May 3, 2002

Mr. Gary Van Middlesworth
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 50-331/02-11(DRS)

Dear Mr. Van Middlesworth:

On March 29, 2002, the NRC completed a baseline inspection at your Duane Arnold Energy Center. The enclosed report documents the inspection findings which were discussed on March 29, 2002, with Mr. R. Anderson and other members of your staff.

This inspection examined activities conducted under your license as they relate to reactor safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel. Specifically, the inspection focused on the design and performance capability of the standby diesel generator (SDG), essential service water (ESW), and 125Vdc systems to ensure the systems were capable of performing required safety-related functions.

Based on the results of this inspection, the inspectors identified one issue of very low safety significance (Green). This issue was determined to involve a violation of NRC requirements. However, because of its very low safety significance and because it has been entered into your corrective action program, the NRC is treating this issue as a Non-Cited Violation, in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny this Non-Cited Violation, 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 Duane Arnold Energy Center.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure 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/NRC/ADAMS/index.html (the Public Electronic Reading Room).

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

/RA/

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

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

Enclosure: Inspection Report 50-331/02-11(DRS)

cc w/encl: E. Protsch, Executive Vice President -
Energy Delivery, Alliant;
President, IES Utilities, Inc.
Robert G. Anderson, Plant Manager
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:	50-331/02-11(DRS)
Licensee:	Alliant, IES Utilities Inc.
Facility:	Duane Arnold Energy Center
Location:	3277 DAEC Road Palo, Iowa 52324-9785
Inspection Dates:	March 11 through March 29, 2002
Inspectors:	Z. Falevits, Lead Inspector A. Dunlop, Reactor Inspector G. O'Dwyer, Reactor Inspector D. Schrum, Reactor Inspector S. Sheldon, Reactor Inspector R. Quirk, Consultant
Approved by:	Ronald N. Gardner, Chief Electrical Engineering Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000331-02-11(DRS), on 03/11/2002 through 3/29/2002, IES Utilities, Inc., Duane Arnold Energy Center. Safety System Design and Performance Capability.

The inspection was a routine baseline inspection of the design and performance capability of the standby diesel generator, essential service water, and 125Vdc systems. It was conducted by regional engineering specialists and a consultant. The inspection identified one Green finding, which was a Non-Cited Violation. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609 "Significance Determination Process" (SDP). 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/NRR/OVERSIGHT/index.html.** Findings for which the SDP does not apply are indicated by "No Color" or by the severity level of the applicable violations.

Cornerstone: Mitigating Systems

- Green. The licensee failed to establish adequate measures to assure that the design requirements in calculations E92-007 and E92-008, specifically the number of battery cells, were correctly translated into work instructions in Work Order A5250. This was required to insure that the 1D1 125Vdc battery would remain capable of performing it's design function (operable) with 57 instead of the nominal 58 connected cells.

  The finding was determined to be of very low safety significance because, although the calculated number of cells in the battery was not conservative and not consistent with the technical specification bases, the 125Vdc system was judged to be capable of supporting the plant during a station blackout or similar design basis accident. Additionally, there was no actual loss of safety function. A Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, was identified(Section 1R21. 2).

Report Details

1. REACTOR SAFETY

Cornerstones: Mitigating Systems and Barrier Integrity

1R21 Safety System Design and Performance Capability (71111.21)

Introduction

Inspection of safety system design and performance verifies the initial design and subsequent modifications and provides monitoring of the capability of the selected systems to perform design bases functions. As plants age, the design bases may be lost and important design features may be altered or disabled. The plant risk assessment model is based on the capability of the as-built safety system to perform the intended safety functions successfully. This inspectable area will verify aspects of the mitigating systems and barrier integrity cornerstones for which there are no indicators to measure performance.

The objective of the safety system design and performance capability inspection was to assess the adequacy of calculations, analyses, other engineering documents, and operational and testing practices that were used to support the performance of the standby diesel generator (SDG), essential service water (ESW) and 125 Vdc systems during normal, abnormal, and accident conditions. The inspection was performed by a team of inspectors that consisted of a team leader, four Region III inspectors, and one consultant.

The standby diesel generator (SDG), essential service water (ESW) and 125 Vdc systems were selected for review during this inspection. This selection was based upon:

- having a high probabilistic risk analysis ranking;
- having had recent significant modifications; and
- not having received recent NRC review.

The criteria used to determine the system's performance included:

- applicable Technical Specifications;
- applicable Updated Final Safety Analysis Report sections; and
- the systems design documents.

The following system and component attributes were reviewed in detail:

System Needs

Process Medium - water
Energy Source - electrical power
Control Systems - initiation, control, and shutdown actions

Operator Actions - initiation, monitoring, control, and shutdown
Heat Removal - cooling water

System Condition and Capability

Installed Configuration - elevation and flow path operation
Design - calculations and procedures
Testing - flow rate, pressure, temperature, voltage, and current

Components

The following components were selected for detailed review during the inspection. The ESW pumps, heat exchangers and control valves, SDG, SDG transfer pump, heating ventilation and air conditioning (HVAC) and air start system, and the 125Vdc battery and battery chargers. The following attributes were reviewed for these components:

Component Degradation
Vibration
Operation
Equipment Protection - flood, missile and freezing
Component Design - Inputs and Outputs
Industry Operating Experience

.1 System Requirements

a. Inspection Scope

The team reviewed the following attributes for the systems selected: energy sources (electrical and air), control systems, and equipment protection. The team also reviewed applicable electrical, I&C, and mechanical calculations. The team verified that procedural instructions to operators were consistent with operator actions required to meet, prevent, and/or mitigate design basis accidents.

