

May 22, 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 50-331/03-02(DRS)

Dear Mr. Peifer:

On March 7, 2003, the NRC completed an inspection at your Duane Arnold Energy Center facility. The enclosed report documents the inspection findings which were initially discussed on February 14, 2003, with you and members of your staff. The final inspection findings were discussed telephonically with Mr. K. Schneider of your staff on May 12, 2003.

The inspection examined the effectiveness of activities conducted under your license as they related to implementation of your NRC approved Fire Protection Program. The inspection consisted of a selected examination of design drawings, calculations, analyses, procedures, audits, field walkdowns, and interviews with personnel.

Based on the results of this inspection, the inspectors identified three issues of very low safety significance (Green). These issues were determined to involve violations of NRC requirements. However, because of their very low safety significance and because the issues have been entered into your corrective action program, the NRC is treating these issue 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, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Dresden Nuclear Power Station facility.

The inspectors also identified an issue that involves an unresolved item. This issue is discussed in the enclosed report and requires additional information to evaluate its significance. The specific issue requiring a response is identified in Enclosure 2. Please provide a written response to the issue identified in Enclosure 2 within 60 days of receipt of this letter.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your responses will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Julio F. Lara, Chief
Electrical Engineering Branch
Division of Reactor Safety

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

Enclosures: 1. Inspection Report 50-331/03-02(DRS)
2. Request for Additional Information

cc w/encls: E. Protsch, Executive Vice President -
Energy Delivery, Alliant;
President, IES Utilities, Inc.
J. Cowan, Chief Nuclear Officer
J. Forbes, Senior Vice President
J. Bjorseth, Plant Manager
S. Catron, Manager, Regulatory Affairs
J. Rogoff, Esquire General Counsel
B. Lacy, Nuclear Asset Manager
D. McGhee, Iowa Department of Commerce
Chairman, Linn County Board of Supervisors
State Liaison Officer
Chairperson, Iowa Utilities Board
The Honorable Charles W. Larson, Jr.
Iowa State Representative

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 - D. McGhee, Iowa Department of Commerce Chairman, Linn County Board of Supervisors State Liaison Officer
 - Chairperson, Iowa Utilities Board
 - The Honorable Charles W. Larson, Jr. Iowa State Representative

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U.S. NUCLEAR REGULATORY COMMISSION
REGION III

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

Report No: 50-331/03-02(DRS)

Licensee: Nuclear Management Company, LLC

Facility: Duane Arnold Energy Center

Location: Palo, IA

Dates: January 27 through May 12, 2003

Lead Inspector: R. Langstaff, Senior Reactor Inspector
Electrical Engineering Branch

Inspectors: D. Schrum, Reactor Inspector,
Mechanical Engineering Branch

K. Sullivan, Contractor
Brookhaven National Laboratory

Approved By: Ronald N. Gardner, Chief
Electrical Engineering Branch
Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000331-03-02(DRS), Nuclear Management Company, LLC; on 01/27/03-05/12/03, Duane Arnold Energy Center. Fire Protection Triennial.

The inspection was conducted by a team of two Region III inspectors and one contractor. The inspection identified three Non-Cited Violation (NCVs). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process." The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described at its Reactor Oversight Process website at <http://www.nrc.gov/reactors/operating/oversight.html>.

A. Inspector-Identified Findings

Cornerstone: Mitigating Systems

- Green. The inspectors identified that the licensee failed to demonstrate that instrumentation for reactor water level, required to support safe shutdown for a fire in Fire Area RB-1, would be free from fire damage. The failure to ensure that a means to monitor reactor water level would be free of fire damage is a violation of 10 CFR Part 50, Appendix R, Section III.G.2.

This issue was greater than minor because instrumentation necessary to provide information to operators for safe shutdown was affected. The finding was determined to be of very low safety significance, i.e., Green, because site emergency operating procedures would have directed operators to operate equipment necessary to achieve safe shutdown conditions. Because the finding was of very low safety significance, and the finding was captured in the licensee's corrective action system, this finding is being treated as an NCV consistent with Section VI.A.1 of the NRC Enforcement Policy (Section 1R05.3.b(1)).

- Green. The inspectors identified that the licensee failed to demonstrate that process monitoring instrumentation, required to support safe shutdown for a fire in Fire Area RB-1, would be free of fire damage. Specifically, the licensee failed to ensure that there was adequate circuit breaker coordination for an instrument power supply. The failure to ensure that a train of process monitoring would be free of fire damage is a violation of 10 CFR Part 50, Appendix R, Section III.G.2.

This issue was greater than minor because instrumentation necessary to provide information to operators for safe shutdown was affected. The finding was determined to be of very low safety significance, i.e. Green, because the licensee had proceduralized steps to restore power to the affected instrumentation bus. Because the finding was of very low safety significance, and the finding was captured in the licensee's corrective action system, this finding is being treated as an NCV consistent with Section VI.A.1 of the NRC Enforcement Policy (Section 1R05.3.b(2)).

Cross-Cutting Issues

- Green. The inspectors identified that the licensee failed to adequately correct a previously identified condition adverse to quality relating to the potential for smoke to enter the control room due to fire outside the control room. The failure to take adequate corrective action is a violation of 10 CFR Part 50, Appendix B, Criterion XVI.

This issue was greater than minor because smoke in the control room could affect operators ability to operate the plant. The finding was determined to be of very low safety significance, i.e. Green, because the plant could initially be maintained in hot shutdown due to the automatic actions of available equipment. Because the finding was of very low safety significance, and the finding was captured in the licensee's corrective action system, this finding is being treated as an NCV consistent with Section VI.A.1 of the NRC Enforcement Policy (Section 4OA2.b).

