

July 23, 2003

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

SUBJECT: DUANE ARNOLD ENERGY CENTER  
NRC INSPECTION REPORT 50-331/03-08 (DRP)

Dear Mr. Peifer:

On July 7, 2003, the NRC completed a baseline team inspection at your Duane Arnold Energy Center facility. The enclosed report documents the inspection findings which were discussed on June 13 and July 7, 2003, with you and other members of your staff.

This inspection was an examination of activities conducted under your license as they relate to the identification and resolution of problems, compliance with the Commission's rules and regulations and with the conditions of your operating license. Within these areas, the inspection involved a selected examination of procedures and representative records, observations of activities, and interviews with personnel.

On the basis of the sample selected for review, the inspectors concluded that in general, problems were properly identified, evaluated, and corrected. There were three findings of very low safety significance (Green) identified during this inspection. The first finding concerned the inadequate commercial grade dedication for replacement capacitors installed in the 1D15 inverter. The heat rating for these capacitors, which is a critical characteristic, was not adequately established through the commercial grade dedication process. The second finding concerned the inadequate assessment of risk in maintenance planning activities. In this case, the 1D15 inverter was out of service and was not being factored into daily plant risk assessments. The third finding concerned inadequate corrective actions to equipment damage in the drywell caused by maintenance personnel. Because of their very low safety significance and because these issues were entered into your corrective action program, the NRC is treating these issues as Non-Cited Violations in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny any of these Non-Cited Violations, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region III; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Duane Arnold Energy Center.

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Sincerely,

*/RA/*

Bruce Burgess, Chief  
Branch 2  
Division of Reactor Projects

Docket No. 50-331  
License No. DPR-49

Enclosure: Inspection Report 50-331/01-003(DRP)

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REGION III

Docket No: 50-331  
License No: DPR-49

Report No: 50-331/03-08 (DRP)

Licensee: Alliant, IES Utilities, Inc.

Facility: Duane Arnold Energy Center

Location: 3277 DAEC Road  
Palo, Iowa 52324-9785

Dates: May 27 - 30, 2003  
June 9 - 13, 2003

Inspectors: J. Jacobson, Team Leader  
T. Tongue, Project Engineer  
D. McNeil, Reactor Engineer  
D. Merzke, Reactor Engineer

Approved by: Bruce Burgess, Chief  
Branch 2  
Division of Reactor Projects

Enclosure

## SUMMARY OF FINDINGS

IR 05000331/03-08, on 05/27/03-06/13/03; IES Utilities, Inc. Duane Arnold Energy Center, Unit 1, biennial baseline inspection of the identification and resolution of problems. The inspection was conducted by two headquarters reactor engineers, one regional project engineer, and one regional reactor engineer.

This inspection identified three Green findings which involved Non-Cited Violations (NCV). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green," or be assigned a severity level after Nuclear Regulatory Commission (NRC) management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

### Identification and Resolution of Problems

The licensee was generally effective in identifying and appropriately characterizing problems. No new issues were identified by the team during its walkdown of equipment. Station personnel effectively identified and entered problems into the corrective action program using corrective action program forms (CAPs). In most instances, the licensee appropriately classified items entered into the corrective action program into one of four significance levels (A-D), with the more safety significant issues being given a higher significance classification. The inspectors identified two areas of concern regarding the licensee's significance classification of issues. First, all potential issues that arose from the licensee's screening of Operating Experience (OE) issues were initially entered into the corrective action program at a "D" significance level (the lowest level). Second, the inspectors noticed an inconsistency in how the licensee had classified some repeat issues.

The inspectors' review of level "A" root cause analyses identified that the root cause analyses often missed important contributing factors, and consequentially, corrective actions for these contributing factors were not specified. In some instances, the root cause analyses did a credible job of identifying the specific failure mode associated with the equipment involved, but often did not address why the equipment failed or what other factors associated with the events in question contributed to the event's significance. In one instance, the root cause analysis did not identify either primary or contributing causes.

For the large majority of samples reviewed by the team, appropriate corrective actions were taken for items entered into the corrective action program; however, the inspectors identified that in two instances, the corrective action program was not effective in resolving longstanding or repetitive issues. The inspectors concluded that the effectiveness of equipment trending was largely dependent on the experience or knowledge of the associated equipment or component engineer, and that the corrective action program had not been used effectively to trend equipment issues.

### **Cornerstone: Initiating Events**

- Green. A finding of very low safety significance was identified by the inspectors as a result of the licensee's failure to follow procedures associated with the procurement and commercial grade dedication of inverter capacitors. The finding is more than minor as the capacitors failed resulting in the inoperability of the safety related inverter. The finding was determined to be of very low safety significance because a back-up alternate source of power was available to supply power to safety related loads. A Non-Cited Violation of Appendix B of 10 CFR 50, Criterion V, was identified by the inspectors. (Section 40A2.b.(3))
- Green. A finding of very low safety significance was identified by the inspectors when the licensee failed to consider the unavailability of the 1D15 inverter as part of their daily risk assessment for out-of-service equipment. The finding is more than minor because it affected the outcome of the licensee's daily risk assessment used for maintenance planning. The finding was determined to be of very low safety significance since the impact to overall plant risk was relatively minor. A Non-Cited Violation of 10 CFR 50.65.a(4) was identified by the inspectors. (Section 40A2.b.(3))

### **Cornerstone: Mitigating Systems**

- Green. A finding of very low safety significance was identified by the inspectors for inadequate corrective action associated with seal leakage of the High Pressure Coolant Injection (HPCI) pump and equipment damage in the drywell caused by maintenance personnel. The finding was more than minor because, in each case, either the operability of the equipment was affected or the equipment was degraded. The finding was determined to be of very low safety significance because, in each case, alternate equipment was available to perform the intended safety functions. A Non-Cited Violation of Appendix B of 10 CFR, Criterion XVI was identified by the inspectors. (Section 40A2.c.(3))

## REPORT DETAILS

### 4. OTHER ACTIVITIES (OA)

#### 4OA2 Problem Identification and Resolution

##### a. Effectiveness of Problem Identification

###### (1) Inspection Scope

The inspectors conducted a review of the Duane Arnold process for identifying and correcting problems at the plant. The inspectors reviewed previous licensee and inspector identified issues related to the safety cornerstones in the Reactor Safety and Radiation Safety strategic performance areas to determine if problems were appropriately identified, characterized, and entered into the corrective action program. The problem identification program and its effectiveness were evaluated by reviewing issues identified in previous NRC inspections, selected corrective action program documents and records, and discussions of the program with licensee personnel.