To do this, the team reviewed design basis documents and plant drawings, abnormal and emergency operating procedures, requirements, and commitments identified in the Updated Final Safety Analysis Report (UFSAR) and technical specifications (TSs). The team reviewed alarm setpoints and verified that instrumentation and alarms were available to operators for making necessary decisions in coping with postulated accident conditions. In addition, the team verified that system alignments were consistent with design and licensing basis assumptions.

b. Findings

No findings of significance were identified.

.2 Design Review

a. Inspection Scope

The team reviewed the electrical aspects of the 125Vdc, SDG, and ESW systems. The team reviewed electrical calculations for AC and DC power to selected emergency pumps and motor operated valves. The review included design assumptions, calculations, boundary conditions, and modifications.

The team also performed a single failure review of individual components to determine the potential effects of such failures on the capability of the system to perform its safety functions. Additionally, the team performed analyses to verify that design values were correct, appropriate, and translated into operational and maintenance procedures. Documentation reviewed included drawings, procedures, calculations, corrective action requests, and maintenance work orders identified in the attachment to this report, as well as the design bases document for the 125Vdc, SDG, and ESW systems, the technical specifications, the USAR, operator training procedures, and risk analysis documents. The purpose of the reviews was to determine whether the design bases of the system were met by the installed and tested configurations.

b. Findings

Plant Operation with One Battery Cell Jumpered Out

The team identified one Green Finding that is being treated as a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for failure to assure that design requirements in calculations were correctly translated into work instructions. The team noted that on April 11, 1991, the licensee operated the plant at power with 57 cells installed in the 125Vdc, 1D1 battery, instead of the previously analyzed 58 cells. The licensee failed to perform the required analysis and 50.59 evaluation prior to operating with cell number 51 jumpered out. This did not result in an actual loss of safety function for the associated equipment, because there were no extended battery discharges while the cell was jumpered out. As a result, the issue had very low risk significance.

The most up-to-date analysis for the 125Vdc battery load and sizing were calculations E92-007, "1D1 Battery Load and Margin Calculation," Revision 4, and E92-008, "1D2 Battery Load and Margin Calculation," Revision 4. These calculations were based on 58 - cell batteries and a minimum allowed voltage of 105V. Therefore, the minimum analyzed cell voltage was 105V/58 cells, or 1.81V per cell. Operation with 57 cells was permitted by the bases for Technical Specification 3.8.4.1. The minimum average cell voltage for the Technical Specification permitted configuration is 105V/57cells, or more than 1.84V per cell.

The team evaluated this issue and determined that a change from 58 to 57 cells would reduce the limiting scenario (station blackout (SBO)) design margin by over 10 percent. Based on the battery discharge characteristic curves in the calculation changing from 58 to 57 cells for loads lasting four hours results in approximately 10 percent loss of capability. The short term (one minute loads) would be reduced by approximately 20 percent. As most of the reactor core isolation cooling (RCIC) scenario loads are

base loads for the four hour duration, the reduction of margin would still be approximately 10 percent. The licensee's calculation showed 27 percent margin; reducing this by 10 percent would still result in margin >10 percent which is the value desired for SBO. This evaluation does not include the load increases from the many non-conservative load estimates.

The team noted that on at least one occasion, the licensee operated the plant at power with only 57 cells installed. Specifically, on April 11, 1991, battery 1D1 cell number 51 was jumpered out using work order A52520. The work order approval was based on BATTRY-C173-01, "Batteries Equipment-Specific Maintenance Procedure," Revision 29, which provided the steps to jumper out a battery cell. No analysis or 50.59 evaluation was performed to verify if this change to the facility was acceptable.

The team determined that there was a credible impact on safety because BATTRY-C-173-01 permitted plant operation with the number of battery cells below the analyzed configuration. Had a station blackout occurred, vital plant equipment may not have operated as required with the number of cells less than the analyzed limit. Therefore, the issue was more than a minor violation. The team also concluded this issue affected the mitigating system cornerstone because vital equipment required to mitigate a design basis event may not have operated or performed at the capacity assumed in the accident analyses. The team subsequently determined that the battery's capacity margin would be reduced; however, the battery would remain operable.

The team determined there was no actual loss of safety function because there were no accidents or events requiring long term battery discharge while only 57 cells were installed in 1D1. The error in the procedure did have a credible impact on safety; however, since only the mitigating systems cornerstone was affected, and no extended discharges occurred, the finding is considered to be of very low safety significance (Green) by the significant determination process.

10 CFR Part 50, Appendix B, Criterion III, requires, in part, that "measures shall be established to assure that applicable regulatory requirements and the design basis . . . are correctly translated into specifications, . . . procedures, and instructions."

Contrary to the above, the licensee failed to establish adequate measures to assure that the design requirements in calculations E92-007 and E92-008, specifically the number of battery cells, were correctly translated into work instructions in Work Order A5250. This violation of 10 CFR Part 50, Appendix B, Criterion III, is being treated as a Non-Cited Violation consistent with Section VI.A of the NRC Enforcement Policy (NCV 50-331/02-11-01). This finding was entered into the licensee's corrective action program as AR 30281, AR 30371 and AR 30385.

.3 10 CFR 50.59 Safety Evaluations (SE) and Screenings

a. Inspection Scope

The team reviewed completed (SE) for the design changes to the plant.

b. Findings

Residual Heat Removal (RHR) Mechanical Seal Failure

On August 2, 1999, the licensee performed a 10 CFR 50.59 evaluation (Safety Evaluation 99-041) to support the decision to not inspect or flow test the cooling water supply to the RHR pumps mechanical seal heat exchangers. The bases for the licensee's decision was the inability to perform a flow test due to the configuration of the associated cooling water piping. The four RHR heat exchangers had not been tested or cleaned in the past. Upon completion of SE 99-041, the licensee changed the Duane Arnold FSAR and Technical Specification Basis to eliminate the need for heat exchanger cooling. The licensee assumed it could operate the RHR Pumps with the heat exchangers plugged for the remaining life of the plant.

