U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Division of Reactor Inspection and Safeguards
Special Inspection Branch

Report No.: 50-285/88-200

Docket No.: 50-285

Licensee: Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

Facility Name: Fort Calhoun Station

Inspection at: Omaha Public Power District Engineering Offices, Omaha, Nebraska

Inspection Conducted: February 18, March 21-25, and April 4-8, 1988

Inspection Team Members:

Team Leader: R. W. Parkhill, Senior Operations Engineer, NRR
Assist. Team Leader: M. E. Murphy, Region IV
Mechanical Systems: G. J. Overbeck, Consultant, ERC International
Mechanical Components: A. V. DuBouchet, Consulting Engineer
Instrumentation and Control: J. M. Leivo, Consulting Engineer
Electrical Power: G. W. Morris, Consultant, ERC International

Attended Exit Meeting:

J. P. Jaudon, Deputy Director, DRS, Region IV
A. B. Beach, Deputy Director, DRP, Region IV
E. V. Imbro, Section Chief, NRR
T. F. Westerman, Section Chief, Region IV
P. H. Harrell, Sr. Resident Inspector, Fort Calhoun
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R. W. Parkhill — 8-17-88
Ronald W. Parkhill, Team Leader — Date

Approved by: E. V. Imbro — 8-19-88
E. V. Imbro, Chief, Team Inspection Development and Appraisal Section — Date

Fort Calhoun Station
SSOMI Design Reinspection
February 18, March 21-25, and April 4-8, 1988

1. Background

The NRC Office of Inspection and Enforcement conducted a safety systems outage modification inspection (SSOMI) of the Fort Calhoun Station in the fall of 1985. That inspection was initiated to examine the adequacy of licensee management and control of modifications during major outages. The associated inspection report, 50-285/85-22, for the design portion of the SSOMI was issued on January 21, 1986; and an enforcement conference was held in the regional offices on July 10, 1986. NRC regional management requested that the Division of Reactor Inspection and Safeguards within the NRC's Office of Nuclear Reactor Regulation conduct a reinspection to assess the licensee's corrective actions associated with all of the original SSOMI's design findings.

2. Purpose

The primary purpose of this inspection was to verify the adequacy of the corrective actions initiated by the licensee in response to the 47 design-related findings identified in Inspection Report 50-285/85-22. This assessment included an evaluation of the generic implications of each finding as well as the specific resolution. The secondary purpose of the inspection was to perform a programmatic review of the licensee's design-basis reconstitution program.

3. Personnel Contacted

The following is a listing of key personnel contacted during the inspection:

Name	Position
J. Fisicaro	Supervisor, Nuclear Regulatory and Industry Affairs (NRIA)
S. K. Gambhir	Section Manager, Generating Station Engineering (GSE)
H. M. Tackett	Consultant to NRIA
M. Eidem	Manager, GSE Mechanical and Nuclear
D. Mangan	Consultant, GSE
R. Parsons	Design Basis Project Engineer, GSE
D. Deboer	Engineer, GSE
R. Lewis	Supervisor, Mechanical Engineering, GSE
H. J. Faulhaber	Electrical Engineering Manager, GSE
S. Miller	Battery Engineer, GSE
D. Morris	Load Coordinator, GSE
R. Ronning	Cable Engineer, GSE
R. Clemens	Cable Engineer, GSE
W. C. Gartner	Lead Electrical Design Engineer, GSE
J. Tucker	Sr. Design Engineer, Electrical Engineering, GSE
S. Crites	Sr. Designer, Mechanical Engineering, GSE
J. Lechner	Fire Protection Engineer, Fort Calhoun Station

4. Summary of Open Items/Licensing Issues

The NRC inspection team reviewed a large number of calculations, drawings, specifications, and other design documents during the 10-day inspection as further detailed in this report. On the basis of this review, the team was able to close 39 of the 47 original findings identified in Inspection Report 50-285/85-22. The findings that remain open are D2.1-1 and D2.2-3 in the mechanical systems discipline, U3.1-3 and D3.2-7 in the mechanical components discipline, D4.3-1 and U4.4-1 in the instrumentation and controls discipline, and D5.1-1 and D5.2-1 in the electric power systems discipline.

Attachment A provides a comprehensive description of the resolution and status of all the SSOMI design findings in Inspection Report 85-22 including a description of the correction actions necessary to resolve the open items.

The two mechanical system items that remain open identify concerns relating to the adequacy of the functional testing performed on the air accumulators for air-operated valves. These air accumulators are attached to the instrument air lines to allow various safety-related air-operated valves to achieve a safety-related position in the event of loss of the instrument air system. Through review of the actual test procedure and test results, the inspection team found that the licensee did not adequately perform postmodification testing to ensure that the accumulators and their associated check valves would function as designed. Specifically, the functional test did not duplicate accident conditions, nor were the test data reviewed to correlate them to accident conditions. Also, the test instrumentation was not arranged to measure initial accumulator pressure and system leakage. To resolve this finding the licensee is asked to review and validate all air accumulators tested to date, complete its program for evaluation of the use of air accumulators including the development of functional test criteria and surveillance testing, and provide the necessary training to all affected personnel.

The two mechanical component items that remain open are associated with maintenance of the Updated Safety Analysis Report (USAR) and compliance with USAR commitments. The team found that the licensee's alternate seismic criteria for small-bore piping need to be submitted to the NRC for formal review since they relax current USAR commitments (see Unresolved Item U3.1-3 for details). Also, the team noted that the licensee is not complying with the USAR criteria associated with valve actuator seismic accelerations, nor has it developed an alternate criterion. As a consequence valve actuator seismic accelerations have not been considered and valve operability during and after a seismic event is uncertain (see Deficiency D3.2-7 for details).