The inspectors reviewed documents associated with the corrective action program for a period covering January 2001 through May 2003, in order to determine if problems were being identified at the proper threshold and entered into the corrective action process. The documents reviewed included previous NRC inspection reports, Action Requests (ARs), procurement deficiency reports, and corrective action program forms (CAPs). In addition, in order to identify the presence of longstanding unresolved issues the inspectors reviewed a list of all ARs and CAPs issued during the last three refueling outages, as well as a licensee list of recurring equipment issues and operator work-arounds. The inspectors also reviewed the licensee's efforts to capture industry operating experience (OE) issues in the corrective actions program. Documents reviewed included industry operating event reports, NRC Information Notices, NRC bulletins, and vendor generic notices.

The inspectors also reviewed records of an internal audit and self-assessment completed by the Duane Arnold corrective action program organization. Several CAPs written by licensee personnel on audit and assessment findings were reviewed to verify that adequate corrective action had been or was to be taken. The inspectors reviewed other selected licensee audits and self-assessments performed since March 2001. The inspectors conducted the review to determine whether the audit and self-assessment programs were effectively managed, adequately covered the subject areas, and to determine whether the associated findings were appropriately captured in condition reports. In addition, the inspectors interviewed licensee staff regarding the audit and self-assessment programs. The inspectors also reviewed selected operability evaluations completed since March 2001, and conducted walkdowns of the Control Room, Standby Diesel Generator (SBDG) rooms, the High Pressure Coolant Injection (HPCI) system, and the Reactor Core Isolation Cooling (RCIC) system.



A listing of the specific documents reviewed is attached to the report.

(2). Assessment

There were no findings identified in this area during this inspection. The licensee was generally effective in identifying and appropriately characterizing problems. No new issues were identified by the team during its walkdown of equipment. Station personnel effectively identified and entered problems into the corrective action program using corrective action program forms (CAPs). The significance threshold for entering issues into the program appeared appropriate. The inspectors did, however, identify that in some instances, issues raised by the inspectors during the inspection were not entered into the corrective action program in a timely manner. This hesitation appeared to be limited to certain groups, with those individuals involved in managing the corrective action program clearly showing a greater sensitivity to the questions raised by the team than others more directly related to the issues.

The licensee's corrective action program is essentially a computer based, paperless system. In order to aid in the efficiency of the inspection, the inspectors were provided access to the licensee's computerized database which allowed the inspectors to directly retrieve information on particular CAPs and which allowed for the performance of limited searches for issues and trends. In some instances, the inspectors found the licensee's database to be extremely slow as it was a web-based application whose performance varied with web congestion. The system's performance made it difficult at times to perform searches for related issues and may cause problems in terms of using the system effectively to perform trending or history reviews. Also, in several cases, the database did not contain important related documents that provided the basis for closure of the CAPS. In such cases, the documentation usually existed, although not accessible via a direct link from the database. The licensee stated that they were taking actions to improve the system's performance by moving the database to a location internal to the company.

Licensee's audits and assessments of the corrective action program appeared to be of appropriate depth and scope, and findings and recommendations were appropriately captured. Licensee audits and self-assessments of the problem identification part of the program had raised some issues analogous to those identified by the inspectors, regarding the willingness of certain individuals or groups to recognize that a CAP should be written for certain lower level issues, mainly associated with personnel safety.

(3). Findings

No findings of significance were identified.

b. Prioritization and Evaluation of Issues

(1). Inspection Scope

The inspectors reviewed the licensee's significance classification and evaluation of a selected sample of CAPs. The assessment included a review of the category assigned, operability and reportability determinations, extent of condition evaluations, cause

investigations, and the appropriateness of the assigned corrective actions. The inspectors also assessed licensee evaluations to previously issued NRC Non-Cited Violations (NCVs). They also attended daily management meetings and plan of the day meetings to observe the assignment of CAP categories for current issues and the review of root cause analyses and corrective actions. In order to assess the adequacy of the licensee's root cause analyses, the inspectors performed a focused review of four of the licensee's highest significance level CAPs. The inspectors used the inspection guidance contained in Inspection Procedure 95001 as an aid in assessing the root cause analyses.

(2). Assessment

In most instances, the licensee appropriately classified items entered into the corrective action program into one of four significance levels (A-D), with the more safety significant issues being given a higher significance classification. Issues classified at the A or B level were generally designated to receive a root cause or an apparent cause evaluation. Issues classified at the C or D level usually did not receive a root or apparent cause evaluation, but were evaluated using an action request or condition evaluation. The inspectors identified two areas of concern regarding the licensee's significance classification of issues. First, all potential issues that arose from the licensee's screening of OE issues were initially entered into the corrective action program at a "D" significance level (the lowest level). This seemed to conflict with the licensee's Action Request System procedure which indicated that level "D" items were improvements, suggestions, or enhancements to improve business practices, programs, or plant performance. The licensee issued an Action Request (027806) to assess this apparent discrepancy.

