIRE AN MT OR PT EXAMINATION ON ALL MACHINED SURFACES. DURING REPAIR MACHINING OF THE D OUTBOARD MSIV, UNACCEPTABLE LINEAR INDICATIONS WERE DISCOVERED ON THE MT EXAM. THESE INDICATIONS WERE COMPARED TO THE ORIGINAL RADIOGRAPHS AND DETERMINED TO BE SHRINKAGE DEFECTS FROM THE CASTING PROCESS. FURTHER GRINDING WAS PERFORMED TO A DEPTH OF 0.593 IN (CLOSE TO THE LIMIT FOR STRESS RELIEVING) AND THREE UNACCEPTABLE INDICATIONS IN GROUND AREA WERE FOUND ON MT EXAM. THE INDICATIONS HAVE NOT BEEN REMOVED BUT HAVE BEEN WELD OVERLAYED, WITH A MT AFTER EACH WELD LAYER AND AN MT AND RT EXAMINATION PERFORMED AFTER FINAL MACHINING. ACCEPTANCE OF THE MACHINED SURFACE WAS BASED ON THE ORIGINAL CODE ACCEPTANCE CRITERIA. THE DETAILS OF THE REPAIR PROCESS ARE DESCRIBED IN ATTACHMENT 2 OF NG-93-4013.				
ALTERNATIVE EXAMINATION THE SHRINKAGE INDICATIONS WERE REPAIRED BY GRINDING THE AREAS IN PREPARATION FOR WELDING. THE SHRINKAGE DEFECTS WERE WELD OVERLAYED AND AN MT AND RT EXAMINATION PERFORMED AFTER FINAL MACHINING, ACCEPTANCE WAS BASED ON ORIGINAL CODE ACCEPTANCE CRITERIA. ENGINEERING EVALUATION HAS BEEN PERFORMED FOR ACCEPTING THE SUBSURFACE INDICATIONS USING ASME SECTION XI 1980 WITH W81 ADDENDA, TABLE IWB-3518-1. RADIOGRAPHY OF THE REPAIRED AREAS WILL BE PERFORMED ONCE DURING EITHER RFO13 OR RFO 14 AND ONCE DURING EITHER RFO 15 OR RFO 16, NOT TO EXCEED 2 CYCLES BETWEEN RTs.				
SCHEDULE FOR IMPLEMENTATION RFO12, RFO13, RFO14, RF015, RF016 (AS REQUIRED)				