REPORT DETAILS

Summary of Plant Status: The unit was operated at or near full power from January 27 through January 31, 2003. On February 1, 2003, the unit was manually scrammed to address problems associated with a condenser tube leak. The unit was returned to criticality on February 14, 2003, and synchronized to the grid on February 15, 2003. The unit was operated at or near full power from February 16, 2003, until March 23, 2003. On March 23, 2003, the unit was manually scrammed to support a refueling outage. The unit was returned to criticality on April 19, 2003, and returned to or near full power operation on April 21, 2003. The unit was operated at or near full power for the remainder of the inspection period.

1. REACTOR SAFETY

Cornerstones: Initiating Events and Mitigating Systems

1R05 Fire Protection (71111.05)

The purpose of this inspection was to review the Duane Arnold Energy Center fire protection program for selected risk-significant fire areas. Emphasis was placed on verifying that the post-fire safe shutdown capability and the fire protection features were maintained free of fire damage to ensure that at least one post-fire safe shutdown success path was available. The inspection was performed in accordance with the NRC regulatory oversight process using a risk-informed approach for selecting the fire areas and attributes to be inspected. The lead inspector used the Duane Arnold Energy Center Individual Plant Examination for External Events (IPEEE) to choose several risk-significant areas for detailed inspection and review. The fire areas and zones chosen for review during this inspection were:

<u>Fire Area</u>	<u>Description of Fire Area Reviewed</u>
CB-1	Cable spreading room, control room and HVAC area
CB-3	East essential switchgear room and 125 VDC battery
RB-1	757 elevation reactor building and NW torus area

The primary focus for this inspection was on the safe shutdown procedures and safe shutdown methodology for the selected fire areas. The determination of license commitments and changes to the fire protection program were reviewed for both fire areas.

.1 Systems Required to Achieve and Maintain Post-Fire Safe Shutdown

10 CFR Part 50, Appendix R, Section III.G.1, required the licensee to provide fire protection features that were capable of limiting fire damage to structures, systems, and components important to safe shutdown. The structures, systems, and components that were necessary to achieve and maintain post-fire safe shutdown were required to

be protected by fire protection features that were capable of limiting fire damage to the structures, systems, and components so that:

- One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) was free of fire damage; and
- Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) could be repaired within 72 hours.

Specific design features for ensuring this capability were specified by 10 CFR Part 50, Appendix R, Section III.G.2.

a. Inspection Scope

The inspectors reviewed the plant systems required to achieve and maintain post-fire safe shutdown to determine if the licensee had properly identified the components and systems necessary to achieve and maintain safe shutdown conditions for each fire zone selected for review. Specifically, the review was performed to determine the adequacy of the systems selected for reactivity control, reactor coolant makeup, reactor heat removal, process monitoring, and support system functions. This review included the fire protection safe shutdown analysis.

The inspectors also reviewed the operators' ability to perform the necessary manual actions for achieving safe shutdown including a review of procedures, accessibility of safe shutdown equipment, and the available time for performing the actions.

The inspectors reviewed the updated final safety analysis report and the licensee's engineering and/or licensing justifications (e.g., NRC guidance documents, license amendments, technical specifications, safety evaluation reports, exemptions, and deviations) to determine the licensing basis.

b. Findings

No findings of significance were identified.

.2 Fire Protection of Safe Shutdown Capability

10 CFR Part 50, Appendix R, Sections III.G.2, required separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a three hour rating. If the requirements cannot be met, then alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room, or zone under consideration should be provided (Section III. G.3).

a. Inspection Scope

For each of the selected fire areas, the inspectors reviewed the licensee's safe shutdown analysis to ensure that at least one post-fire safe shutdown success path was available in the event of a fire. This included a review of manual actions required to achieve and maintain hot shutdown conditions and make the necessary repairs to reach cold shutdown within 72 hours. The inspectors also reviewed procedures to verify that adequate direction was provided to operators to perform these manual actions. Factors,

such as timing, access to the equipment, and the availability of procedures, were considered in the review.

The inspectors also evaluated the adequacy of fire suppression and detection systems, fire area barriers, penetration seals, and fire doors to ensure that at least one train of safe shutdown equipment was free of fire damage. To do this, the inspectors observed the material condition and configuration of the installed fire detection and suppression systems, fire barriers, and construction details and supporting fire tests for the installed fire barriers. In addition, the inspectors reviewed license documentation, such as deviations, detector placement drawings, fire hose station drawings, carbon dioxide pre-operational test reports, smoke removal plans, fire hazard analysis reports, safe shutdown analyses, and National Fire Protection Association (NFPA) codes to verify that the fire barrier installations met license commitments.

b. Findings

No findings of significance were identified.