Second, the inspectors noticed an inconsistency in how the licensee had classified some repeat issues. For example, an inverter problem that ultimately caused a reactor scram was given an "A" level classification in October 2001 (ACR 28166) but a similar problem with the inverter that occurred just prior to the inspection in May 2003 (CAP 027422), but for which a reactor scram did not occur, was only given a "C" classification. The "A" level issue received a full root cause analysis while the "C" level issue was closed to a work order without any analysis of the cause of the failure being performed. During the first example, power to the safety related instrument bus was lost because when the inverter failed, the alternate AC supply was also out for maintenance. In the second example, the alternate AC supply was available, and power was not lost to the instrument bus. The inspectors noted the licensee's classification guidance, at the time of the inspection, focused solely on actual as opposed to potential consequences. As such, similar issues can receive significantly different levels of review depending on the actual consequences that occur. The inspectors were concerned that the effectiveness of the corrective action program was being limited by not considering the potential consequences, or the repetitive nature of the issue, when assigning significance levels.

The inspectors review of the four significance level "A" root cause analyses identified that the root cause analyses often missed important contributing factors, and consequentially, corrective actions for these contributing factors were not specified. In some instances, the root cause analyses did a credible job of identifying the specific

failure mode associated with the equipment involved, but often did not address why the equipment failed or what other factors associated with the events in question contributed to the event's significance.

For example, the root cause analysis associated with the failure of a replacement emergency service water pump (AR 31430) did not address why previous indicators of the pump's degradation were not acted upon, including previous trips of thermal overloads and an increase in pump breakaway torque. Also, although the licensee's analysis correctly identified that the primary root cause for the pump's failure was the use of improper bearing material, the analysis did not investigate the process used by the licensee to specify the replacement pump, including the materials used for the pump's bearings.

In another example, the root cause analysis was not comprehensive enough to identify either the primary or contributing causes. The licensee's root cause analysis (AR 28166) associated with failure of the Division I instrument bus 1D15 inverter and associated reactor trip failed to identify the basic cause for the failure. This root cause also failed to adequately address contributing factors, including the performance of on-line maintenance that resulted in the alternate AC source not being available. The root cause analysis did not contain a detailed failure modes and effects or fault analysis, but rather, was essentially a summary of the basic troubleshooting that ultimately involved the replacement of three circuit cards. The inspectors determined that a more definitive assessment of all possible failure modes should have been performed, since the inverter failure could not be repeated and the vendor's testing of the three replacement circuit cards found them to be fully operational.

Licensee audits and self assessments of the corrective action program have also identified issues concerning the quality of root and apparent cause analyses, similar in nature to those raised during this inspection.

During the course of the inspector's review of selected root causes, two Green findings and one Unresolved Item were identified and are detailed in the following paragraphs of the report.

(3). Findings

i. Introduction. A finding was identified concerning the inadequate commercial grade dedication for replacement capacitors installed in the 1D15 inverter. The heat rating for these capacitors, which is a critical characteristic, was not adequately established through the commercial grade dedication process.

Description. Just prior to the inspection, on May 15, 2003, the inspectors learned that the 1D15 inverter supplying an instrument bus had failed and had been removed from service. The alternate AC source was available and was used to power the instrument bus, preventing a reactor trip. As stated in Section 40A2.b.2 of this report, the licensee classified this failure as a level "C" condition (CAP 027422) and closed the level "C" CAP to a work order prior to commencing troubleshooting. During the troubleshooting of the inverter conducted by the licensee during the inspection, the licensee identified that all 20 input filtering capacitors were severely degraded. These capacitors had been

replaced by the licensee in 1998 as part of the preventative maintenance program. The inspectors reviewed procurement records associated with the purchase of these replacement capacitors and identified that they had been procured as commercial grade items and had been dedicated by the licensee for use in a safety related application. The inspectors compared the original and replacement capacitors and identified that, although they had the same ratings, the replacement capacitors were not identical. Upon inspection, the replacements appeared differently constructed and were significantly lighter in weight than the originals. The inspectors reviewed the licensee's dedication package (TERI 96-019) and determined that, although the licensee had performed some limited testing to determine the acceptability of the replacement capacitors for use in a safety related application, the licensee had not performed any testing to verify the heat rating of the capacitors, a critical characteristic for use in inverter applications. The dedication package also did not address the manufacturing quality or expected life ratings of the components in the intended application.

At the conclusion of the inspection, the licensee had not developed a detailed troubleshooting plan to identify the root cause of the capacitor failures and to return the inverter back to service. Also, the licensee had not yet checked the capacitors in the redundant division inverter, which also had its capacitors replaced.

Analysis. The licensee's inadequate procurement and commercial grade dedication of the inverter capacitors is identified as a performance deficiency that is greater than minor as failure of the capacitors affected the operability of the inverter and increased the frequency for an initiating event. Because this issue was greater than minor, the inspectors reviewed it in accordance with Manual Chapter 0609, "Significance Determination Process," Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," regarding mitigating systems. Because the alternate AC power source was available to the instrument bus and the issue did not meet any of the criteria in Appendix A, this finding screened as Green and was of very low safety significance.

Enforcement. Appendix B of 10 CFR 50, Criterion V, states, in part, that activities affecting quality should be prescribed in documented instructions, procedures, or drawings of a type appropriate to the circumstances and should be accomplished in accordance with those documents. Licensee procedure ACP 1204.14, Revision 9, "Dedication and Upgrade of Commercial Grade Items", required that critical characteristics be developed for dedicated commercial grade items and that methods for verifying the critical characteristics be established. Contrary to the above, adequate methods were not established to verify a critical characteristic, the heat rating of the replacement capacitors, prior to their installation in a safety related inverter. Because of the low safety significance of this issue, and because this issue was entered into the corrective action program (CAP 028412), the NRC is treating this issue as a Non-Cited Violation (NCV 50-331/08-01), in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

ii. Introduction. A finding was identified concerning the inadequate assessment of risk in maintenance planning activities. In this case, the 1D15 inverter was out of service and was not being factored into daily plant risk assessments.