The licensee based SE 99-041 on the Byron Jackson Pump Division (Borg-Warner Corporation) vendor manual, "Installation, Operation, and Maintenance Instructions for Type 'U' Mechanical Seals," issued in 1969, which stated that the mechanical seal components were designed for temperatures up to 450 degrees Fahrenheit (F). However, the licensee failed to take into account the critical temperature for operating the mechanical seals which is the temperature allowed for the actual sealing surface face. The vendor data indicated that the maximum water temperature for these seal faces was 150 degrees F. The inspectors determined that without a cooling water supply to the mechanical seals the water remaining in the seal will not support the sealing surface as a lubricant. The seal would fail in a relatively short period of time depending on the original condition of the seal.

During the inspection, the licensee attempted to obtain design information from several vendors to allow operation of the seals without seal cooling. The licensee did eventually receive a memorandum, "Alliant Energy Containment Pumps - Upset Conditions," March 28, 2002, from Flowserve Corporation that stated that the seals could survive torus cooling temperatures following a LOCA without total failure, but with damage and several gallon per minute leakage. The vendor stated that accelerated mechanical seal face wear could be expected at approximately 200 degrees F. The vendor conditioned this statement with the judgement that the amount of wear was difficult to predict and the seals not failing was conditional on corrosion, shaft run-out, and varying product characteristics. The licensee did not provide any test data for high temperature seal operation to support the statements that the mechanical seals would not fail in high temperature applications.

After receiving the above information from the vendor, the licensee stated that they would put the heat exchangers back into the Generic Letter 89-13 Program and take credit for seal cooling for the RHR Mechanical Seals. Seal cooling flow had never actually been isolated from the RHR heat exchangers, so no actual damage would have occurred to the RHR Pump Mechanical Seals. The licensee stated that the seal heat exchangers would be opened and cleaned during the next RHR pump outage. In addition, the heat exchangers would be put into the preventive maintenance program for periodic cleaning. The inspectors considered the pending corrective actions for the RHR Pumps acceptable.

The licensee performed an Operability Evaluation (AR#30414), March 28, 2002, for continued plant operations. The licensee used the Core Spray Pump evaluation to bound the RHR and Core Spray Pumps because the Core Spray Pumps do not have seal coolers and these pumps operate at a higher RPM (more frictional heat in the seals). The inspectors considered the Operability Evaluation acceptable, however, it contained significant weaknesses. One significant weakness was that the licensee used the original design specifications to determine the acceptability for continued use of the RHR and Core Spray Pump Seals without seal cooling. The original GE design specification for pump seals specified that the seals be capable of operation at temperatures of 212 degrees F for one day and operation at temperatures of 200 degrees F for six months. The licensee did not receive a seal that meets these design requirements during plant construction. The current seals can only survive at these temperatures for a short time period without cooling. The licensee stated that additional information would be provided for this condition and that this was a potential Part 21 issue. This generic condition of the seals appears to be applicable to other BWR plants. A second weakness in the Operability Evaluation was that shutdown cooling temperatures were not addressed.

The inspectors considered the RHR pump seals operable based on the fact that water could still be seen flowing in the RHR Heat Exchanger Sight Glasses. In addition, it appears that no RHR Seals were damaged during the last shutdown of the plant when the seals were subjected to temperatures above 300 degrees F.

The licensee stated in the conclusion of the operability evaluation that a more exhaustive evaluation and analysis would be required to ensure that RHR Pump Seals would perform their design function. The significance of the RHR pump issue is dependent on whether the Seal Cooler Heat Exchangers are found plugged and potentially incapable of performing their function. The licensee issued AR 30234, dated March 17, 2002, to resolve the issues related to the evaluation of the seals. The NRC will review the licensee's evaluation to demonstrate that all seals will meet their design basis conditions. These issues will be tracked as Unresolved Item 50-331/2002-011-02. Pending the outcome of the above evaluations and inspections, these issues will be evaluated in the Significance Determination Process (SDP).

Conclusions

The team determined that additional evaluation and analysis would be required to ensure that the RHR and Core Spray Pump Seals would have performed their design function. These issues will be tracked as an Unresolved Item. Pending the outcome of the above evaluations, these issues will be evaluated in the SDP.

.4 System Condition and Capability

a. Inspection Scope

The team reviewed periodic testing procedures (listed in the attachment) and results to verify that the design requirements were demonstrated by the performance of tests. The team also verified the environmental qualification of a sample of system

components for operation under design environmental conditions and assumed operating parameters (e.g., voltage, speed, and power).

The team also reviewed the system's operations by conducting system walkdowns; reviewing normal, abnormal, and emergency operating procedures; and reviewing the UFSAR, the TSs, design calculations, drawings, and procedures. In addition, the team reviewed the operations department operator work-arounds to ensure no design assumptions were invalidated by past or current operator daily practices..

b. Findings

No findings of significance were identified.

.5 System Walkdowns

a. Inspection Scope

The team performed selective field inspections of the 125Vdc, SDG, and ESW systems. The purpose of these walkdowns was to assess the adequacy of materiel condition and installation configurations by focusing on the installation and configuration of piping, components, and instruments; the susceptibility to flooding, fire, or other environmental concerns; physical separation; provisions for high energy line break; accessibility for operator action; and the conformance of the currently installed configuration of the systems with the design and licensing bases.

b. Findings

No findings of significance were identified.

6. Safety System Testing

a. Inspection Scope

The team reviewed the program and procedures for Technical Specification required battery testing. The review included service and performance tests.

b. Findings

No findings of significance were identified.