.3 Post-Fire Safe Shutdown Circuit Analysis

10 CFR Part 50, Appendix R, Section III.G.1, required that structures, systems, and components important to safe shutdown be provided with fire protection features capable of limiting fire damage to ensure that one train of systems necessary to achieve and maintain hot shutdown conditions remained free of fire damage. Options for providing this level of fire protection were delineated in 10 CFR Part 50, Appendix R, Section III.G.2. Where the protection of systems whose function was required for hot shutdown did not satisfy 10 CFR Part 50, Appendix R, Section III.G.2, an alternative or dedicated shutdown capability and its associated circuits, was required to be provided that was independent of the cables, systems, and components in the area. For such areas, 10 CFR Part 50, Appendix R, Section III.L.3, specifically required the alternative or dedicated shutdown capability to be physically and electrically independent of the specific fire areas and capable of accommodating post-fire conditions where offsite power was available and where offsite power was not available for 72 hours.

a. Inspection Scope

On a sample basis, the inspectors investigated the adequacy of separation provided for the power and control cabling of redundant trains of shutdown equipment. This investigation focused on the cabling of selected components in systems important for safe shutdown. The inspectors' review also included a sampling of components whose inadvertent operation due to fire may adversely affect post-fire safe shutdown capability. The purpose of this review was to determine if a single exposure fire, in one of the fire areas selected for this inspection, could prevent the proper operation of both safe shutdown trains.

b. Findings

b(1) Lack of Assured Reactor Water Level Instrumentation

The inspectors identified that the licensee failed to demonstrate that instrumentation for reactor water level, required to support safe shutdown, would be free of fire damage. This issue was considered to be of very low safety significance and was dispositioned as a Green NCV.

For a postulated fire in Fire Area RB-1, the licensee could not demonstrate that a reliable indication of reactor water level would remain available. In the event of fire in this area, Division I equipment was relied upon to achieve and maintain safe shutdown conditions. However, Division I reactor water level transmitters (transmitters LT 4565B and LT4565C) could become unavailable due to fire damage to equipment or cabling that is located in this fire area. In addition, the capability to monitor reactor water level at local Yarway indicators located outside the main control room would be unreliable due to potential flashing of heated instrument sensing line reference legs during emergency depressurization. Emergency depressurization would be required in order to allow injection using the credited low pressure injection makeup system (Core Spray). In the event this were to occur (i.e., a loss of all reactor water level indication), operators are directed to enter Emergency Operating Procedure "RPV Flood Procedure." However, the inspection team noted that execution of this EOP could also be hindered by a loss of torus pressure indication that may result from coordination deficiencies described in Section 1R05.3.b(2) below.

Title 10 CFR Part 50, Appendix R, Section III.G.1, requires, in part, that fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage. Generic Letter (GL) 81-12, Fire Protection Rule (45 FR 76602, November 19, 1980), identified process monitoring equipment, including reactor water level instrumentation for boiling water reactors (BWRs), as necessary equipment to support hot shutdown. Additionally, Information Notice (IN) 84-09, Lessons Learned From NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R), listed the minimum monitoring capability considered necessary to achieve safe shutdown. For BWR plant designs, the capability to monitor reactor water level indication is identified as a required parameter. Title 10 CFR Part 50, Appendix R, Section III.G.2, requires, in part, that where cables or equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of a specified means of ensuring that one of the redundant trains is free of fire damage be provided. The failure to demonstrate that a specified means to monitor reactor water level would be free of fire damage is a violation of 10 CFR Part 50, Section III.G.2.

In accordance with Inspection Manual Chapter (IMC) 0612, the inspectors determined that the issue was more than minor because the finding was associated with the protection against external factors (i.e., fire) attribute of the mitigating systems reactor safety cornerstone and affected the mitigating systems objective in that instrumentation

necessary to provide information to operators for safe shutdown was affected. In accordance with IMC 0609, Appendix A, the inspectors performed a Significance Determination Process (SDP) Phase 1 screening and determined that the finding degraded the Fire Protection portion of the Mitigation Systems Cornerstone. As such, screening under IMC 0609, Appendix F, was required. Based on review of IMC 0609, Appendix F, the inspectors determined that the finding did require a Phase 2 analysis because adequate Appendix R fire protection features were not provided. However, although water level instrumentation may not have been available, site emergency operating procedures would have directed operators to operate equipment necessary to achieve safe shutdown conditions. As such, this finding was considered to be of very low safety significance (i.e., Green). The failure to provide an assured means to monitor reactor water level is a violation of 10 CFR Part 50, Section III.G.2. This violation is associated with a finding that is characterized by the SDP as having very low risk significance (i.e., Green) and is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the NRC Enforcement Policy. This violation was entered into the licensee's corrective action program as CAP025608 (NCV 050-331/03-02-01).

b(2) Inadequate Circuit Breaker Coordination for Instrument Power Supply

The inspectors identified that the licensee failed to demonstrate that process monitoring instrumentation, required to support safe shutdown, would be free of fire damage. This issue was considered to be of very low safety significance and was dispositioned as a Green NCV.

In a Safety Evaluation Report (SER) for Appendix R, dated January 6, 1983, the NRC staff stated: "All power and control circuit breakers and fuses are coordinated, which includes control power for instrumentation loops." Contrary to this statement, the team determined that in the event of fire in Fire Area RB-1, 120VAC distribution panel 1Y11 was susceptible to loss due to inadequate coordination of its electrical protection devices (circuit breakers). For fire in Fire Area RB-1, power supply 1Y11 is relied upon to provide electrical power to various instruments relied upon to accomplish post-fire safe shutdown conditions. Due to a lack of selective coordination of electrical protection devices, a fire-induced fault (bolted-short to ground) on one of the load cables of this supply could cause the upstream feeder breaker to trip before the individual load breaker. If this were to occur, instrumentation credited in the safe shutdown analysis for accomplishing safe shutdown would be unavailable until operation of power supply 1Y11 was recovered by manual operator actions, prescribed by procedure AOP 913, involving the shedding of all loads and restoration of only those loads required for post-fire safe shutdown.