Description. Since the 1D15 inverter had been out of service since May 15, 2003, the inspectors asked whether any Technical Specifications were applicable. The licensee stated that the inverter was not subject to a Technical Specification limiting condition for operation, only the bus that it supplied power to was subject to Technical Specifications. Since the bus was still being energized from an alternate AC source, the bus was operable. The fact that the inverter was not available did, however, impact the redundancy of the bus and as such, the inspectors asked the licensee how the inverter being out of service was being factored into the daily risk analysis performed to comply with the requirements of the Maintenance Rule (10 CFR 50.65.a.(4)). The licensee stated that since the inverter was not modeled in the risk program (ORAM Sentinel) used, the risk associated with its unavailability was not being considered. After questioning the risk assessment and the applicability of the Technical Specifications, the licensee re-performed their risk assessment, this time including the inverter unavailability. The new assessment concluded that the daily risk level should be changed from Green to Yellow, thus highlighting to plant operators that the loss in redundancy and additional vulnerabilities that were created by the out-of-service inverter was, in fact, risk significant. The change in risk level was based upon a qualitative assessment performed by the licensee which concluded that an increased frequency for an initiating event was the result of a loss of redundant power to the instrument bus. This increase in frequency for an initiating event was derived from the fact that a previous reactor scram had occurred during an inverter failure.

The inspectors also learned that the inverter failures were not being captured as maintenance rule preventable failures since maintenance rule monitoring of this equipment was being conducted at the "train" level. Unless the alternate AC source also failed, any failures of the inverter would not be counted as a maintenance rule preventable failure. The licensee issued a CAP (CAP 027799) to evaluate the appropriateness of monitoring these components at the train level.

Analysis. The licensee's failure to consider the inverter as part of their daily risk assessment for out-of-service equipment is considered a performance deficiency that is more than minor because the inoperable inverter was determined by the licensee to cause an increase in initiating event frequency. Because this issue was greater than minor, the inspectors reviewed it in accordance with Manual Chapter 0609, "Significance Determination Process," Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," regarding mitigating systems. Because the increase in the initiating event frequency was very small and was determined qualitatively, this finding screened as Green and was of very low safety significance.

Enforcement. 10 CFR 50.65a.(4), states, in part, that before performing maintenance activities, the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. Contrary to this requirement, the licensee failed to appropriately assess the increase in risk caused by the unavailability of the 1D15 inverter during its daily assessments of plant risk contained in the Plant Status Report, from May 15 until June 2, 1993. The Plant Status Report is used in planning the maintenance activities that can be performed based upon the overall level of plant risk and consideration of the current equipment that is unavailable for service. Because of the low safety significance of this issue, and because this issue was entered into the corrective action program (CAP027704), the NRC is treating this issue as a Non-Cited

Violation (NCV 50-331/08-02), in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

iii. Introduction. An Unresolved Item was identified concerning the adequacy of voltage to 20 drywell MOVs that were powered from the instrument bus that received power from the 1D15 inverter.

Description. The 1D15 inverter was declared inoperable prior to this inspection, requiring that the 1Y11 instrument bus be fed from the alternate AC source. The inspectors requested voltage regulation calculations that supported operating all loads fed from the alternate AC source. The inspectors reviewed voltage calculation APED-R81-001 and determined that voltage to the 20 drywell cooling motor-operated valves (MOVs) could fall as low as 86.2 volts under certain scenarios. The calculation stated, however, that these MOVs were never required to be operated. The inspectors questioned this assumption and the licensee's investigation revealed that the valves were in fact required to be operated. The licensee also stated that they had spoken with the valve actuator vendor who indicated the valves could operate at a slower speed at voltages as low as 86.2 volts; however, this information could not be verified during the inspection. Operation of the drywell MOVs under reduced voltage conditions is therefore identified as Unresolved Item 50-331/03-08-03 pending receipt of information that validates the licensee's contention that the valves can operate acceptably with supply voltage at 86.2 volts.

Analysis. Additional information regarding the safety function of the MOVs in question is necessary before analyzing the safety significance of this issue.

Enforcement. Any enforcement actions that will be taken as a result of this issue (if any) will be decided after completion of the analysis as indicated above.

c. Effectiveness of Corrective Action

(1). Inspection Scope

The inspectors reviewed selected CAPs and associated corrective actions to evaluate the effectiveness of corrective actions. The inspectors reviewed action requests, operability determinations, and root cause reports to verify that corrective actions, commensurate with the issues, were identified in a timely manner, including corrective actions to address long-standing or repetitive issues. The inspectors also verified the implementation of a sample of corrective actions. The samples that were selected for review were based in part on their importance in reducing operational risks.

A listing of the specific documents reviewed is attached to the report.

(2). Assessment

For the large majority of samples reviewed by the team, appropriate corrective actions were taken for items entered into the corrective action program. However, the inspectors identified that in some instances, the corrective action program was not effective in resolving longstanding or repetitive issues. The inspectors identified that the

licensee was not performing trend analyses for equipment issues using the corrective action program data, and as such, the effectiveness of equipment trending was largely dependent on the experience or knowledge of the associated equipment or component engineers. In contrast, the licensee had identified equipment trending as a strength in its most recent self-assessment.