.4. OTHER ACTIVITIES (OA)

4OA2 Identification and Resolution of Problems (71152)

a. Inspection Scope

The team reviewed a sample of 125Vdc, SDG, and ESW systems problems identified by the licensee in the corrective action program to verify an appropriate threshold for identifying issues and evaluate the effectiveness of corrective actions related to design issues. In addition, CRs written on issues identified during the inspection were

reviewed to verify adequate problem identification and incorporation of the problem into the corrective action system. The specific corrective action documents that were sampled and reviewed by the team are listed in the attachment to this report.

b. Findings

No findings of significance were identified

4OA6 Meeting

Exit Meeting

The inspectors presented the inspection results to Mr. R. Anderson and other members of licensee management on March 29, 2002. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

KEY POINTS OF CONTACT

Licensee

R. Anderson, Plant Manager
S. McVay, System Engineer
T. Evans, Operations Manager
K. Huber, System Engineering Manager
E. Weinkam, Regulatory Services Director
C. Bleau, Licensing Engineer
J. Ertman, Engineering Team Leader
J. Quimby, Project Engineering I&C
G. Hawkins, Design Engineering Supervisor
M. Fairchild, Nuclear Oversight

NRC

P. Prescott, Senior Resident Inspector
M. Kurth, Resident Inspector
J. Jacobson, Chief, MEB/DRS

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-331/02-011-01	NCV	The licensee failed to establish adequate measures to assure that the design requirements in calculations E92-007 and E92-008, specifically the number of battery cells, were correctly translated into work instructions in Work Order A5250.
50-331/02-011-02	URI	The licensee needs to perform a more exhaustive evaluation and analysis for continued use of the Core Spray Pump seals without cooling and to ensure that RHR Pump Seals would perform their design function. In addition, more detailed analysis, inspection and calculations are required to support Operability Evaluation (AR#30414).

Closed

None

Discussed

None

LIST OF ACRONYMS USED

AC	Alternating Current
ADAMS	NRC's Document System
AR	Action Request
CFR	Code of Federal Regulations
DAEC	Duane Arnold Energy Center
DBD	Design Basis Document
DC	Direct Current
DCP	Design Change Package
DRS	Division of Reactor Safety
EMA	Engineered Maintenance Action
ESW	Essential Service Water
NRC	Nuclear Regulatory Commission
P&ID	Piping and Instrumentation Drawing
RHR	Residual Heat Removal
RCIC	Reactor Core Isolation Cooling
SDG	Standby Diesel Generator
SDP	Significance Determination Process
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report

LIST OF DOCUMENTS REVIEWED

Calculations

Number	Title	Revision or Date
440E-001	Determine Size of 125V Batteries 1D1 and 1D2	Revision 1
APED-R20-004	Analysis of the 1A4 Essential Electrical Power Distribution System	Revision 3
APED-R20-003	Analysis of the 1A3 Essential Electrical Power Distribution System	Revision 3
APED-A61-091	Station Blackout Asset Enhancement Program Evaluation Task T0903	Revision 1
CAL-E99-003	125Vdc Electrical Distribution System Short Circuit Calculation	Revision 1
CAL-IELP-E90-001	125 Volt Battery 1D1 Load and Sizing	Revision 0
CAL-IELP-E90-002	125 Volt Battery 1D2 Load and Sizing	Revision 0
DAEC-HWC-E2	Load Addition to 1L182 - Diesel Generator Loading	Revision 0
E-79-01	Diesel Generator 1G21 and 1G31 Loading and Response	Revision 0
E92-007	1D1 Battery Load and Margin Calculation	Revision 4
E92-008	1D2 Battery Load and Margin Calculation	Revision 3
EC-10A	Diesel Generator Loading	Revision 0
CAL-BECH-MC-153	Sizing Diesel Fuel Oil Transfer Pumps IP044A & B	April 20, 1990
CAL-IELP-M79-19	RHRSW & ESW System Self Cleaning Strainers Sizing of Accumulator for Backwash Valves	August 31, 1990
CAL-IELP-M79-20	RHRSW, ESW Strainers Backwash Orifices	February 20, 1980
CAL-IELP-M81-09	EDG Fuel Oil Day Tanks (1T037A/B) Level Volume Relationship	July 30, 1991
CAL-M91-005	Emergency Service Water Pump TDH Analysis	August 11, 1995

CAL-M92-029	MEDP, Pressure, Flow, and Temperature Determination for Emergency Service Water System Motor Operated Valves	November 5, 1992
CAL-M93-078	ESW/RHRSW Pit Plump Down Times	August 11, 1995
M91-14	Standby Diesel Generator 7 Day Fuel Oil Requirement	September 9, 1991
MC-139	Schematic of Diesel Fuel Oil System	July 7, 1982
446-M-001	Diesel Generator Cooler Performance	Revision 1
446-M-002	Performance Study for RHR Room Coolers	Revision 0
446-M-003	ESW Heat Loads	Revision 2
446-M-005	Performance Study for RCIC Room Coolers	Revision 0
446-M-006	Performance Study for HPCI Room Coolers	Revision 0
446-M-007	Chiller Performance	Revision 0
446-M-008	Control Building Control Room Heating	Revision 0
446-M-009	Diesel Generator Coolers Thermal Performance Determination of ESW Flow	Revision 0
446-M-0010	Control Room Temperature W/O Coolers	Revision 0
446-M-0011	Transient Temperature Model	Revision 0
CAL-IELP-M77-04	M77-4 Sizing for Replacement ESW Pumps DCR-742	August 24, 1977
7884-M15-104-1	Seismic Calculations for Nuclear Standby Diesel Generators	March 3, 1972
CAL-M84-034	Seismic Analysis for Emergency Diesel Generator Air Start System	February 26, 1995
7884-8-P-18	Diesel Generator Air Intake Seismic Check	Revision 1
7884-1-B-8	Underground Diesel Oil Tank IT-35 Design Basis Earthquake Seismic Loads	Revision 1
M87-46	Battery Rack Anchorage Evaluation	Revision 1
401-13	Calculation Diesel Air Intake Modification	February 4, 1981
CALC-IELP-M92-97	Core Spray Operation With Reduced ESW Cooling to Motor	Revision 0
466-M-009	Diesel Generator Coolers Thermal Perfomance-Determination of ESW Flow	Revision 0