Title 10 CFR Part 50, Appendix R, Section III.G.1, requires, in part, that fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage. Generic Letter 81-12 identified process monitoring equipment as necessary equipment to support hot shutdown. Title 10 CFR Part 50, Appendix R, Section III.G.2, requires, in part, that where cables or equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area

outside of primary containment, one of a specified means of ensuring that one of the redundant trains is free of fire damage be provided. The failure to ensure that process monitoring equipment is free of fire damage is a violation of 10 CFR Part 50, Section III.G.2.

In accordance with IMC 0612, the inspectors determined that the issue was more than minor because the finding was associated with the protection against external factors (i.e., fire) attribute of the mitigating systems reactor safety cornerstone and affected the mitigating systems objective. In accordance with IMC 0609, Appendix A, the inspectors performed an SDP Phase 1 screening and determined that the finding degraded the Fire Protection portion of the Mitigation Systems Cornerstone. As such, screening under IMC 0609, Appendix F, was required. Based on review of IMC 0609, Appendix F, the inspectors determined that the finding did require a Phase 2 analysis because adequate Appendix R fire protection features were not provided. However, although process monitoring instrumentation may not have been initially available, the licensee had proceduralized steps to restore power to the affected instrumentation bus. As such, this finding was considered to be of very low safety significance (i.e., Green). The failure to ensure process monitoring was available is a violation of 10 CFR Part 50, Section III.G.2. This violation is associated with a finding that was characterized by the SDP as having very low risk significance (i.e., Green) and is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the NRC Enforcement Policy. This violation was entered into the licensee's corrective action program as CAP025607 (NCV 50-331/03-02-02).

.4 Alternative Safe Shutdown Capability

10 CFR Part 50, Appendix R, Section III.G.1, required that structures, systems, and components important to safe shutdown be provided with fire protection features capable of limiting fire damage to ensure that one train of systems necessary to achieve and maintain hot shutdown conditions remained free of fire damage. Options for providing this level of fire protection were delineated in 10 CFR Part 50, Appendix R, Section III.G.2. Where the protection of systems whose function was required for hot shutdown did not satisfy 10 CFR Part 50, Appendix R, Section III.G.2, an alternative or dedicated shutdown capability independent of the area under consideration was required to be provided. Additionally, alternative or dedicated shutdown capability must be able to achieve and maintain hot standby conditions and achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter. During the post-fire safe shutdown, the reactor coolant process variables must remain within those predicted for a loss of normal alternating current (AC) power, and the fission product boundary integrity must not be affected (i.e., no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary).

a. Inspection Scope

The inspectors reviewed the licensee's systems required to achieve alternative safe shutdown to determine if the licensee had properly identified the components and systems necessary to achieve and maintain safe shutdown conditions. The inspectors also focused on the adequacy of the systems to perform reactor pressure control,

reactivity control, reactor coolant makeup, decay heat removal, process monitoring, and support system functions.

b. Findings

No findings of significance were identified.

.5 Operational Implementation of Alternative Shutdown Capability

10 CFR Part 50, Appendix R, Section III.L.2.d, required that the process monitoring function should be capable of providing direct readings of the process variables necessary to perform and control the functions necessary to achieve reactivity control, reactor coolant makeup, and decay heat removal.

a. Inspection Scope

The inspectors performed a walkdown of a sample of the actions defined in procedure AOP [Abnormal Operating Procedure] 915, Shutdown Outside Control Room, which was the procedure for performing a plant alternative shutdown from outside the control room for fire area CB-1. The inspectors verified that operators could reasonably be expected to perform the procedure actions within the identified applicable plant shutdown time requirements and that equipment labeling was consistent with the procedure.

The inspectors' reviews of the adequacy of communications and emergency lighting associated with these procedures are documented in Sections 1R05.6 and 1R05.7 of this report.

b. Findings

No findings of significance were identified.

.6 Communications

For a fire in an alternative shutdown fire area such as the cable spreading room, control room evacuation is required and a shutdown is performed from outside the control room. Radio communications are relied upon to coordinate the shutdown of both units and for fire fighting and security operations. 10 CFR Part 50, Appendix R, Section III.H., required that equipment provided for the fire brigade include emergency communications equipment.

a. Inspection Scope

The inspectors reviewed the adequacy of the communication system to support plant personnel in the performance of alternative safe shutdown functions and fire brigade duties.

b. Findings

No findings of significance were identified.

.7 Emergency Lighting

10 CFR Part 50, Appendix R, Section III.J., required that emergency lighting units with at least an eight-hour battery power supply be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto.

a. Inspection Scope

The inspectors performed a walkdown of a sample of the actions defined in procedure AOP 915. As part of the walkdowns, the inspectors verified that sufficient emergency lighting existed for access and egress to areas and for performing necessary equipment operations.

b. Findings

No findings of significance were identified.

.8 Cold Shutdown Repairs

10 CFR Part 50, Appendix R, Section III.L.5, required that equipment and systems comprising the means to achieve and maintain cold shutdown conditions should not be damaged by fire; or the fire damage to such equipment and systems should be limited so that the systems can be made operable and cold shutdown achieved within 72 hours. Materials for such repairs shall be readily available onsite and procedures shall be in effect to implement such repairs.

a. Inspection Scope

The inspectors reviewed the licensee's procedures to determine if any repairs were required to achieve cold shutdown. The inspectors determined that the licensee did require repair of some equipment to reach cold shutdown based on the safe shutdown methods used. The inspectors reviewed the procedures for adequacy.

b. Findings

No findings of significance were identified.

