ATTACHMENT TO SAFETY EVALUATION
OF NRC GENERIC LETTER 88-01
RESPONSE

REVISED

FINAL

TECHNICAL EVALUATION REPORT ON
RESPONSE FROM
IOWA ELECTRIC LIGHT AND POWER COMPANY
TO GENERIC LETTER 88-01
PERTAINING TO THE
DUANE ARNOLD ENERGY CENTER

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prepared by

Robert C. Bates
Armand Lakner

Viking Systems International
2070 Wm. Pitt Way
Pittsburgh, PA

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ABSTRACT

This report contains an evaluation of the licensee (Iowa Electric Light and Power Company) submittal for the Duane Arnold Energy Station which was submitted in response to the NRC Generic Letter 88-01 in which Iowa Electric was requested to: (1) Furnish their current plans relating to piping replacement and other measures to mitigate IGSCC, inspection, repair, and leakage detection. (2) Indicate whether they plan to follow the NRC Staff positions, or propose alternative measures. Iowa Electric's plans are evaluated in Section 2 of this report in terms of compliance to NRC Staff positions. Iowa Electric did not submit any alternative positions to those of the NRC Staff.

SUMMARY

The Licensee, Iowa Electric Light and Power Company, submitted a response to the NRC Generic Letter 88-01. Iowa Electric's response pertaining to the austenitic stainless steel piping in the Duane Arnold Energy Station (a BWR nuclear power plant) was evaluated in terms of: (1) Their previous and planned actions to mitigate IGSCC to provide assurance of continued long-term service. (2) Their Inservice Inspection (ISI) Program. (3) Their Technical Specifications pertaining to ISI and their plans to ensure that leakage detection will be in conformance with the NRC Staff position. (4) Their plans to notify the NRC of significant flawe identified (or changes in the condition of the welds previously known to be cracked) during inspection.

Iowa Electric endorses all 13 NRC Staff positions which are outlined in Generic Letter 88-01. Past mitigating actions at Duane Arnold include application of Induction Heating Stress Improvement, wald overlay repair of welds, and implementation of Hydrogen Water Chemistry (HWC). Future plans for mitigating IGSCC include continuation of HWC, apply weld overlays as needed, and possibly replace 81 IGSCC Category G welds in the portion of the RWCU that are outboard of the outer isolation valve.

An ISI program has been developed that complies with the NRC Staff position on schedule, methods and personnel, sample expansion, and reporting requirements. In addition Iowa Electric has submitted a request for a change of the Technical Specifications (TS) on ISI to add the required statement that the ISI program will comply with the NRC Staff position.

The TS on leakage detection does not conform with the NRC Staff position on limits on the increase of unidentified leakage, definition of unidentified leakage, frequency of leakage measurement, and requirements for operability of measurement instruments. A request for a revision of the TS was submitted, but two deficiencies still exist.

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1. INTRODUCTION

Intergranular stress corrosion cracking (IGSCC) near weldments in Boiling Water Reactor (BWR) piping has been occurring for almost 20 years. Substantial efforts in research and development have been sponsored by the BWR Owners Group for IGSCC Research, and the results of this program, along with other related work by vendors, consulting firms and confirmatory research sponsored by the NRC, have permitted the development of NRC Staff positions regarding the IGSCC problems. The technical basis for NRC Staff positions is detailed in Reference 1, and further background is provided in Reference 2.

The results of these research and development programs prompted the NRC to issue Generic Letter 88-01 (see Reference 3) requeating all licensees of BWR's and holders of construction permits to:

(1) Furnish their current plans relating to piping replacement, inspection, repair, and leakage detection.

(2) Indicate whether they:
    (a) Plan to follow the staff positions, or
    (b) Propose alternative measures.

Specifically, Generic Letter 88-01 stated that an acceptable licensee response would include the following items:

(1) Current plans regarding pipe replacement and/or other measures taken or to be taken to mitigate IGSCC and provide assurance of continued long-term piping integrity and reliability.

(2) An inservice inspection (ISI) program to be implemented at the next refueling outage for austenitic stainless steel piping.

(3) A change to the Technical Specifications to include a statement

in the section on ISI that the inservice inspection program for piping will be in conformance with the staff positions on schedule, methods and personnel.

(4) Confirmation of plens to ensure that the Technical Specification related to leakage detection will be in conformance with the Staff position on leak detection.

(5) Plans to notify the NRC, in accordance with 10CFR50.55a(o), of any flaws identified that do not meet IWB-3500 criteria of Section XI of the ASME Code for contiaued operation without evaluation, or a change found in the condition of the welds previously known to be cracked, and an evalustion of the flaws for continued used operation and/or repair plans.

This report contains a technical evaluation of the response which Iows Electric Light and Power Company (hereafter called either Iowa Electric or IEL&P) submitted in response to the NRC Generic Letter 88-01 pertaining to the Duane Arnold Energy Center (hereafter called Duane Arnold or DAEC).