466-M003	ESW Heat Loads	Revision 2
APED-R20-003	1A3 Essential Electrical Power Distribution	Revision 3
APED-R20-004	1A4 Essential Electrical Power Distribution	Revision 3
CAL-E92-020	AC Motor Operated Valve Degraded Condition/Voltage Calculation	Revision 9
CAL-E95-006	4.16kV Essential Bus Degraded Voltage Setpoint Calculation	Revision 2
CAL IELP M76-10	Emerg. Diesel-Generator Air Start Compressor Exhaust Line	Revision 0
CAL IELP M81-09	EDG Fuel Oil Day Tanks (1T037A/B) Level Volume Relationship	Revision 1
CAL IELP M82-35	Emergency Service Water Flow Orifice FE-4938A,B, Differential Pressure vs. Flow	February 2, 1983

Condition Reports/Action Requests Initiated as a Result of this Inspection

Number	Title	Revision or Date
AR 30216	Calculation M91-14 Does Not Take Into Account NPSH Requirements of the Fuel Oil Transfer Pumps	March 22, 2002
AR 30150	USAR Section 8.3.1.1.5 Degraded Voltage Text Incorrect	March 11, 2002
AR 30195	Multiple Active Calculations of Record For 125Vdc Battery Profile and Sizing	March 14, 2002
AR 30207	Breaker Sequence Modeled in CAL-E92-07 and CAL-E92-08 is Non-conservative	March 15, 2002
AR 30212	Battery Profile Non-conservative with Respect to IEEE-485 Guidance	March 15, 2002
AR 30266	Calculation CAL-E92-07 Not Updated To Reflect Plant Design Change	March 22, 2002
AR 30281	Plant Operation with 57 of 58 Cells in Vital Battery	March 21, 2002
AR 30314	Non-conservative Error in 125Vdc Short Circuit Calculation	March 21, 2002
AR 30362	Use of Non-conservative Non-Design Values in Battery Margin Load and Margin Calculations	March 25, 2002

Number	Title	Revision or Date
AR 30371	Add Sensitivity Analysis to Battery Margin Load and Margin Calculations	March 26, 2002
AR 30380	Use of Non-Licensing Basis Battery in Power Uprate SBO Analysis	March 27, 2002
AR 30381	Number of Battery Starts and Assumed in SBO Profile	March 27, 2002
AR 30385	Inadequate Technical Evaluation Before Revising Battery Maintenance Procedure To Permit Jumpering Out a Cell	March 27, 2002
AR 30392	Questionable Values Used in Modeling Breaker Coil and Spring Charging Motor in Battery Load and Margin Calculations	March 27, 2002
AR 30417	Non-conservative Value for Containment Spray Pump Motor Used in Diesel Generator Loading Analysis	March 29, 2002
AR 30414	RHR Pump and Core Spray Pump Operability Evaluation	March 28, 2002
AR 30302	Review NE & SW Corner Rooms, RHR, Core Spray, Heat Load Calculations 466-M-003	March 21, 2002
AR 30377	Typographical Errors in CAL-E95-006	March 27, 2002
AR 30405	CAL-E92-020 “AC MOV Degraded Voltage Calc, Needs to be Revised	March 28, 2002
AR 30410	Invalid Assumptions in CAL-IELP-M76-10-Ref	March 28, 2002
AR 30392	Questionable Values Used in Modeling Breaker Coil and Spring Charging Motor in Battery Load and Margin Calculations	March 27, 2002
AR 30458	Tech Spec ITS Comment Resolution May be Incorrect	April 3, 2002

Condition Reports/Action Requests

Number	Title	Revision or Date
AR 27349	FSAR Diesel Generator Loading Sequence Table Values	February 28, 2002
AR 9110	Degraded Voltage Setpoint Adequacy	July 23, 1997

Number	Title	Revision or Date
AR 22576	1P099B Stopped Very Quickly Following STP NS54002	October 16, 2000
AR 26499	Request Operability Determination for 'A' ESW Pump Due to Increasing Calculated D/P	June 25, 2001
AR 26968	1K004 After Cooler Leak at Welded Joint Near Inlet	August 3, 2001
AR 27060	Clarification of Requirements in EMP-1P099-FV	August 16, 2001
AR 30347	1P099B Vibration Levels in the Alert Range	March 22, 2002
NCR-90-005	Parts for RHRSW Strainers 1S090A/B Purchased Under PO S40440	March 5, 1990
AR 24484	UFSAR Documentation Discrepancy	March 29, 2001
AR 29926	10 CFR Part 21 Notification on "Core Spray and HPCI Surface Temperature for HVAC Design"	February 20, 2002
AR 27339	Review NE and SW Corner Rooms, RHR, Core Spray, Heat Load Calculations	August 28, 2001
AR 13156	SER 3-98: Recurring Event Flooding of ECCS Rooms	September 29, 1998
AR 19459	Potential for Unmonitored Release During Maintenance via Storm Drain	April 23, 2000
AR 26597	Investigate Controls on Corner Room to Torus Room Doors	August 24, 2001
AR 27350	Form an Engineering Team to Review Design Basis Calculations	August 24, 2001
AR 27054	NRC 50.59/Modification Inspection: Safety Evaluation 99-041, ESW Flow to RHR Pump Seal Coolers, Requires Clarification	August 20, 2001
AR 18358	1K010C Blown Fuse	January 4, 2000
AR 18680	Can 1VSF0568 or B Be Removed From Service Without Declaring RHRSW/ESW & SBDG Inop	March 5, 2002
AR 19364	Minor Work Authorized on Protected System	April 5, 2000
AR 20885	Locked Valves Not Shown As Locked On P+ID's	July 20, 2000
AR 21394	Scaffolding in 'B' SBDG Room Erected for 4 Days Without Engineering Review	August 22, 2000
AR 22378	TDRs in 1C468A&B Should be Periodically Replaced	November 8, 2000
AR 13146	Circuit Breaker Reliability	September 23, 1998