.9 Fire Barriers and Fire Zone/Room Penetration Seals

10 CFR Part 50, Appendix R, Section III.M, required that penetration seal designs be qualified by tests that are comparable to tests used to rate fire barriers.

a. Inspection Scope

The inspectors reviewed the test reports for three-hour rated barriers installed in the plant and performed visual inspections of selected barriers to ensure that the barrier installations were consistent with the tested configuration. In addition, the inspectors reviewed the fire loading for selected areas to ensure that existing barriers would not be challenged by a potential fire.

b. Findings - Fire Spread Rating and Thickness Requirements for Epoxy Floor Covering

During this inspection, the inspectors identified an unresolved item (URI) with respect to use of epoxy floor covering. Specifically, the inspectors identified that the epoxy floor covering applied over cement flooring, such as applied in the reactor building and other plant areas, may be a combustible not accounted for in licensee's fire protection program. The installed epoxy floor coating consisted of one coat of epoxy primer/sealer and one top coat of epoxy.

The licensee's initial evaluation, documented on CAP025540, indicated that the National Fire Protection Association's (NFPA) Fire Protection Handbook defined interior finish as materials thicker than 0.9 millimeter (mm) (equivalent to 0.035 inches). The licensee indicated in the evaluation that using vendor installation instructions for thicknesses of primer and top coat of epoxy that epoxy floor coating would not have to be considered as an interior finish. The inspectors requested that the licensee measure various sections of the epoxy flooring from the High Pressure Coolant Injection (HPCI) Pump Room to verify that it was less than 0.9 mm thickness. The licensee obtained measurements of three samples of the epoxy coating indicating thicknesses of 0.03850, 0.05100, and 0.05900 inches. The three measurements obtained exceeded the 0.9 mm thickness suggesting that the epoxy flooring should be considered an interior finish.

The Duane Arnold Energy Center (DAEC) Fire Hazards Analysis (FHA), Section FHA-200 contained Branch Technical Position (BTP) APCSB 9.5-1 Appendix A Regulatory Requirement and DAEC Commitments. The licensee's commitment in response to position D.1.(d) stated, in part:

"In general, areas housing safety-related systems, equipment, and components are concrete or masonry construction with no interior finishes applied to the surfaces."

Specific exceptions to this commitment were listed in the FHA. However, the epoxy floor covering was not listed as an exception to this commitment.

Generic Letter 86-10, Supplement 1, Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Trains Within the Same Fire Area (Supplement 1 to Generic Letter 86-10, "Implementation of Fire Protection Requirements") defined a "non-combustible material" as follows:

Noncombustible Material - (a) Material which, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat; (b) Material having a structural base of noncombustible material, with a surfacing not over 1/8-inch thick that has a flame spread rating of not higher than 50 when measured in accordance with ASTM E-84, "Surface Burning Characteristics of Building Materials." (There is an exception to this definition as defined by BTP Appendix A, Position D.1.(d). This position allows the use of combustible interior finishes when listed by a nationally recognized test laboratory, such as Factory Mutual or Underwriters Laboratories, Incorporated, for a flame spread, smoke and fuel contribution of 25 or less in its use configuration.)

The licensee provided the inspectors with documentation of an Underwriters Laboratory approved test for this type of epoxy flooring (documented by "Report on Surface Burning Characteristics Determined by ASTM E 84 Twenty-Five Foot Tunnel Furnace Test," Number T-10951, dated May 24, 2002). The test report conclusions indicated that the epoxy floor covering of the type installed at DAEC had a Flame Spread Rating of 110. This test indicated that the licensee's floor covering did not meet the guidance of GL 86-10 Supplement 1 nor did the covering meet licensee commitments in response to BTP Appendix A as described above.

In response to a NRC Resident Inspector staff concern that the epoxy floor covering could burn from fire area to fire area under doors, the licensee initiated roving fire watches as a compensatory measure until the floor covering could be evaluated. The licensee issued CAP 025540, "Detailed Operability Evaluation," dated March 14, 2003, to resolve the issues related to the epoxy floor covering. The licensee planned to perform an evaluation which demonstrated acceptability to use epoxy floor covering. This issue will be tracked as an URI pending NRC review of the licensee's evaluation. (URI 50-331/03-02-03(DRS))

.10 Fire Protection Systems, Features, and Equipment

a. Inspection Scope

The inspectors reviewed the material condition, operations lineup, operational effectiveness, and design of fire detection systems, fire suppression systems, manual fire fighting equipment, fire brigade capability, and passive fire protection features. The inspectors reviewed deviations, detector placement drawings, fire hose station drawings, carbon dioxide (CO₂) system pre-operational test reports, and fire hazard analysis reports to ensure that selected fire detection systems, sprinkler systems, portable fire extinguishers, and hose stations were installed in accordance with their design, and that their design was adequate given the current equipment layout and plant configuration.

b. Findings

No findings of significance were identified.