2. EVALUATION OF RESPONSE TO GENERIC LETTER 88-01

This evaluation consisted of a review of the response to NRC Generic Letter 88-01 of January 25, 1988 by Iowa Electric pertaining to Duane Arnold to determine if their performance and plans are in conformance with the NRC Staff positions or if proposed alternatives are acceptable. Proposed inspection schedules and amendments to the Technical Specification were included in the review.

2.1 Documents Evaluated

Review was conducted on the information pertaining to Duane Arnold

provided by the Licensee in the following documents.

"Response to Generic Letter 88-01, 'NRC Position on IGSCC in BWR Austinitic Stainless Steel,' Duane Arnold Energy Center Docket No 50-331, License No DPR-49," NG 88-0973, Iowa Electric Light and Power Company, P.O. Box 351, Cedar Rapids, Iows 52406, July 27, 1988.

"Plans for Inspection of Reactor Coolant Pressure Boundary Piping During Cycle 9/10 Refueling Outage, Duane Arnold Energy Center, Docket No 50-331, Licanse No DPR-49," NG 88-1756, Iowa Electric Light and Power Company, P.O. Box 351, Cedar Rapids, Iowa 52406, June 17, 1988.

"Request for Technical Specification Change (RTS-1434A): IGSCC Augmented Inservice Inspection Requirements, Duane Arnold Energy Center, Docket No 50-331, License No DPR-49," NG 88-1207, Iowa Electric Light and Power Company, P.O. Box 351, Cedar Rapids, Iowa 52406, July 27, 1988.

"Response to Request for Additional Information Regarding NRC Generic Letter 88-01, Duane Arnold Energy Center, Docket No 50-331, License No DPR-49," NG 89-0373, Iowa Electric Light and Power Company, P.O. Box 351, Gedar Rapids, Iowa 52406, April 24, 1989.

Hereafter, in this report, these documents will be referred to as Iowa Electric Submittals No. 1, No 2, No. 3, and No 4, respectively, and collectively as the Iowa Electric Submittals.

2.2 Review of Iowa Electric's Responses to Staff Positions and Implementation of Those Positions.

Generic Letter 88-01 outlines thirteen NRC Staff pesitions pertaining to (1) materials, (2) processes, (3) water chemistry, (4) weld overlay, (5) pertial replacement, (6) strees improvemsnt of cracked weldments, (7) clamping devices, (8) crack evaluation and repair criteria, (9) inspection methods and personnel, (10) inspection schedules, (11) sample expansion, (12) leak detaction, and (13) reporting requirements. Generic Letter 88-01 states that the licensee should indicate in their aubmittal whether they endorse these NRC Staff positions or propose alternative positions. The Iowa Electric Submittals specifically describe their positions pertaining to the thirteen NRC Staff positions, and these items are summarized in Table 1 which is reproduced from Iowa Electric Submittal No. 4.

Note that Iowa Electric endorses all thirteen NRC Staff positions. In addition, they will consider all of those positions for future application, and they have previously applied all except two, i.e., those pertaining to clamping devices and sample expansion.

Concerning their ISI (Inservice Inspection) program: (1) Although not shown in Table 1, Iowa Electric submitted a request to amend the Duane Arnold Technical Specifications (TS) on ISI (es required by Generic Letter 88-01) to include a statement that their ISI program will comply with the NRC Staff position. (2) In the development of their ISI program, Iowa Electric did not take credit for hydrogen water chemistry, although it is their intention to take such credit in the future and apply for relief from some of the inspection requirements of Generic Letter 88-01.

Concerning leakage detection: Iowa Electric submitted an amendment to the TS on leak detection to comply with the NRC Staff position.

Table 1

Summary of Iowa Electric's Responses to Staff Positions

Staff Position	IEL&P Accepta NRC Staff Position	IEL&P Has/Will Applied In Past	IEL&P Has/Will Consider for Future Use
1. Materials	yes	yes[a]	yes
2. Processes	yes	yes[b]	yes
3. Water Chemistry	yes	yes	yes
4. Weld Overlay	yes	yes	yes
5. Partial Replacement	yes	yes	yes
6. Stress Improvement of Cracked Weldments	yes	yes	yes
7. Clamping Devices	yes	no	yes
8. Crack Evaluation and Repair Criteria	yes	yes	yes
9. Inspection Method and Personnel	yes	yes	yes
10. Inspection Schedule	yes	yes	yes
11. Sample Expansion	yes	no	yes
12. Leak Detection	yes[c]	yes	yes
13. Reporting Requirements	yes	NI	yes

(a) DAEC used NRC Staff position to assign IGSCC Categories to the welds in service.

(b) Iowa Electric has applied Induction Heating Stress Improvement but not other processes.

(c) Iowa Electric applied for revisions to the Duane Arnold Technical Specifications on leakage detection to bring their TS into conformance with Generic Letter 88-01. (See Iowa Electric Submittal No. 3. Also, see text for discussion).