AR 2551	Evaluate QL 1 Agastat 2400/7000 Relay for Periodic Replacement	January 22, 1997
AR 18089	Incorrect Fuse Installed in 1C469B	February 8, 2000

Electrical and Mechanical Drawings

Number	Title	Revision or Date
BECH-E104 Sheet 3	4160V ACB 152-101 System Control and Protection	Revision 2
BECH-E104 Sheet 4	4160V ACB 152-103 System Control and Protection	Revision 0
BECH-E104 Sheet 5	4160V ACB 152-201 System Control and Protection	Revision 0
BECH-E001 Sheet 1	Single Line Diagram Station Connections	Revision 26
BECH-E027BECH -E027	Single Line Meter & Relay Diagram 125Vdc	Revision 23
BECH-M113	P&ID RHR Service Water & Emergency Service Water Systems	Revision 58
BECH-M132<1>	P&ID Diesel Generator Systems	Revision 8
BECH-M146	P&ID Service Water System Pumphouse	Revision 67
C-149	Underground Diesel Oil Tank IT-35 Plan & Details	Revision 4
M010-101	RHR Service Water Pump 1P-22A thru D	Revision 0
M015-002	Fuel Oil System Schematic	Revision 10
M015-005	Starting Air System Schematic	Revision 10
M015-056	1000 Gallon Fuel Oil Day Tank	Revision 5
M41-154-3	Diesel Fuel Oil Storage Tank Data Sheet	Revision 2
7884-M-10-DS-M10-1	ESW Pump Data Sheet	Revision 3
7884-M32-1-3	Model GA-1K-150# DES (Submerged)	Revision 1
7884-M32-10-1	Diesel Oil Pumps	Revision 1
93-286	EDG Cylinder Differential Temp Exceeded Allowed Value	September 27, 1993

94-0382	EDG Cylinder Differential Temp Exceeded Allowed Value	August 31, 1994
AR 9110	New Load Case for 4160 Degraded Voltage Relay Setpoint	June 26, 1997
AR 13108	“A” EDG Pressure Switch, PS3244A, Did Not Function Due to Foreign Material	October 28, 1998
AR 16587	Fuel Oil Level Indications for EDG Day Tanks	September 10, 1999
AR 18481	Lube Oil High Temp Switch Out of Cal	February 8, 2000
AR 19373	Change Setpoints on LIS3208 & 10	March 17,2000
AR 21797	Div I 125VDC Alarms	September 6, 2000
AR 24177	Set Point Change for PS4929A and PS4929B	February 20, 2001
AR 24617	FI 4938A Out of Spec	March 29, 2001
AR 27129	1G100/ENG Generator Output Frequency Out-of-Spec	August 27, 2001
AR 29326	1G031/ENG Jacket Coolant Temp Low Out of Spec	December 23, 2001
AR 29632	10 CFR Part 21 Issued on all Woodward Electronic Controls with Electrolytic Capacitors	January 24, 2002
AR 29952	EDG Accident Loading	February 20, 2002
AR 29953	Engineering Power Systems Analyses	February 20, 2002
APED-E21-006<2>	Elem Diag Core Spray System	Revision 22
BECH-E001<1>	Single Line Diagram Station Connections	Revision 26
BECH-E104<025>	4160V & 480V System Control & Protection	Revision 16
BECH-E104<026>	4160V & 480V System Control & Protection	Revision 18
BECH-E106<005>	Standby Diesel Generator And Auxiliary Control	Revision 7
BECH-E106<005A>	Standby Diesel Generator And Auxiliary Control	Revision 3
BECH-E106<006>	Standby Diesel Generator And Auxiliary Control	Revision 5
BECH-E111<008>	Service Water Systems	Revision 15
BECH-E111<008A>	Service Water Systems	Revision 3

BECH-E111<008B>	Service Water Systems	Revision 4
BECH-E111<008C>	Service Water Systems	Revision 3
BECH-E111<028>	Service Water Systems	Revision 2
BECH-E113<053>	Heating & Ventilating Systems	Revision 15
BECH-E113<040>	Heating & Ventilating Systems	Revision 11
BECH-E113<040A>	Heating & Ventilating Systems	Revision 5
BECH-M404<2A>	Emergency Diesel Generator Day Tank IT-37A, IT-37B Level Settings Diagram	Revision 2
M015-006<1>	Diesel Generator Control	Revision 17
M015-006<1A>	Diesel Generator 1G21 Start Circuit A & B Governor Control & Excitation Control	Revision 6
M015-006<2>	Electrical Schematic Diagram Remote Alarm Contacts	Revision 15
M015-006<3>	Electrical Schematic Diagram AC Auxiliaries	Revision 11
M015-006<4>	Electrical Schematic Diagram Relay Contacts	Revision 11
M015-015<1>	3 - Line Schematic	Revision 10
M015-015<2>	3 - Line Schematic	Revision 11
M015-015<3>	3 - Line Schematic	Revision 14
M015-015<4>	3 - Line Schematic	Revision 12
M-132-F.D. SH 1	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 2	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 3	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 4	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 5	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 6	Functional Description Diesel Generator System	Revision 0
M-132-F.D. SH 7	Functional Description Diesel Generator System	Revision 0

Vendor Manuals and Drawings

Number	Title	Revision or Date
	Crane Company Chempump Series G	Revision 2
9085100910	Standby Diesel Generator Baesler Voltage Regulator Schematic	Revision B
TC-3573	Core Spray Pump Curve	June 16, 1971
Vendor Manual	Installation, Operation, and Maintenance Instructions for Type “U” Mechanical Seals	1969
Vendor Manual	Borg-Warner High Pressure Heat Exchangers	June 1970