The following examples of inadequate corrective action were identified during the inspection:

- On April 17, 2003, CAP027075 was issued documenting that a PSV4400 bellows failure alarm and light actuated during reactor startup as a result of equipment damage caused during the outage. The damage inflicted during the outage to this ADS valve bellows resulted, after a preliminary operability analysis by the licensee, in the pressure actuation function of one automatic depressurization system (ADS) relief valve to be declared inoperable requiring the licensee to enter a 30 day Limiting Condition of Operation (LCO) per Tech Spec 3.4.3 Condition A. On November 27, 1999, an electrical ground caused PSV4402 (Main Steam Line 'B' ADS Relief Valve) to actuate resulting in a reactor vessel pressure drop, an increase in vessel water level due to swell and an increase in torus water level. It was determined that the root cause of the November 27, 1999 event was damaged wiring due to personnel stepping on the conduit for SV-4402. One of the corrective actions from this event was to conduct training on the consequences of stepping on plant equipment prior to RFO 17. During the inspection, the inspectors identified that training had not been conducted prior to RFO 17 or RFO 18. Failure to implement this corrective action in a timely manner was identified as a performance deficiency. After bringing this issue to the licensee's attention, the inspectors were told that concern had also been identified by the licensee's quality assurance organization during a recent audit.
- As a follow-up to the review conducted by the inspectors on the 1D15 inverter, the inspectors performed a computer search of all CAP items involving inverter failures since 1997. From this search, the inspectors identified seven failures of the 1D45 inverters that had occurred when cycling motor operated valves connected to the 120 VAC bus. Corrective actions to these failures had not been effective and the corrective action program had not effectively escalated the issue for a more in-depth analysis to identify the cause of the repeated failures. On April 10, 2003, the licensee issued a trend CAP at the level "C" significance level for these issues, but corrective actions to this latest CAP had not been specified at the conclusion of the inspection.

(3). Findings

Introduction. A finding was identified concerning two examples of inadequate corrective action to degraded equipment.

Description. On December 4, 2002, plant staff performed a surveillance test on the High Pressure Coolant Injection (HPCI) pump, 1P216. The outboard seal was reported to leak one cup per minute during the test, and stopped when the HPCI pump was

secured. The seal was not leaking with HPCI in standby with approximately 20 psi of head pressure provided by the Condensate Storage Tank (CST). Both the inboard and outboard seals had been replaced in April 2001 due to the identification of similar intermittent seal leakage measured to be less than one pint per minute. The removed seals were discolored and had radial cracks indicative of heat checking.

Plant staff interviewed indicated minor leakage from the mechanical seals was expected, but this leak had worsened from December 4, 2002 through May 29, 2003. The inspectors determined that, although the leakage of the pump seal was abnormal, this condition was only being informally monitored and there was not an open issue in the corrective action program documenting this deficiency, only a work order written to replace the seal during the next refueling outage.

On March 31, 2003, a trend CAP (CAP026571) was written due to equipment damage in the drywell during refueling outage (RFO) 18, indicating a problem with work control in the drywell. The damage was apparently caused by personnel stepping on equipment during maintenance activities. Three example CAPs were cited (026400, 026483 and 026535). The condition evaluation (CE000650) closing out the trend CAP stated "...supervisors provided adequate oversight and direction on the issue of protecting equipment in the vicinity of the work. The oversight of the project met expectations in this area. The damage that occurred is considered incidental... No further actions are deemed necessary." The inspectors determined that the licensee's failure to develop and implement corrective actions for a repetitive problem of damaging equipment in the drywell during outage work was a performance deficiency. The trend CAP was closed out with no corrective action taken. The inspectors also determined that the evaluation of this CAP did not receive any peer or additional management review before being closed out. While the licensee's process does not require an additional peer or management review for evaluations completed by management, the inspectors concluded that such a review could have likely prevented this violation from occurring. During the inspection, an additional CAP (027075) related to equipment damage in the drywell was identified by the inspectors.

Analysis. The inspectors reviewed these issues against the guidance contained in Appendix B, "Issue Dispositioning Screening," of IMC 0612, "Power Reactor Inspection Reports," to determine whether the finding was minor. The inspectors concluded that the finding was more than minor because if left uncorrected, the HPCI system could be adversely affected due to the degrading pump seal and additional instances of damage to safety related mitigating equipment could occur.

Because this finding was greater than minor, the inspectors reviewed it in accordance with Manual Chapter 0609, "Significance Determination Process," Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," regarding mitigating systems. Because the HPCI pump was still operable and additional instances of equipment damage had not occurred, this finding screened as Green and was of very low safety significance.

Enforcement. Appendix B of 10 CFR 50, Criterion XVI, states, in part, that measures shall be established to assure that conditions adverse to quality, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures



shall assure that the condition is determined and corrective action taken to preclude repetition. Contrary to the above, the licensee failed to take corrective action to prevent repetitive failures of the HPCI pump seal leakage and equipment damage in the drywell. Because of the low safety significance of these issues and because each issue was entered into the corrective action program, the NRC is treating these issues as a Non-Cited Violation (NCV 50-331/08-04), in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

d. Assessment of Safety-Conscious Work Environment

(1). Inspection Scope

During the conduct of interviews, document reviews and observations of activities, the inspectors looked for evidence that suggested plant employees may be reluctant to raise safety concerns. The inspectors also discussed the implementation of the Employee Concerns Program conducted per Administrative Control Procedure (ACP) 114.7, "Employee Safety Concerns", Revision 6, with the station's program owner and reviewed a recent Safety Conscious Work Environment self-assessment.

(2). Assessment

The individuals interviewed during the inspection indicated they were not hesitant to identify safety concerns. Review of NRC allegation records and the licensee's employee concern program showed few individuals that felt it necessary to raise concerns outside of the corrective action program.

(3). Findings

No findings of significance were identified.

e. Exit Meeting

On June 13, 2003, the inspectors conducted an interim exit meeting with the licensee to discuss the potential findings identified during the inspection. A final exit meeting was conducted telephonically on July 7, 2003, to discuss the potential violations identified during the inspection.