2.3 Review of Previous Mitigating Actions, Classification of Welds, and Previous Inspections

2.3.1 Current IGSCC Classifications and Summary of Mitigating Treatments

Iowa Electric has not replaced the austenitic stainless steel primary coolant piping at Duane Arnold; however, a combination of mitigating actions have been applied including IHSI (induction heating stress improvement), repair of cracked welds using weld overlays, and implementation of HWC (hydrogen water chemistry). A summary of the mitigating actions applied to the welds within the scope of Generic Letter 88-01 and the IGSCC classifications of those welds is presented in Table 2. This table was generated from a system-by-system summary (attached as Appendix A) which in turn was developed from tables in Iowa Electric Submittal No. 1.

Iowa Electric Submittal No. 4 (submitted in response to a Request for Additional Information) states the following concerning the number of welds included in Table 2:

> "As a result of the staff's question, the entire DAEC piping inspection program was reviewed and a number of revisions to our inspection program have been made."
>
> "We now have included a total of 270 welds (i.e., inspection points) in our inspection program.... The welds added to the IGSCC inspection program are located in non-safety related portions of the Reactor Water Cleanup (RWCU) system. In addition our review resulted in recategorization of some welds."

The new totals for each IGSCC Category are shown in Table 3

Table 2

Summary of Classification of Welds and Mitigating Treatments at Duane Arnold (per Iowa Electric Submittal No. 1)

IGSCC Categ.	Total Number of Welds in Category	Number of Welds with Indicated Treatment		
		No Treat.	IHSI + Overlay	IHSI
A	0	-	-	-
B	0	-	-	-
C	93	0	0	93
D	77	77	0	0
E	9	0	9	0
F	0	-	-	-
G	0	-	-	-
	179	114	9	93

Table 3

Summary of Classification of Welds at Duane Arnold (per Iowa Electric Submittal No. 4)

IGSCC Categ.	Number of Welds in Category		
	Safety Related	Non-Safety Related	Total
A	3	11	14
B	0	0	0
C	91	0	91
D	75	0	75
E	9	0	9
F	0	0	0
G	0	81	81
	178	92	270

of this report. Note that the revised listing of welds included in the IGSCC program includes 92 welds in the RWCU which were not previously included. It also changes the total number of welds included in the safety-related portion from 179 to 178. In addition, the reclassifications resulted in: (a) addition of 3 IGSCC Category A welds (b) deletion of two IGSCC Category C welds, and (c) deletion of 3 IGSCC Category E welds. The specific welds involved were not identified by Iowa Electric. It should also be notad that according to Iowa Electric Submittal No. 4, all welds that are within the scope of Generic Letter 88-01 are included in Table 3. In addition, the following comment pertaining to crevicea is contained in Iowa Electric Submittal No. 4 (Response to RAI):

> "There are no known crevices, such as partial penetration welds, in DAEC piping systema to which the guidelines of NRC Generic Letter 88-01 apply."

2.3.2 Stress Improvement

Induction Heating Stress Improvement (IHSI) treatments were applied to 104 welds during the 1985/86 refueling outage. Post-IHSI inspections revealed cracks in 13 of the treated welds, and these welds were repaired with weld overlays as described below. The remaining 91 welds were classified as IGSCC Category C welds.

2.3.3 Weld Overlays

The nine IGSCC Category E welds listed in Tables 2 and 3 resulted from application of weld overlays which are described in Iowa Submittal No. 4 as follows:

> "There were a total of eleven indications repaired by

nine full structural weld overlays that covered sixteen original welds. Please note that seven of the overlays each covered two original welds. However, we count each overlay as a single 'weld' for inspection purpeses."

2.3.4 Hydrogen Water Chemistry

According to Iowa Electric Submittal No. 1, a hydrogen water treatment system, which meets guidelines established by the Electric Power Research Institute (EPRI), was installed at Duane Arnold during the 1987 refueling outage.

It is the intention of Iowa Electric to request relief at some time in the future (pending the development of sufficient operational data) from some of the inspection requirements imposed by Generic Letter 88-01.

2.3.5 Previous Inspection Program

Inspections of piping susceptible to IGSCC, in accordance with the NRC Generic Letter 84-01 and NRC Bulletin 82-01, Revision 1 have been applied to welds in the safety-related portion. Indications found, including indications found during post-IHSI inspections, were repaired as described above. Specifically Iowa Electric Submittal No. 1 states:

"Inspections of piping susceptible to IGSCC have been undertaken at the DAEC in accordance with NRC Bulletin 82-03, Revision 1 and NRC Generic Letter 84-11 as detailed in References 1, 2 and 3."

"During the 1985 refueling outage, a comprehensive inspection program for detection of IGSCC was implemented. As a result of this program eleven welds with indications

were detected in recirculation system piping. All eleven indications were subsequently repaired by nine full structural weld overlays... The inspection results and the repair process utilized for the weld overlays were reviewed by the NRC staff which concluded ... that the DAEC could be operated until the next refueling outage with the weld overlays in place."