Functional Control Diagrams (FCD)

Number	Title	Revision or Date
APED-E41-012 Sheet 1	High Pressure Coolant Injection System FCD	Revision 8
APED-E41-012 Sheet 2	High Pressure Coolant Injection System FCD	Revision 7
APED-E51-013 Sheet 1	Reactor Core Isolation Cooling System FCD	Revision 11
APED-E51-013 Sheet 2	Reactor Core Isolation Cooling System FCD	Revision 11
APED-E51-013 Sheet 3	Reactor Core Isolation Cooling System FCD	Revision 3
APED-E51-013 Sheet 4	Reactor Core Isolation Cooling System FCD	Revision 7

Piping and Instrumentation Drawings (P&IDs)

Number	Title	Revision or Date
BECH-M113	RHR Service Water & Emergency Service Water Systems P&ID	Revision 58
BECH-M146	Service Water System P&ID	Revision 67
M015-002	Fuel Oil System Schematic	Revision 10
M015-005	Starting Air System Schematic	Revision 10

Modifications/Design Change Packages

Temporary Mod 01-027	Jumper Out Bad Cell in 125Vdc Battery 1D1	April 11, 2001

PMP 0080	Reduce Battery Load on Battery 1D1	June 29,1993
DCR-669	Standby Diesel Generator Fuel Line Header	April 20, 1977
DCR-914	Diesel Oil Storage Tank Cross-tie	April 20, 1980
DCP-1149	Diesel Air Start System Improvements	June 6, 1987
DCR-1332	Diesel Oil Pumps Flowmeter	January 9, 1986
DCP-1497	Diesel Generator Fuel Oil Transfer System	August 20, 1992
Minor Mod. 278	Emergency Diesel Generator Air Start System Improvements	May 1, 1991
SE 99-041	Change Emergency Service Water Flow Requirements to the RHR Pump Seal Coolers	Revision 1
DCC 2584	High Pressure Drop Across Air Filter at IC93 C-5 and IC94 C-5 Replace the Annunciator Card	August 9, 1994
EMA A53379	Relocate Diesel Engine Governor Booster Assembly	January 4, 2001
141	Provide Air Filters in Diesel Air Start System	Revision 1
488	Emergency Service Water System	Revision 3
A34181	Replace PI3265A	May 16, 1997
A45188	Replace Speed indication for 1G-31	February 7, 2000
A52175	Setpoint Change - PS4929A & PS4929B	Revision 0
DCR 984	Replace TS3270A and 3270B with new Switches	June 11, 1980
DCR 1113	Annunciators and Computer Logging for Station Batteries	June 30, 1982
DCP 1149	Modification to Diesel Generator Air Start System	December 24, 1987

Procedures

Number	**Title**	**Revision or Date**
ACP 1410.6	Temporary Modification Control	Revision 27, 30
BATTRY-C173-01	Equipment Specific Maintenance Procedure - Batteries	Revision 29, 31
ACP 1203.59	Power System Configuration and Analysis	Revision 1
AOP 301	Loss of Essential Power Systems	
EMP-1P099-FV	Emergency Service Water Flow Verification Test	Revision 7

Number	Title	Revision or Date
OI 324	Standby Diesel Generator System	Revision 52

Specifications

Number	Title	Revision or Date
	Battery Current Summation Program BCSUM.EXE Software Design Specification	Revision 0
37706N	Woodward EG-A Control	August 1992

Standards., Guides, and Codes

Number	Title	Revision or Date
IEEE Std 945	IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations	1983
IEEE Std 450	IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations	1987
ANSI N45.2.11	Quality Assurance Requirements for the Design of Nuclear Power Plants	1974

System Descriptions

Number	Title	Revision or Date
	Emergency Service Water System Description	Revision 3
SD-324	Standby Diesel Generator System	Revision 3
SD-375	Plant DC Power Supply System	Revision 5

Technical Specifications

Number	Title	Revision or Date
3.3.8.1	Loss of Power	
3.7.3	Emergency Service Water	
3.8.1	AC Sources - Operating	
3.8.2	AC Sources - Shutdown	
3.8.3	Diesel Fuel Oil, Lube Oil, and Starting Air	
3.8.4	DC Sources - Operating	

Number	Title	Revision or Date
3.8.5	DC Sources - Shutdown	
3.8.6	Battery Cell Parameters	
3.8.7	Distribution Systems - Operating	
3.8.8	Distribution Systems - Shutdown	
B 3.7.3	Emergency Service Water (ESW) System	Amendment 223
B 3.8.1	AC Sources - Operations	Amendment 223
B 3.8.2	AC Sources - Shutdown	Amendment 223
B 3.8.3	Diesel Fuel Oil, Lube Oil, and Starting Air	Amendment 223

Work Requests

Number	Title	Revision or Date
A45792	ESW Pump 1P099B Slows Down Faster than 1P099A	February 26, 2002
A53520	Jumper Out Cell Number 51 in 1D1 Battery Due to Low Voltage	April 11, 2001
A18851	Cylinder Differential Temp Exceeded Allowed Limit	December 9,1993
A32606	PS3225A Calibration Data Sheet	September 4,1996
A39124	LIS3216 Calibration Data Sheet	November 10,1998
A45187	PS3233A Calibration Data Sheet	September 21,1999
1089796	PS3224A Calibration Data Sheet	December 5, 1995
1096100	PS3232A Calibration Data Sheet	December 4, 1996
1097611	LIS3207 Calibration Data Sheet	April 4, 1997
1103710	LIS3209 Calibration Data Sheet	March 7, 1998
1103712	LIS3215 Calibration Data Sheet LIS3208 Calibration Data Sheet	March 10, 1998
1117154	Calibrate FI4938A	August 17, 2001
1117155	Calibrate FI4938B	August 17, 2001
1118927	LIS3210 Calibration Data Sheet	March 1, 2002
STP 3.3.8.1-02	4KV Emergency Bus Degraded Voltage Calibration	January 28, 2002