ATTACHMENT: SUPPLEMENTAL INFORMATION

## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

J. Bjorseth, Plant Manager  
C. Bleau, Senior Engineer, Licensing  
S. Catron, Regulatory Affairs Manager  
P. Dutcher, I&C Supervisor  
T. Evans, Operations Manager  
E. Harrison, Shift Manager  
R. Harter, Performance Improvement Supervisor  
B. Klotz, AR Administrator  
C. Kress, Training Manager  
W. McVicker, Operational Experience Coordinator  
R. Murrell, Performance Improvement Manager  
S. Nelson, Radiation Protection Manager  
M. Peifer, Site Vice President  
G. Pry, Assistant Operations Manager  
W. Simmons, Maintenance Manager  
M. Tepley, Project Director, Dry Cask Storage  
D. Wheeler, Chemistry Manager  
G. Whittier, System Engineer, HPCI and RCIC

### Nuclear Regulatory Commission

J. Caldwell, Deputy Regional Administrator  
G. Wilson, Senior Resident Inspector

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

50-331/03-08-01	NCV	Inadequate Dedication of Commercial Grade Equipment
50-331/03-08-02	NCV	Inadequate Assessment of Risk Due to Out of Service Equipment
50-331/03-08-03	URI	Operation of the drywell MOVs under reduced voltage
50-331/03-08-04	NCV	Inadequate Corrective Action to Multiple Equipment Failures

### Closed

N/A

## LIST OF ACRONYMS USED

ACE	Apparent Cause Evaluation
ACP	Administrative Control Procedure
AR	Action Request
CAP	Corrective Action Program
CE	Condition Evaluation
CFR	Code of Federal Regulations
CR	Condition Report
CST	Condensate Storage Tank
DAEC	Duane Arnold Energy Center
DRP	Division of Reactor Projects
HPCI	High Pressure Coolant Injection
IMC	Inspection Manual Chapter
IR	Inspection Report
LCO	Limiting Condition of Operation
LLRT	Local Leak Rate Test
MOV	Motor-Operated Valve
NCV	Non-Cited Violation
NMC	Nuclear Management Corporation
NRC	Nuclear Regulatory Commission
OE	Operating Experience
OWA	Operator Work-around
RCE	Root Cause Evaluation
RCIC	Reactor Core Isolation Cooling
RFO	Refueling Outage
SBDG	Standby Diesel Generator
SDP	Significance Determination Process
STP	Surveillance Test Procedure
TS	Technical Specification

## LIST OF DOCUMENTS REVIEWED

### Procedures

- \* Abnormal Operating Procedure AOP 317, "Loss of 120VAC Instrument Control Power", Rev. 51
- \* Administrative Control Procedure (ACP) 114.4, "Corrective Action Program", Rev. 12
- \* ACP 114.3, "Root Cause and Apparent Cause Analysis", Rev. 15
- \* ACP 114.5, "Action Request System", Rev. 35
- \* ACP 114.7, "Employee Concerns Program", Rev. 8
- \* ACP 102.1, "External Operating Experience," Rev. 19
- \* ACP 1201.2, "Conduct of Systems Engineering," Rev. 7
- \* STP 3.6.1.1-03, "Containment Leak Tightness Test - Type 'B' Penetrations"
- \* STP 3.6.1.3-06, "ASME In-Service Valve Testing"
- \* NG-02-0499, "Plant Leakage Line Management Self Assessment Report"
- \* FP-PA-OE-01, NMC Corporate, "External Operating Experience," Rev. 0
- \* NGA02F001H, NMC Corporate, "General Access Training," Rev. 2
- \* NGA01F001H, NMC Corporate, "Plant Access Training, Self-Study Guide," Rev. 2
- \* Enhancement of DAEC External Operating Experience Program (proposed)

### CAPs Reviewed

- |        |   |
|--------|---|
| 002834 | 1D45 (120 Volt Uninterruptible AC Power Supply) trip during cycling of MO1909         |
| 005500 | 1D45 (120 Volt Uninterruptible AC Power Supply ) input fuse blowing                   |
| 007235 | 1D45 trouble annunciator received when cycling MO2316                                 |
| 009530 | Continuing to receive undervoltage alarm when cycling MO2322                          |
| 011916 | While stroking MOV1909, 1D45 (120 V Uninterruptible AC Power Supply) transferred      |
| 026860 | 1D45 blown fuse while opening MO 1909   |
| 026874 | 1D45 uninteruptible alarms while cycling large 250 volt dc valves                     |
| 027798 | Evaluate CSM's for pump shaft bearing in light of recent operating experience         |
| 019493 | CV1611 (RFP-1P-1B Recirc to Condenser) Failed Open upon Start of 'B' Feedpump         |
| 027737 | NOS Finding: Failure to Complete Corrective Actions                                   |
| 019082 | Electrical Ground Caused PSV 4402 (Main Steam Line 'B' ADS Relief Valve) to Actuate   |
| 005624 | PSV 4402 (Main Steam Line 'B' ADS Relief Valve) Did Not Open During STP 3.4.3-03      |
| 010709 | Temperature Rises Observed for ADS Relief Valve PSV 4402                              |
| 027335 | Found Field Wires at TE 4241 Landed Incorrectly and Unsigned Termination Sheet        |
| 026887 | Wiring Found Reversed for PS 4407   |
| 027087 | PSV 4405 Lost Indication and Blew Fuses When Cycling for STP 3.4.3-03                 |
| 027075 | PSV 4400 Bellows Failure Alarm and Lite Actuated During Reactor Startup               |
| 026361 | Penetration N230B (JX201) Will Not Hold Pressure                                      |
| 009797 | Unable to Complete STP 3.6.1.1-03 Containment Leak Tightness Test-Type B Penetrations |
| 019199 | HPCI Declared Inoperable Due to Oil Leak on a Threaded Fitting                        |

019162 Potential Seat Leakage Through Either/Both CV1579 / CV1621 (A/B Feedwater Reg Valves)

011584 Unplanned LCO Entry on Kaman 9/10 Due to Inability to Complete STP on Work Shift

020061 'A' RHRSW Strainer High D/P While Running 'A' and 'C' RHRSW Pumps

011540 Unknown Foreign Material Found in Pump House Stilling Basin

009185 Visual Inspection of Snubbers (STP NS992802) Revealed Unsat Condition

026481 Three Lisega Snubbers with Discolored Oil Found During Visual STP NS992806

027724 1G-31 'A' SBDG Exhaust Pipe Debris

026533 MO4424 (Main Steam Line Drain Outboard Isolation) Failed LLRT

009747 MO4424 (Main Steam Line Drain Outboard Isolation) Failed LLRT Type 'C' Containment Testing

007842 Rework Evaluation of V25-0001 (Valve, Chk, RCIC, Torus Water Suction Line)

026734 V25-0001 Failed STP NS590005

010831 1G100/Eng (TSC/DAC Standby Diesel Generator Engine) Maintenance, Procedural, and Safety Concerns