"During the 1987 refueling ontage, a second comprehensive inspection of piping susceptible to IGSCC was undertaken. All nine weld overlays were reexamined. No raportable indications were detected in the weld overlays or piping inspected. The inspection results were reported to the NRC staff... The staff concluded that the DAEC would be returned to operation until the next refueling outage with assurance that the integrity of the reactor coolant pressure boundary would be maintained."

Iowa Electric did not provide a list of welds that were inspected during the 1985 inspections, but they did provide such a list for the 1987 inspections (Refueling Outage No. 8). That informetion is summarized in Appendix A of this report which shows the number of welds of each IGSCC category in each piping system that were scheduled for inspection during that outage. Table 4 further condenses that summary and shows the number of welds for each IGSCC category for the entire piping system that were scheduled for inspection in 1987. Note that all IGSCC Category E welds, nearly all IGSCC Category C welds, and about 40% of the IGSCC Category D welds were scheduled for inspection during the 1987 refueling outage.

The 81 IGSCC Category G welds in the non-safety related portion of the RWCU have not been inspected.

Table 4

Summary of Inspection Schedule for Duane Arnold
(per Iowa Electric Submittal No. 1 - see notes)

IGSCC Categ.	No. in Categ.	Number to be Inspected During Indicated Refueling Outage 08	09	10	11	12	13	Required by Generic Letter 88-01
A	0	-	-	-	-	-	-	25% every 10 years (at least 12% in 6 years)
B	0	-	-	-	-	-	-	50% every 10 years (at least 25% in 6 years)
C	77	76	14	17	17	14	16	All within the next 2 refueling cycles, then all every 10 years (at least 50 % in 6 years)
C*	16	15	8	8	8	8	8	
D	77	31	62	35	42	35	42	All every 2 refueling cycles
E	9	9	9	9	9	9	9	50% next refueling cycle, then all every 2 refueling cycles
F	0	-	-	-	-	-	-	All every refueling outage
G	0	-	-	-	-	-	-	All next refueling outage

Notes: Iowa Electric Submittal No. 4 lists several IGSCC Category G welds in non-safety portion of RWCU and several IGSCC Category A welds in both safety related and non-safety related areas which are not listed in Iowa Electric Submittal No. 1. All IGSCC Category G welds will be inspected during R.O.#10, and IGSCC Category A welds will be inspected per guidelines in Generic Letter 88-01.

IGSCC Category C* welds are Category C welds, but they will be examined as IGSCC Category D welds.

Dates for refueling outages are:

Outage	Scheduled	Outage	Scheduled	Outage	Scheduled
08	02/87-06/87	10	03/90-06/90	12	03/93-06/93
09	09/88-12/88	11	09/91-12/91	13	09/94-12/94

2.3.6 Evaluation and Recommendations

An extensive program has been conducted to mitigate IGSCC at Duane Arnold. A substantial portion of the 270 welds at Duane Arnold have been treated with IHSI and all non-resistant welds in the safety related portion of the piping have been inspected. All flawed welds have been repaired with full structural overlays. However, 81 non-resistant welds in the non-safety related portion of the RWCU have not been inspected and are classified as IGSCC Category G. Based on the information provided, Iowa Electric has correctly classified the welds within the scope of Generic Letter 88-01, and acceptance of those classifications is recommended.

Iowa Electric did not specifically state whether any of the inspections described above were conducted using methods and personnel as described in NUREG 0313, Revision 2 (i.e., in accordance with the NDE Coordination Plan agreed upon by NRC, EPRI, and BWROG as upgraded in September, 1987). However, as indicated in Table 1, Iowa Electric Submittal No. 4 states that they have applied inspection methods and personnel par the NRC Staff position. Thus, it is presumed that the 1987 inspections (Refueling Outage No. 8) were conducted in accordance with the Coordination Plan and should be credited as acceptable inspections.

2.4 Current Plans for Mitigating Actions

2.4.1 Summary of Plans

Iowa Electric Submittal No. 1 lists the following plans for the future:

(1) Continue operation of the Hydrogen Water Chemistry system and develop operational data.

(2) Apply inspections as outlined later in this report.

(3) Apply additional mitigating actions to welds that develop indications that are revealed by the inspection program or to existing indications that propagate beyond acceptable limits.

In addition to the above, Iowa Electric Submittal No. 4, in commenting on the IGSCC Category G welds in the non-safety related portion of the RWCU (i.e., those welds that are outboard of the second containment isolation valve), states the following:

"We are considering replacement of the piping in non-safety related portions of the RWCU system with IGSCC resistant material."

2.4.2 Evaluation of Conformance to Staff Positions and Recommendation

Since: (1) extensive mitigating actions have already been applied at Duane Arnold, (2) continued use of Hydrogen Water Chemistry should further reduce the possibility of IGSCC in the large number of IGSCC Category D and G welds at Duane Arnold, and (3) the replacement of the IGSCC Category G welds (if it is performed) will further reduce the possibility of IGSCC, acceptance of Iowa Electric's plan is recommended.