Safety Evaluations

Number	Title	Revision or Date
E-99-03-08	Provide Instructions For Jumpering Out Weak Battery Cells	April 1,1999

Updated Final Safety Analysis Report Sections

8.2	Offsite Power System	
8.3	Onsite Power Systems	
8.3.1.1	Auxiliary AC Systems	
8.3.1.2	Standby AC Power Systems	
8.3.2	DC Power Systems	
9.2.3	Emergency Service Water system	Revision 15
9.5.4	Diesel-Generator Fuel Oil Storage and Transfer System	Revision 15
9.5.6	Diesel-Generator Starting System	Revision 15
UFSAR Change No. 99-030	Change the Values of Emergency Service Water Flow Requirements in UFSAR Table 9.2-1 From 6 GPM to 0 GPM.	August 2, 1999
Table 9.2-1	Emergency Service Water Flow Requirements	Revision 15

Miscellaneous Documents

ANSI/ISA-67.04.01-2000	Setpoints for Nuclear Safety-Related Instrumentation	February 29, 2000
ISA-RP67.04.02-2000	Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation	January 1, 2000
ISA Draft TR67.04.09	Graded Approaches to Setpoint Determination (Draft 5)	September 2000
	Battery 1D1 Performance Test Surveillance	November 5, 1999
	Battery 1D1 Service Discharge Test	April 12, 1998
	Battery 1D1 Service Discharge Test	May 9, 2001
	Technical Evaluation Report Duane Arnold Energy Center Station Blackout Evaluation	May 13, 1991

Number	Title	Revision or Date
	RCIC Vacuum Pump Breaker Coordination Curve	March 22, 2002
	Standby Diesel Generator Exciter Breaker Coordination Curve	March 22, 2002
	Inverter 1D25 Supply Breaker Coordination Curve	March 22, 2002
	Safety Evaluation of the Duane Arnold Energy Center	January 23, 1973
SD-454	Emergency Service Water System Description	Revision 3
DBD-R42-001	125 VDC System Design Bases Document	Revision 4
DBD-R43-001	Standby Diesel Generator System Design Bases Document	Revision 2
DBD-E13-001	Emergency Service Water System Design Bases Document	Revision 6
	Pump and Valve Inservice Testing Program for Duane Arnold Energy Center	Revision 16
	Emergency Service Water and EDG Fuel Oil Transfer Pump IST Data (1995-2002)	
7884-24	Diesel Generator Pre-op Test	Revision 1
NG-90-2031	ESW and RHRSW Strainer Backwash Safety Classification	August 16, 1990
NG-91-0620	Operating EDG Fuel Oil Transfer Pumps at Less Than Specified NPSH for a Limited Period of Time	March 14, 1991
NG-91-2656	Fuel Oil Transfer Pumps, 1P-44A/B, NPSH Requirements	August 30, 1991
Memorandum	Alliant Energy Containment Spray Pumps - Upset Conditions	March 28, 2002
Vendor Manual	Installation, Operation, and Maintenance Instructions for Type “U” Mechanical Seals	1969
Vendor Manual	Borg-Warner High Pressure Heat Exchangers	June 1970
DBD-E13-001	Duane Arnold Energy Center Design Bases Document for Emergency Service Water System	Revision 6

EQR: Qual-L200-03C, 02C, 01C	Environmental Qualification System Component Evaluation Worksheet	Revision 1
Memorandum	EDSFI IR 91-0002 Unresolved Item #5: Engineering Analysis of EDG Air Supply Ducting Common Mode Vulnerability (Tornado)	August 21, 1991
QUAL-SC101	Environmental and Seismic Service Conditions	Revision 11
M015-147	Emergency Diesel Generator Inter Cooler Heat Exchanger Specification Sheet	Revision 0
M015-146	Emergency Diesel Generator Jacket Water Cooler Heat Exchanger Specification Sheet	Revision 0
MO15-145	Emergency Diesel Generator Lube Oil Cooler Heat Exchanger Specification Sheet	Revision 1
7884-APED-E11-2776-32-2	Technical Manual Residual Heat Removal Pump - Byron Jackson Pump Division	March 21, 1972
	Letter from Steve Rose, Flow Solutions Division of Flowserve, to Jim Dvorsky, Alliant Energy about RHR and Core Spray Pump Mechanical Seals	March 28, 2002
NG-93-4271	“A” EDG #6 and #7 Cylinder Temperatures	October 1, 1993
NG-94-0828	Input to Degraded AC Voltage Calculation for Motor Operated Valves, CAL-E92-20	March 2, 1994
Memorandum NG-02-0157	DAEC Safety Syatem Design Inspection (SSDI) Preinspections	February 22, 2002

Surveillances (completed)

Number	**Title**	**Date performed**
STP 3.8.1-11	Standby Diesel Generator Air Compressor, Air Start Check Valve, and Fuel Oil Transfer Pump Tests	December 27, 2001
STP #99	Diesel Generator 1G-21 Fuel Line Test	April 2, 1982
STP NS540002	Emergency Service Water Operability Test	December 21, 2001
EMP-1P099-FV	Emergency Service Water Flow Verification Test	October 22, 1999 & July 6, 1999
EMP-1E053-HT	Emergency Diesel Generator 1E-53A & B Coolers - Heat Transfer Test	July 6, 2000 & August 28, 2001

Surveillances (completed)

Number	Title	Date performed
STP 3.7.9-02	CB/SBGTS Instrument Air Compressors System Leakage and Capacity Test	March 19, 2000 & June 16, 2000, September 9, 2001 & December 8, 2001
EDSFI Report 331/91002	Review of Corrective Actions taken to Address Selected Design Issues Documented in EDSFI Report 331/91002	April 15, 1991