026571 Adverse Trend in Equipment Damage in the Drywell Due to Outage Work

019954 HPCI Pump Outboard Seal was Observed to Have a Solid Stream Leak (1 Cup per Minute) During Surveillance Runs on 12/04/02

010601 Potential Internal Binding in CV 1064 (Main Steam Drain Isolation to Condenser)

027034 Replace CV 1064 with New Valve and Actuator (EMA A54646) at First Opportunity

009794 MO 2401 (RCIC Steam Supply Outboard Isolation) Tripped on Thermal Overload

005277 MO 2401 (RCIC Steam Supply Outboard Isolation) Exceeded Its ASME 13-17 Seconds to Open

010699 1P032 (Main Condenser Mechanical Vacuum Pump) Has Tripped Twice (High Amps) While Establishing a Vacuum

005031 1P032 (Main Condenser Mechanical Vacuum Pump) Tripping Breaker on "Over Current"

019151 RPS Trip Caused by High SDV Level While Shutdown

012397 B FRV position oscillations.

019106 Multiple DIV 1 125VDC System Trouble Alarms While Cycling MO2404.

019119 Operator Work-Around; 1VCH001A (Control Building Chiller) tripped due to low lube oil temperature on the start of the ESW pump for weekly service water sampling.

019170 CV-1579 Had Oscillating Signal

019187 Rx SCRAM after loss of 1P001B (Rx Feedwater Pump).

019247 Unanticipated Reactor Mode Change

019337 OWA: BS3300 (1P-49 Cooling Water Supply Basket Strainer) High DP

025639 OWA: Control Rod Double Notching. (Mis-positioned control rod)

025869 Inadvertent entry into a technical specification.

026214 A fuel assembly struck a spent fuel bundle while being moved.

026269 Adverse trend in events with potential damage to fuel bundles.

027106 Reactor Mode was changed while in a Tech Spec action statement.

010156 RHR room clean area contaminated during venting and draining for startup.

011263 No radioactive material informational tags on diving equipment stored in LLRWSF.

011269 "Hot Trash identification and inventory," and related "3rd Session 2002 HP Continuing Training", Rev. 0.

011329 Safety Evaluation for removal of HPCI/RCIC auto open logic lacks discussion or evaluation of the need for annunciation when the steam supply valves are not full open.

011804 P12201A per Champs and document should be a Dresser Model - the one installed is a Crosby - need to find out what really needs to be installed.

011917 CV2315 (HPCI CST Test Return Line Isolation) exceeded allowable "Stroke Time".

012071 HPCI has been placed in Maintenance Rule Yellow due to management concerns about system performance.

013346 Worker entry into a High Radiation Area on a RWP that does not allow HRA entry.

013759 Health Physics Job Standard not followed for posting areas during resin HIC preparation for resin transfer.

014112 Mast Worker on Refuel Floor nor on the correct RWP.

014246 RCIC Lube Oil unable to be filled completely after maintenance.

014306 Actual plant overall risk color is 'yellow', when it was inadvertently published as being 'Green'.

019199 HPCI declared inoperable due to oil leak on a threaded fitting.

019210 During a HPCI run an Operations Technician entered the Torus (posted - Stop, Danger, High Radiation Area, Contact HP prior to entry)

019466 Greater than 50% of the allowable RCIC LCO (14 days) has been exceeded.

019664 Per Maintenance Rule Module 4, Section 7.B, Feedwater is being returned to RED and the associated Evaluation of 50.65(a)(1) [RED] Analysis for Goal Setting.

025197 GE SIL-646m Target Rock SRV Failure to Fully Open.

025225 NRC IN 2003-1, Failure of a BWR Target Rock Main Steam Safety/Relief Valve.

025394 Several of the floor drains in the Drywell are not draining.

025715 RCIC failure to meet required flow during STP 3.5.3-02.

026056 South East corner room housekeeping.

026742 Steam Dryer Indications observed during RF018 IVVI exam and the associated General Electric Nuclear Energy Document GE-NE-000-015-2453-01, Review and Evaluation of Steam Dryer Visual Indications.

027622 Determine if HP Peer Checks of RWP for HRA Entries be controlled by Procedures.

026855 CAP Backlog Above Site Goal

027704 Unavailability of inverter 1D15 not included in risk review of emergent work

027422 1D15 (120 Volt Instrument Power Supply) failed

#### Root Cause Evaluations

RCE 001001 Reactor Coolant Chemistry Excursion and Resultant Reactor Scram

RCE 000099 Breaker 1A307 Failed to automatically charge

RCE 000226 Maintenance Rule 50.65 (a) (1) Red 125VDC

RCE 000201 Electrical Ground Caused PSV 4402 (Main Steam Line 'B' ADS Relief Valve) to Actuate

RCE 000212 HPCI Declared Inoperable Due to oil Leak on a Threaded Fitting

RCE 000213 Root Cause Report for AR 29280, Unauthorized High Radiation Area Entry.