2.5 Plans for Future Inspections

Iowa Electric Submittal No. 1 states:

> "An augmented ISI program is provided, meeting the staff positions, in Attachment 1 of this letter. This program will be implemented during the next refueling outage. This program is intended to supersede any prior IGSCC-susceptible commitments made by Iowa Electric."

2.5.1 Summary of Inspection Schedule

Iowa Electric Submittal No. 1 contains a list of inspections for the augmented inspection program mentioned above which supersedes an inspection plan contained in Iowa Electric Submittal No. 2. The list in Iowa Electric Submittal No. 1, which contains the planned inspection schedules for Refueling outages 9 through 13 (1988 through 1994), is summarized in Appendix A and Table 4 along with the previously mentioned summary of the 1987 inspections (Refueling Outage No. 8).

It may be noted from an examination of Table 4 that the planned inspection schedules comply with the requirements of Generic Letter 88-01, providing that credit is allowed for the inspections performed in 1987. Although Table 4 does not include plans for IGSCC Category A welds or the IGSCC Category G welds in the portion of the RWCU that is outboard of the outer isolation board, Iowa Electric Submittal No. 4 states that inspection schedules have been developed for the IGSCC Category A welds and for the recategorized welds that are consistent with the guidelines of Generic Letter 88-01. In addition, the following statement is contained in Iowa Electric Submittal No. 4 pertaining to

the IGSCC Category G welds:

> "We have deferred inspection of these welds until the Spring 1990 refueling outage... We are considering replacement of the piping in non-safety related portions of the RWCU system with IGSCC resistant material."

2.5.3 Methods and Personnel

Assignment of responsibilities for ISI is described in an attachment to Iowa Electric Submittal No. 1. In addition, that document describes Iowa Electric's position on inspection methods and personnel which is patterned after the requirements of Generic Letter 88-01 and NUREG 0313, Revision 2. Thus, Iowa Electric complies with the NRC Steff position on this item.

2.5.4 Sample Expansion

An attachment to Iowa Electric Submittal No. 1 describes their plan for Sample Expansion which complies with the NRC Staff position as delineated in Generic Letter 88-01 and NUREG 0313, Revision 2. Specifically, that document states that if a newly detected flaw does not meet the requirements of IWB-3500 criteria of ASME Section XI, the number of augmented examinations shall be expanded as follows:

> "The additional number of IGSCC Categories A, B, C, or D welds inspected shall be equal to the number in the original sample in that category. Welds shall be selected for inclusion in the additional sample in the same distribution (according to pipe size, system, and location) to the original sample, unless considerations such as inaccessibility, personnel exposure, etc., dictate

otherwise. If any cracked welds are found in the additional augmented sample, all remaining welds in the category shall be examined, unless consideration such as inaccessibility, personnel exposure, etc., dictate otherwise."

"The additional number of IGSCC Category E welds (Weld Overlay/Repairs) inspected shall be expanded to include all other Category E welds if aignificant crack growth or additional cracks are found."

In addition to the above statementa, significant crack growth is defined in exactly the same manner as it is defined in Generic Letter 88-01.

2.5.5 Evaluation snd Recommendations

IGSCC Category G welds have not been inspected, although such inspections should have been performed during the 1988 refueling outage (Refueling Outage No. 9). However, future plans call for inspections or replacement of those welds during the next refueling outage. Thus, in terms of future plans for IGSCC Category G, Iowa Electric is in conformance with the NRC Staff position for IGSCC Category G welds.

For other welds, inspection schedules of Iowa Electric's augmented ISI program Duane Arnold are also in conformance with the requirements of Generic Letter 88-01, providing that credit is allowed for the inspections performed in 1987 during Refueling Outsge No. 8. As discussed in Section 2.3.6 such credit should be allowed. All other aspecta of Iowa Electric's augmented ISI program for Duane Arnold is in conformance with the requirements of Generic Letter 88-01. Thus, acceptance of Iowa Electric's ISI program is

recommended.

2.6 Changes in the Technical Specification Concerning ISI

2.6.1 Iowa Electric's Position

Iowa Electric Submittal No. 1 states:

> "A proposed license amendment (RTS-143A) intended to meet the requirements set forth in Generic Letter 88-01 was submitted separately in Reference 7. This proposed change supersedes a change request submitted earlier in Reference 8."

Reference 7 in the above statement is the document referred to in this report as Iowa Electric Submittal No. 3. Oue of the changes requested in that document is:

> "Add a requirement (TS 4.6.G.3) to implement an augmented ISI program in accordance with Generic Letter 88-01 and NUREG 0313, Revision 2."

2.6.2 Evaluation and Recommendation

Since Iowa Electric's position in in compliance with the requirements of Generic Letter 88-01 to add a statement to the Technical Specification that the ISI program will conform with the NRC Staff position, acceptance of that position is recommended.