.11 Compensatory Measures

a. Inspection Scope

The inspectors conducted a review to verify that adequate compensatory measures were put in place by the licensee for out-of-service, degraded or inoperable fire protection and post-fire safe shutdown equipment, systems, or features. The inspectors also verified that short term compensatory measures were adequate to compensate for a degraded function or feature until appropriate corrective actions were taken.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems

a. Inspection Scope

The inspectors reviewed the corrective action program procedures and samples of corrective action documents to verify that the licensee was identifying issues related to fire protection at an appropriate threshold and entering them in the corrective action program. The inspectors reviewed selected samples of condition reports, work orders, design packages, and fire protection system non-conformance documents.

b. Findings - Inadequate Corrective Action for the Potential for Smoke to Enter the Control Room

The inspectors identified that the licensee failed to adequately correct a condition adverse to quality relating to the potential for smoke to enter the control room due to fire outside the control room. This issue was considered to be of very low safety significance and was dispositioned as a Green NCV.

The licensee had identified that, in the event of a fire, there was a potential for smoke to enter the control room due to shared ventilation ductwork between control room and other portions of the control building such as both essential switchgear rooms (fire areas CB-2 and CB-3). In response, the licensee had initiated Action Request (AR) 12026, Potential for smoke entering Control Room during fire event, dated May 26, 1998. As corrective action, the licensee issued revision 18 to AOP 913, Fire, which directed operators to shutdown the ventilation system fans which supplied air to the control room. The revision became effective January 4, 1999.

During this inspection, the inspectors identified the following problems associated with the original corrective action strategy implemented by the licensee:

- Although stopping the supply fans would help mitigate the introduction of smoke into the control room, smoke could still enter the control room due to the common ductwork between the control room and other portions of the control building. In addition, fire dampers installed to prevent the spread of fire from one room to another would not prevent smoke from propagating to other areas.
- Area Fire Plan AFP-24, Control Building, 1-A4, 1A-3, Essential Switchgear Rooms, revision 22, directed the fire brigade to operate the control building air handling unit with maximum outside air. This guidance was in conflict with the AOP 913 guidance to stop the control room supply fan.
- Although AOP 913 directed operators to stop the supply fans for the control room, there was no direction to stop the supply fan to the computer room which was adjacent to the control room. During plant tours and walkdowns, the

inspectors observed that doors between the computer and control room were open.

- The guidance to stop the control room supply fans did not address how to provide adequate cooling to the control room. Other steps in AOP 913 for maximizing ventilation for cooling were rendered ineffective due to the guidance for stopping the supply fans.

The inspectors noted that AOP 915 was the operations procedure to be used in the event that conditions existed that threatened control room habitability. AOP 915 relied upon the remote shutdown panel and other equipment primarily powered off of Division II buses. The inspectors also verified through review of training materials and discussions with operations training personnel that operators had been trained to implement AOP 915 if there were conditions which affected control room habitability. However, the inspectors noted that in the event of a fire in fire area CB-2, the remote shutdown panel and associated equipment could be unavailable because fire area CB-2 contained Division II switchgear.

In response to issues identified by the inspectors, the licensee notified operators of the potential for smoke in the control room and provided interim guidance on February 13, 2003, by issuing a "Hot Item" required reading. In addition, the licensee issued a revision to AOP 913 to provide guidance to operators until long term corrective actions could be determined. The revised procedure directed operators to don self-contained breathing apparatus, stop the computer room supply fan in addition to the control room supply fans, and provide another means of ventilating the control room and computer room by blocking doors open. At the time of this inspection, the licensee was considering performing modifications as long-term corrective actions to address the issue.

Title 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," requires, in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. Contrary to the above, as of January 31, 2003, the licensee had failed to correct conditions which would allow smoke to enter control room thereby affecting operators' ability to operate the plant. The potential for smoke to enter the control room had been identified in May 1998.

In accordance with IMC 0612, the inspectors determined that the issue was more than minor because the finding was associated with the protection against external factors (i.e., fire) attribute of the mitigating systems reactor safety cornerstone and affected the mitigating systems objective in that smoke in the control room could affect operators ability to operate the plant. In accordance with IMC 0609, Appendix A, the inspectors performed an SDP Phase 1 screening and determined that the finding degraded the Fire Protection portion of the Mitigation Systems Cornerstone. As such, screening under IMC 0609, Appendix F, was required. Based on review of IMC 0609, Appendix F, the inspectors determined that the finding did not require a Phase 2 analysis because no Appendix R fire protection feature was affected. In addition, although smoke could affect the operators, the inspectors determined that the plant could initially be maintained in hot shutdown due to the automatic actions of available equipment. As

such, this finding is considered to be of very low safety significance (i.e., Green). The failure to take adequate corrective actions is a violation of 10 CFR Part 50, Appendix B, Criterion XVI. This violation is associated with a finding that was characterized by the SDP as having very low risk significance (i.e., Green) and is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the NRC Enforcement Policy. This violation was entered into the licensee's corrective action program as CAP025363. (NCV 050-331/03-02-04)

4OA6 Meeting(s)

Exit Meeting

On February 14, 2003, at the conclusion of the on-site inspection activities, the inspectors presented their initial findings to Mr. Peifer and other members of licensee management at the Duane Arnold Energy Center. The licensee representatives acknowledged the findings presented. The inspectors identified the proprietary information reviewed during the inspection and noted that the information would be handled accordingly. The licensee did not identify any other material reviewed during the inspection as being proprietary. In addition, the inspectors conducted a working level discussion regarding epoxy floor coverings with licensee staff on May 8, 2003, telephonically. The inspectors presented the final inspection findings to Mr. K Schneider and other members of licensee management telephonically on May 12, 2003.