### Apparent Cause Evaluations

- ACE 000219 CV1611 (RFP-1P-1B Recirc to Condenser) Failed Open upon Start of 'B' Feedpump
- ACE 001159 PSV 4405 Lost Indication and Blew Fuses When Cycling for STP 3.4.3-03
- ACE 001126 Three Lisega Snubbers with Discolored Oil Found During Visual STP NS992806
- ACE 001137 V25-0001 Failed STP NS590005
- ACE 000256 HPCI Pump Outboard Seal was Observed to Have a Solid Stream Leak (1 Cup per Minute) During Surveillance Runs on 12/04/02
- ACE 000091 Worker entry into a High Radiation Area on a RWP that does not allow HRA entry.
- ACE 000124 Health Physics Job Standard not followed for posting areas during resin HIC preparation for resin transfer.
- ACE 000146 Mast Worker on Refuel Floor nor on the correct RWP.
- ACE 000157 RCIC Lube Oil unable to be filled completely after maintenance.
- ACE 000160 Actual plant overall risk color is 'yellow', when it was inadvertently published as being 'Green'.
- ACE 001041 Several of the floor drains in the Drywell are not draining.
- ACE 001075 RCIC failure to meet required flow during STP 3.5.3-02.
- ACE 001187 Priority Level 1,2,&3 "Evaluations" are not being completed within 30 days.

### Condition Evaluations

- CE 000725 Condition Evaluation for Past Operability of LLS Logic
- CE 000591 Penetration N230B (JX201) will Not Hold Pressure
- CE 000650 Adverse Trend in Equipment Damage in the Drywell Due to Outage Work
- CE 000600 1A601 Under Voltage Close Test Was 80 VDC Instead of 70 VDC
- CE 000465 Negative Operations Department Procedure Usage and Adherence Trend

### Corrective Actions

- CA027612 DAEC CAP Self-Assessment - AFI in "Timeliness of evaluations and actions."
- CA027681 Review the expectations and documentation of System Engineer Qualifications and Turnovers.
- CA026678 Interim Effectiveness Review of CAP19466.
- CA027736 CAP Backlog Above Site Goal.

### Operability Determinations

- AR 32234 During RCIC operability test on August 21, 2002, oil level could not be maintained.

### Duane Arnold Energy Center Audits and Assessments

- \* DAEC Corrective Action Program Performance Indicator Summary, March 2003
- \* 10CFR50.59 Screening, CE000723 "Steam Dryer Observed During RF018 IVVI Exam."
- \* Health and Status Report for High Pressure Coolant Injection, as of 5/27/2003.
- \* Health and Status Report for Reactor Core Isolation Cooling, as of 6/9/2003.
- \* CAP Self Assessment Report, March 17-21,2003

### Non-Cited Violations

- NCV 50-331/0206-01 Inadequate assessment and management of risk during maintenance on the RCIC system.
- NCV 50-331/0207-04 Inadequate corrective maintenance procedure that was used to drain and fill the Reactor Core Isolation Cooling (RCIC) Lubricating Oil System.
- NCV 50-331/0303-01 Failure of the corrective actions to adequately address the degraded drains in the southeast corner room.
- NCV 50-331/0303-03 Failure to evaluate the addition of the filter socks on the operation of the drywell floor drain system.
- NCV 50-331/0303-04 Inadequate maintenance procedure that was used to calibrate the RCIC Turbine Governor.

### Others

- Excellence Plan Top Ten Lists, Rev. 6, 4/17/2003
- APED-R81-001, "Division 1 Instrument AC Load Study"
- Duane Arnold Equipment Reliability Evaluation, November 15, 2002
- Technical Evaluation Of Replacement Items 96-019
- Procurement Action Request 97-020
- Procurement Receiving Report CPR107
- Purchase Order T 15935
- Root Cause Report for AR 32025
- Root Cause Report for AR28166, "Loss of Instrument AC Bus"
- Root Cause Report for AR 31430, "B Emergency Service Water Pump Failure"
- AR 9393        Replace CV 1064 with New Valve and Actuator (EMA A54646) at First Opportunity
- AR 24901        Highly Radioactive Particles Associated with Fuel Pool Work.
- AR 28886        Fact Finding Meeting - Error in entry into a High Radiation Area.
- AR 29687        Review NRC IN 2002-06, Design Vulnerability in BWR Reactor Vessel Level Instrumentation Backfill Modification.
- AR 32234        RCIC Lube Oil unable to be filled completely after maintenance.
- AR 31430        Emergency Service Water Pump Failure
- AR 32276        GE SIL-644, BWR/3 Steam Dryer Failure
- AR 32589        BWR Owners Group 9/16/02 Letter #OG02-0358-01, Summary of Special September 13, 2002, PIRT Call Regarding Target Rock SRV Main Stage Failure, and the Power Point Presentation.
- AR 32753        NRC Information Notice (IN) 2002-06, Failure of Steam Dryer Cover Plate After a Recent Power Uprate.
- Work Order A48343 HPCI Pump Seal Replacement
- DAEC Plant Status Report, May 28, 2003

### NRC Documents

- Generic Letter 91-05 Licensee Commercial Grade Dedication Programs



### Information Notices

- IN 2002-03 Highly Radioactive Particle Control Problems During Spent Fuel Pool Cleanout.
- IN 2002-06 Design Vulnerability in BWR Reactor Vessel Level Instrumentation Backfill Modification.
- IN 2002-26 Failure of Steam Dryer Coverplate After a Recent Power Uprate.
- IN 2003-01 Failure of a Boiling Water Reactor Target Rock Main Steam Safety/Relief Valve.

### NRC Inspection Reports

- IR 50-331/01-03 (DRP)
- IR 50-331/01-04 (DRP)
- IR 50-331/01-05 (DRP)
- IR 50-331/01-06 (DRP)
- IR 50-331/01-07 (DRP)
- IR 50-331/01-08 (DRP)
- IR 50-331/01-09 (DRP)
- IR 50-331/01-10 (DRS)
- IR 50-331/02-02 (DRP)
- IR 50-331/02-03 (DRP)
- IR 50-331/02-05 (DRP)
- IR 50-331/02-06 (DRP)
- IR 50-331/02-07 (DRP)
- IR 50-331/02-11 (DRS)
- IR 50-331/02-12 (DRS)
- IR 50-331/03-03 (DRP)