2.7 Confirmation of Leak Detection in the Technical Specification

As indicated in Section 2.2 of this report, Iowa Electric endorses and will comply with the NRC Staff position on leakage detection, and Iowa Electric Submittal No. 3 contains requests to change portions of the Technical Specifications (TS) including changes necessary to bring the Technical Specification into conformance with the requirements of Generic Letter 88-01. Additional details are provided below.

2.7.1 Leakage Limits

Generic Letter requires that plant shutdown should be initiated for corrective action when: (a) within any 24 hour period any leakage detection system indicates en increase of unidentified leakage in excess of 2 gpm, or (b) the total unidentified leakage attains a rate of 5 gpm or equivalent.

Iowa Electric Submittal No. 1 contains the following statement:

> "Section 3.6.C of the DAEC Technical Specifications (TSs) limit leakage from unidentified sources to 5 gallons per minute (gpm) and the total leakage (identified and unidentified) into the primary containment to 25 gpm. Should these limits be exceeded, the reactor is required to be in cold shutdown within 24 hours. Reactor coolant system leakage must be checked and recorded at least once per day."

An additional requirement pertaining to unidentified leakage is being added as stated in their request to revise the TS (Iowa Electric Submittal No. 3), which:

"Revises TSs 3.6.C and 4.6.C to correspond with the Staff position on leakage detection systems as set forth in NRC Generic Letter 88-01. A new limit is added to the TS: if there is a 2 gpm increase in unidentified leakage within 24 hours the plant must be taken to cold shutdown within 24 hours. The permissible period of operation with an inoperable sump system is reduced to 24 hours (rather than 7 days)."

2.7.2 Frequency of Leakage Measurement

Generic Letter 88-01 states that the Technical Specification should require that leakage should be recorded at spproximately 4 hour intervals or less.

Both Iowa Electric Submittels No. 1 and No. 3 state that DAEC Surveillance Test Procedure 42A001 requires that unidentified leakage be monitored at four hour intervals.

However, the surveillance requirement given in the Technical Specification (page 3.6-5 which is attached to Iowa Electric Submittal No. 3) states:

"Reactor coolant system leakage shall be checked by the sump system and recorded at least once per day."

2.7.3 Description of Unidentified Leakage

Generic Letter 88-01 states that unidentified leakage should include all leakage other than: (a) leakage into closed systems, and (b) leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with operations of monitoring systems or not to be from a throughwall crack.

As indicated in the preceding section, the TS revision will include adding a reference to the UFSAR definitions of unidentified and identified leakage.

Iowa Electric Submittal No. 4 adds the following clarification:

> "Total leakage within the drywell is divided into two classifications: identified and unidentified leakage. Identified leakage, which is collected in the Drywell Equipment Drain Sump, is composed of normal seal and valve packing leakage. Unidentified leakage is compesed of all other leakage from the reactor primary systam. Unidentified leakage is collected in the Drywell Floor Drain Sump."

2.7.4 Operability of Measurement Instruments

Generic Letter 88-01 requires that for plants operating with any IGSCC category D, E, F, or G welds, at least one of the leakage measurement instruments associated with each sump shall be operable, and the outage time for inoperable instruments shall be limited to 24 hours. Otherwise an orderly shutdown should immediately be initiated.

Iowa Electric Submittal No. 1 states:

> "The DAEC has a number of IGSCC Category D and E welds and thus, a proposed change to the Technical Specifications to meet the Staff's position regarding the leakage detection systems was transmitted in Reference 7."

Reference 7 (referred to above) is Iowa Electric Submittal

No. 3 which:

> "Revises Table 3.2-E of the Technical Specifications (TSs) to state the minimum operability requirements of the instrumentation associated with the Sump and Air Sampling Systems. Also, the number of instrument channels provided by design is specified for each of the systems."
>
> "Revises the bases for Specification 3.2 to state that the Air Sampling System is provided as a backup system to the Sump System to detect primary coolant leakage."

Iowa Electric Submittal No. 4, which adds further clarification states that any one of the following six methods can detect increased drywell leakage: (1) Drywell Equipment Drain Sump Flow Integrator. (2) Drywell Floor Drain Sump Flow Integrator. (3) Drywell Equipment Drain Sump Pump Run Timer. (4) Drywell Floor Drain Sump Pump Run Timer. (5) Drywell Equipment Drain Sump Fill Timer. (6) Drywell Floor Drain Sump Fill Timer.

The specific wording of the Technical Specification is given in Iowa Electric Submittal No. 3 as:

> "The sump system shall be operable any time irradiated fuel is in the vessel and reactor coolant temperature is above 212°F. From and after the date the sump system is made or found to be inoperable for any reason, continued reactor operation is permissible during the succeeding 24 hours unless the system is made operable sooner, provided the air sampling system is operable."
>
> "If the conditions in 1 or 2 above (leakage limits and operability of measurement instruments) cannot be met, an orderly shutdown shall be initiated and the reactor

shall be in Cold Shutdown Condition within 24 hours."