KEY POINTS OF CONTACT

Licensee

M. Peifer, Site Vice-President
J. Bjorseth, Plant Manager
S. Catron, Manager, Regulatory Affairs
T. Evans, Director, Engineering
P. Hansen, Manager, Operations
M. Huting, Director, Engineering Programs
J. Karrick, Supervisor, Licensing
K. Schneider, Manager, Program Engineering
E. Weinkam, Director, Regulatory Services

NRC

C. Pederson, Director, Division of Reactor Safety

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

NCV 050-331/03-02-01	Lack of Demonstrated Reactor Water Level Instrumentation
NCV 050-331/03-02-02	Inadequate Circuit Breaker Coordination for Instrument Power Supply
URI 050-331/03-02-03	Acceptability of Epoxy Floor Covering
NCV 050-331/03-02-04	Inadequate Corrective Action for Potential for Smoke to Enter Control Room

Closed

NCV 050-331/03-02-01	Lack of Demonstrated Reactor Water Level Instrumentation
NCV 050-331/03-02-02	Inadequate Circuit Breaker Coordination for Instrument Power Supply
NCV 050-331/03-02-04	Inadequate Corrective Action for Potential for Smoke to Enter Control Room

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a list of licensee documents reviewed during the inspection, including documents prepared by others for the licensee. Inclusion on this list does not imply that NRC inspectors reviewed the documents in their entirety, but, rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort.

Corrective Action Documents Issued as a Result of Inspection

CAP025229; Submittal to NRC of Fire Protection Codes of Record; dated January 17, 2003

CAP025283; Engineering Calculation not added to MDL; dated January 24, 2003

CAP025310; AOP-915 TAB 1 step 3, 4th bullet should include cable spreading room; dated January 28, 2003

CAP025311; Fires Doors found Not to be Supervised as Required; dated January 28, 2003

CAP025313; Fire Rating of wall between Essential Switchgear Rooms; dated January 28, 2003

CAP025319; Cables located in fire protection database that have been removed from the plant; dated January 29, 2003

CAP025345; Revise fire protection program documents as a result of NRC Triennial; dated January 30, 2003

CAP025363; Evaluate Core Spray & RHR Keep Fill systems for inclusion in Appen R Prg; dated January 31, 2003

CAP025365; Eval potential fire which could cause loss of CR habitability & failed SD path; dated January 31, 2003

CAP025517; Evaluate installing a Fire damper to mitigate smoke intrusion into Control Room; dated February 10, 2003

CAP025518; Make enhancements to AOP 913 for smoke in Control Room; dated February 10, 2003

CAP025527; Improve AOP 913 regarding RPV level indication; dated February 11, 2003

CAP025534; Structural steel fire proofing in Switchgear rooms; dated February 11, 2003

CAP025540; Epoxy floor coating not considered interior finish; dated February 11, 2003

CAP025540, Detailed Operability Evaluation, dated March 14, 2003

CAP025569; Improve evaluation of fire effects on RPV level instrument sense lines; dated February 12, 2003

CAP025575; AOP-913 actions may conflict with AFP-024; dated February 12, 2003

CAP025600; Emergency Light Battery Conductance Value Not Temperature Corrected; dated February 13, 2003

CAP025607; Investigate Lack of Selective Coordination on the Instrument AC System; dated February 13, 2003

CAP025608; Effect of Fire on Availability of RPV Level Indication; dated February 13, 2003

CAP025609; Use of jumper to initiate Core Spray; dated February 13, 2003

Action Requests

AR 20266; Identify Piping Runs and Perform Magnetic Flux Leakage Testing to Determine to What Extent Corrosion is Present on the System; November 30, 2000

AR 21392; Failed to Achieve Required "Flush Flow" During STP NS13B011 "Fire Suppression Water System Ring Header Flush & Flow Test;" December 18, 2000

AR 31698; Evaluate Diesel Fire Pump Cooling Water Operability Limits; November 13, 2002

AR 33593; During Performance of Surveillance Test Procedure (STP) NS13C003, As a Post Maintenance Test for Sprinkler 7, Approximately 15 Gallons of a Sludge Substance Was Blown onto the Floor of the Pumphouse; November 22, 2002

Calculations

CAL-E96-011; 10CFR50 Appendix R III.G/III.L Assessment for Fire Area CB1; Revision 6

CAL-E96-020; 10CFR50 Appendix R III.G/III.L Assessment for Fire Area RB1; Revision 4

CAL-E96-013; 10CFR50 Appendix R III.G/III.L Assessment for Fire Area CB3; Revision 4

Design Change Requests

DCR No. 1204; Appendix R Modification Automatic Fire Suppression System; September 28, 1984

DCR No. 1205; Appendix R Modification - Fire Detection Systems; January 13, 1984

EMA A21237; Re-fire proofing of Control Building Structural Steel; September 9, 1994

Drawings

BECH-E023; Schematic Meter and Relay Diagram 4160V System SWGR 1A3 and 1A4; revision 26

BECH-E029, sheet 1; Instrument AC Uninterruptible AC & RPS AC Distribution System

BECH-E104, sheet 26A; 4160V & 480V System Control & Protection; revision 5

BECH-E112, sheet 29; Alternate Shutdown Capability System; revision 3

BECH-E121, sheet 5A; Reactor Core Cooling Systems; revision 8

BECH-E121, sheet 14; Reactor Core Cooling Systems; revision 15

BECH-E121, sheet 24; Reactor Core Cooling Systems; revision 10

BECH-E121, sheet 54A; Reactor Core Cooling Systems; revision 5

BECH-M115; P&ID Reactor Vessel Instrumentation; revision 53

BECH-M119; P&ID RHR System; revision 76

BECH-M120; P&ID Residual Heat Removal System; revision 58

BECH-M121; P&ID Core Spray System; revision 35

BECH-M143, sheet 1; P&ID Containment Atmosphere Control System; revision 40

BECH-M143, sheet 2; P&ID Containment Atmosphere Control System; revision 22

BECH-M151; Control Building & TSC Air Flow Diagram; revision 20

Evaluations

DAEC Power System Analysis (Time/Current Characteristic Curves) 480V Essential Bus 1A3, 480V Essential Bus 1B34, 125 VDC Panels 1D10, 1D13, and 1D23, and 120 VAC Panel1Y11