2.7.5 Evaluation and Recommendations

The Duane Arnold Technical Specification is currently in conformance with several of the leakage detection requirements of Generic Letter 88-01, and changes have been proposed. However, one portion is unacceptable, i.e.,:

> The DAEC Technical Specification should be changed to include requirements for recording leakage at approximately 4 hour intervals or less as currently required in their surveillance procedures and required by Generic Letter 88-01

In addition, an editorial change should be made to the portion of the proposed Technical Specification which states that plant shut down must occur in the event that there is an increase of 2 gpm within 24 hours (rather that 24 hours, or less as stated by Generic Letter 88-01). The editorial change should add the wording "or less" in the same manner that these words are included in Generic Letter 88-01.

2.8 Plans for Notification of the NRC of Flaws

2.8.1 Iowa Electric's Position

Iowa Electric intends to comply with the NRC Staff position on notification. Their position is outlined in an attachment to Iowa Electric Submittal No. 1 as follows:

> "If no new flaws have been discovered the NRC shall be notified of the results within 90 days of the completion of the refueling

outage."

"If any indications are identified that do not meet the criteria in ASME Section XI for continued operation (without evaluation), NRC approval of flaw evaluations and/or repairs in accordance with IWB 3630 is required before resumption of operation."

2.8.2 Evaluation and Recommendation

Iowa Electric's position on reporting complies with requirements of Generic Letter 88-01, so acceptance of their position is recommended.

3. ALTERNATIVE POSITIONS AND REQUESTS FOR RELIEF

Iowa Electric did not propose any alternative positions to the NRC Staff positions, nor did they ask for relief to any provisions of Generic Letter 88-01.

4. CONCLUSIONS AND RECOMMENDATIONS

Iowa Electric indicated that they endorse and accept all thirteen NRC Staff positions as delineated in Generic Letter 88-01 pertaining to materials, processes, water chemistry, weld overlay, partial replacement, stress improvement of cracked weldments, clamping devices, crack evaluation and repair criteria, inspection methods and personnel, inspection schedule, sample expansion, leakage detection, and reporting requirements. They have previously applied all except two of these items (i.e., those pertaining to clamping devices and sample expansion).

Iowa Electric provided a list of welds in the safety related portion

of the piping that is covered by Generic Letter 88-01, but they did not provide a list of welds in the non-safety related portion (the portion of the RWCU that is outboard of the outer iaolation valve). They did state that the latter portion of the RWCU contains 11 IGSCC Category A welds and 81 IGSCC Category G welds. Iowa Electric has correctly applied the guidelines of Generic Letter 88-01 and NUREG 0313, Revision 2 to classify the welds at Duane Arnold into the various IGSCC classifications.

Iowa Electric has applied IHSI to 104 welds and nine weld overlays resulting in 91 IGSCC Category C welds and 9 IGSCC Category E welds in the safety related portion of the piping. In addition Duane Arnold contains 3 IGSCC Category A (resistant material) and 75 IGSCC Category D welds in that portion of piping. Duane Arnold does not currently contain any IGSCC Category B or F welds.

Replacement of the IGSCC Category G welds is being considered for the next refueling outage, but no other mitigating treatments are planned other than repair welds as necessary. However, Hydrogen Water Chemistry (HWC) has been implemented at Duane Arnold, and its operation will be continued in the future.

An inservice inspection (ISI) program has been developed by Iowa Electric that complies with the NRC Staff position in terms of schedule, methods and personnel, sample expansion, and reporting requirements. In addition they submitted a request for a revision of the Technical Specification on ISI to include a statement, as required by Generic Letter 88-01, that their ISI program will comply with the NRC Staff position. Iowa Electric has not taken credit for HWC in the development of their inspection schedules; however, they expect to apply for relief from some of the inspection requirements after sufficient HWC operational data have been developed.

Iowa Electric also submitted a request for revision of the Technical

Specification on leakage detection end leakage monitoring to change those requirements that are not currently in compliance. However, the Technical Specification (TS) on leakage is still inadequate in one respect: Duane Arnold's requirement for recording leakage is once per day rather than at approximately 4 hour intervals or less.

As a result of this techaical evaluation, the following recommendations are made.

(1) Acceptance of Iowa Electric's inservice inspection program including their inspection schedules, plans for inspection methods and personnel, plans for sample expansion, and plans for complying with reporting requirements.

(2) Acceptance of Iowa Electric's plan for future mitigating actions at Duane Arnold including continuation of HWC and either inspection or replacement of all IGSCC Category G welds during the next refueling outage.

(3) Acceptance of Iowa Electric's position on changing the Technical Specification on ISI to include the required statement that the inservice program will comply with the NRC Staff position.

(4) Rejection of Iowa Electric's position concerning frequency of leakage monitoring. The Duane Arnold TS should be changed to require recording of leakage at intervals of approximately 4 hours or less rather than once per day.

(5) An editorial change should also be made in the Technical Specification in the portion that restricts the increase in the unidentified leakage to 2 gpm within any 24 hour period. Iowa Electric should change the phrase "within a 24 hour period" to read "within any 24 hour period or less."