DBD-P72-001; Design Basis Document for Fire Protection; Revision 1

FHA-100; Fire Hazard Analysis - Methodology; Revision 12

FPE-B03-001; Maximum Allowable Area of Unprotected Steel in the Switchgear Rooms; February 19, 2003

FPE-R96-001; Evaluation of Equipment Operability Without Essential Service Water; April 7, 1997

FPE-R98-001; Evaluation of Fire Effects on Instrument Tubing and Indication; Revision 1

Memo; Review of Individual Plant Examination of External Events (IPEEE) Submittal, Duane Arnold Energy Center; March 10, 2000

SE 95-05; 10 CFR 50.59 Safety Evaluation for Fire Water System Modification; May 2, 1995

SE 99-042; Safety Evaluation to Support Changing Compensatory Measures for the Cable Spreading Room Carbon Dioxide Suppression System; revision 1

Procedures

ACP 1408.15; Control of Replacement Fuses; Revision 6

AOP 913; Fire; revision 18

AOP 913; Fire; revision 31

AOP 913; Fire; revision 33

AOP 915; Shutdown Outside Control Room; revision 24

OP-024; Shutdown, EOP, Station Blackout Procedure and Equipment Inventory and Sound-Powered Phone Test; revision 34

STP NS13B009; Diesel Driven Fire Pump Operability Tests and Fuel Oil Supply Verification; December 30, 2002

STP NS13B010; Electric Driven Fire Pump Monthly Operability Tests; December 19, 2002

STP NS13C013; Control Building Heating, Ventilation, and Air Conditioning (HVAC) Equipment Area Sprinkler System and Pumphouse; October 19, 2000

STP NS13F001; Fire Barrier Penetration Seal Inspection; May 15, 2001

STP NS13F002; Fire Door and Frame Inspection; July 17, 2002

STP-NS13F003; Fire Damper Internal Inspection and Functional Testing; October 11, 2001

Work Orders

WO1113540; Emergency Lights For Safe Shutdown Path; September 21, 2000

WO1117508; Emergency Lights For Safe Shutdown Path; September 24, 2001

WO1121746; Emergency Lights For Safe Shutdown Path; November 11, 2002

Miscellaneous Documents

NFPA 13; Standard for the Installation of Sprinkler Systems; 1983

GMP-ELEC-03; General Maintenance Procedure; May 28, 2002

ACP 1412.4; Impairments to Fire Protection Systems; Revision 30

T-10951, Report on Surface Burning Characteristics Determined by ASTM E 84 Twenty-Five Foot Tunnel Furnace Test, dated May 24, 2002.

Fire Plan - Volume 1, Program; October 31, 2002

List of Open Engineering Maintenance Actions for Fire Protection Systems; January 28, 2003

Fire Duration Per Fire Zone Based on Combustible Loading; February 11, 2003

List of Open Fire Protection Impairment Requests; February 10, 2003

List of Diesel Fire Pump Impairments- 2000 through 2002; February 10, 2003

Fire Hazards Analysis for Control Building - 12B; Revision 9

Fire Hazards Analysis for Plant Door Matrix; Revision 13

Fire Hazards Analysis for Fire Barrier Identification Matrix; Revision 12

FHA E-01; Safe Shutdown Lighting Paths Elevation 757'-6"; Revision 2

LIST OF ACRONYMS USED

AC	Alternating Current
AOP	Abnormal Operating Procedure
AR	Action Request
BWR	Boiling Water Reactor
BTP	Branch Technical Position
CFR	Code of Federal Regulations
CO ₂	Carbon Dioxide
DAEC	Duane Arnold Energy Center
DPR	Demonstration Power Reactor
DRS	Division of Reactor Safety
FHA	Fire Hazard Analysis
GL	Generic Letter
HPCI	High Pressure Coolant Injection
IMC	Inspection Manual Chapter
IN	Information Notice
IPEEE	Individual Plant Examination of External Events
IR	Inspection Report
mm	millimeter
NCV	Non-Cited Violation
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory Commission
SDP	Significance Determination Process
SER	Safety Evaluation Report
URI	Unresolved Item

**REQUEST FOR ADDITIONAL INFORMATION
TO SUPPORT RESOLUTION OF UNRESOLVED ITEM**

Provide an evaluation or an action plan to justify acceptability of epoxy floor coverings which qualify as interior coatings (i.e., having thicknesses which exceed 0.9 millimeters and a flame spread rating which exceeds 25). The evaluation or action plan should address 1) contribution to combustible fire loading for fire areas, 2) impact on areas required to be free of combustibles (such as separation zones required to support an exemption or to meet 10 CFR Part 50, Appendix R), and 3) potential for fire propagation from one fire area to another. If testing is used to support an evaluation, such testing should bound actual plant configurations (i.e., thickness and material composition). We request that the evaluation or action plan be provided to the NRC within 60 days.

ENCLOSURE 2