(6) Acceptance of the remaining portions of Iowa Electric's position concerning the Technical Specification on leakage detection.

(7) Acceptance of the remaining portions of the Iowa Electric Submittals.

5. REFERENCES

1. "Technical report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," NUREG 0313, Revision 2, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, January, 1988.

2. "Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants," NUREG 0531, U. S. Nuclear Regulatory Commission, February, 1979.

3. "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," Generic Letter 88-01, U.S. Nuclear Regulatory Commission, January 25, 1988.

APPENDIX A

Summary of Examination Schedule

IGSCC Category C Welds

System[a]	I.D.	Pipe Dia., in.	Number of Welds	Number Scheduled for Inspection During Indicated Outage					
				08	09	10	11	12	13
RC	RCA	22	18	18	3	3	2	4	6
	RCB	22	19	19	3	3	7	4	2
RH	RHB	18	1	1	1	0	0	0	0
	RHC	20	2	2	1	0	2	0	0
	RHD	20	2	2	0	0	0	2	0
RM	RMA	10	4	4	0	2	1	0	1
		16	4	4	1	2	1	0	0
		20	1	1	1	0	0	0	0
	RMB	10	4	4	0	2	1	1	0
		16	4	4	1	1	1	0	1
		20	1	1	1	0	0	0	0
RR	RRA	10	2	2	0	2	0	0	0
	RRB	10	2	2	0	0	0	0	2
	RRC	10	4	3	2	0	0	2	0
	RRD	10	1	1	0	0	0	0	1
	RRE	10	2	2	0	1	0	1	0
	RRF	10	2	2	0	1	0	0	1
	RRG	10	2	2	0	0	0	0	2
	RRH	10	2	2	0	0	2	0	0
Totals			77	76	14	17	17	14	16

a. Abbreviations are defined on page A-4

Summary of Examination Schedule
(continued)

IGSCC Category C* Welds

System	I.D.	Pipe Dia., in.	Number of Welds	Number Scheduled for Inspection During Indicated Outage					
				08	09	10	11	12	13
RR	RRA	10	2	2	1	1	1	1	1
	RRB	10	2	2	1	1	1	1	1
	RRC	10	2	2	1	1	1	1	1
	RRD	10	2	2	1	1	1	1	1
	RRE	10	2	2	1	1	1	1	1
	RRF	10	2	1	1	1	1	1	1
	RRG	10	2	2	1	1	1	1	1
	RRH	10	2	2	1	1	1	1	1
Totals			16	15	8	8	8	8	8

Note: IGSCC Category C* welds are Category C welds, but they will be examined as IGSCC Category D welds.

Summary of Examination Schedule
(continued)

IGSCC Category D Welds

System	I.D.	Pipe Dia., in.	Number of Welds	Number Scheduled for Inspection During Indicated Outage					
				08	09	10	11	12	13
CU	CUA	4	18	5	13	0	18	0	18
	CUB	4	13	0	13	13	0	13	0
CS	CSA	4	4	4	4	4	0	4	0
	CSB	4	4	4	4	0	4	0	4
RB	RHA	4	9	3	6	9	0	9	0
	RBB	4	9	3	6	0	9	0	9
RC	RCA	4	4	0	4	4	0	4	0
	RCB	4	3	0	3	0	3	0	3
RH	RHB	4	1	0	1	1	0	1	0
RR	RRA	10	1	1	1	0	1	0	1
	RRB	10	1	1	1	0	1	0	1
	RRC	10	1	1	1	0	1	0	1
	RRD	10	1	1	1	0	1	0	1
	RRE	10	1	1	1	0	1	0	1
	RRF	10	1	1	1	0	1	0	1
	RRG	10	1	1	1	0	1	0	1
	RRH	10	1	1	1	0	1	0	1
JP	JPA	4	2	2	0	2	0	2	0
	JPB	4	2	2	0	2	0	2	0
Totals			77	31	62	35	42	35	42

Summary of Examination Schedule
(continued)

IGSCC Category E Welds

System	I.D.	Pipe Dia., in.	Number of Welds	Number Scheduled for Inspection During Indicated Outage					
				08	09	10	11	12	13
RH	RHB	18	1	1	1	1	1	1	1
RR	RRA	10	1	1	1	1	1	1	1
	RRB	10	1	1	1	1	1	1	1
	RRD	10	2	2	2	2	2	2	2
	RRE	10	1	1	1	1	1	1	1
	RRF	10	1	1	1	1	1	1	1
	RRG	10	1	1	1	1	1	1	1
	RRH	10	1	1	1	1	1	1	1
Totals			9	9	9	9	9	9	9

Abbreviations:

RB - Recirculation System Pump Valve Bypass
RC - Recirculation Pump Suction
RH - Residual Heat Removal
RM - Recirculation Manifold
RR - Recirculation Riser
CU - Reactor Water Cleanup
CS - Core Spray System
JP - Jet Pump Instrumentation