The two instrumentation and controls items that remain open involve noncompliance with a USAR commitment and relaxation of applicable code requirements. First, the team found that the licensee was not meeting a USAR commitment to provide position indication for containment isolation valves during all modes of plant operation including accident scenarios. Second, the team questioned the licensee's basis for physical separation of control wiring within panels. Specifically, the licensee's original practice of common routing of redundant safety-related divisions and common routing of safety-related and nonsafety-related wiring was inappropriately continued for modifications to safety-related panels that were recently procured to the requirements of Regulatory Guide 1.75 and Institute of Electrical and Electronics Engineers (IEEE) Standard 384. The team believes that such modifications may represent an unacceptable relaxation of the criteria stipulated when the panels were procured.

The two electrical power system open items involve nonconservatims in the battery sizing calculation and the fire wrap cable ampacity derating calculation. In regard to the former, the licensee neglected to consider battery end-of-life effects. To resolve this issue, the licensee has committed to obtain the battery manufacturer's assistance to establish the capacity remaining in the batteries. To resolve the latter open item, the licensee needs to correct the cable derating calculation to include proper consideration of a specific manufacturer's cable data, application of the correct thermal conductivity for the fire wrap, and justification for one power feeder cable to a motor control center being above the allowable ampacity.

In addition to the eight open items remaining from the original SSOMI, four of the items that were closed for the purpose of this inspection remain open licensing issues to be resolved by the licensee and NRR's project directorate. These four open licensing issues involve noncompliance with USAR seismic design requirements for valves, electric motor operators, junction boxes and pressure switches and the adequacy of the piping analyses performed in response to NRC Bulletin 79-14. See Open Items 03.1-4, D3.2-4, 03.2-5, and D3.2-8. These issues are discussed below.

In regard to Observation 03.1-4, the inspection team found that the seismic qualification of certain safety-related components was not in accordance with the current licensing commitments in Appendix F of the USAR. The team found that the seismic design or test criteria for various valves (e.g., motor-operated, air-operated, ball, manual gate and globe, relief, safety) and electric motors specified in Omaha Public Power District Contract 763 were not provided in their associated design specifications. The licensee informed the team that the lack of seismic design criteria for valves, motors, and other components would be resolved as a part of Unresolved Safety Issue (USI) A-46. However, during a teleconference between the inspection team, members of NRC's Mechanical Engineering Branch (MEB), the NRC project manager and the Region IV staff, the team was informed that MEB's program to resolve the seismic qualification issues addressed in USI A-46 assumes that safety-related equipment conforms with the USAR commitments. In a letter from NRC (J. Calvo) to OPPD (K. J. Morris) dated July 28, 1988, the NRC staff accepted, subject to certain conditions, OPPD's proposal to delay the resolution of seismic qualification of equipment until the resolution of USI A-46.

The original issues associated with Findings D3.2-4 and 03.2-5 documented that the Unistrut supports for the junction box to valve YCV-1045B did not meet the seismic provisions of USAR Appendix F; and the replacement pressure switches in Modification Request MR-FC-83-83 warranted a more thorough analysis to substantiate seismic qualification, respectively. The team reviewed and found acceptable these specific issues during this inspection of the implementation of corrective actions. However, the licensee stated that the generic issue of seismic qualification of all other safety-related junction boxes and pressure switches will be included in its program for resolving USI A-46. Therefore, it is necessary that this commitment be addressed by the licensee in its submittal pertaining to the A-46 program.

During the programmatic review of the licensee's design-basis reconstitution program for the auxiliary feedwater system, the team identified concerns relating to the adequacy of the licensee's 79-14 program (Deficiency D3.2-8). The intent of this inspection was not to review the licensee's 79-14 program.

However, in reviewing the design-basis reconstitution program, the team tried to determine whether certain design attributes in the area of piping analysis would be addressed by the design-basis reconstitution program and whether the licensee had data available to support these attributes. The team identified three design attributes that should have been reviewed under the 79-14 program, but were not: (1) consideration of seismic anchor movements between structures, (2) consideration of equipment nozzle thermal movements, and (3) consideration of friction loads for pipe supports. In a very limited review of piping analysis attributes, three problems were found. Therefore, the team believes that a more detailed evaluation of the 79-14 program performed for the licensee by Gilbert/Commonwealth should be conducted by NRC.

5. Assessment of Changes Since SSOMI (85-22)

a. Mechanical Systems

Since the SSOMI, the licensee has initiated actions that should substantially improve modification packages if implemented in accordance with procedures. These actions include the following:

(1) issuing general engineering guidelines for the preparation of specifications, design packages, installation and test procedures, and 10 CFR 50.59 safety evaluations

(2) strengthening of Standing Order G-21 to ensure the timeliness of third-party review for normal modifications

(3) developing a new administrative procedure to govern the use and documentation of engineering judgment in place of detailed calculations or design analyses during the preparation of modification packages

(4) revising Administrative Procedure A-5 to clarify that technical exceptions from the recommended bidder must be formally withdrawn by the bidder or the the licensee's purchase document and/or the specification must be reconciled to include the exceptions

(5) revising Administrative Procedure A-11 to control calculations and to require the indexing of all calculations

(6) strengthening of Design Procedure B-11 to require multidisciplinary review of modification packages

The team reviewed these changes and found that they address the weaknesses in the licensee's modification control program originally identified by the SSOMI team. However, continued weaknesses exist in the use of the USAR as a source of design input and in postmodification testing. In recognition of this weakness, a design-basis reconstitution program has been initiated by the licensee. Interim use of the USAR until design-basis documents are available is acceptable considering the precautions included in the various implementing procedures regarding the need for reliable design input. Post-modification testing continues to be a weakness. During the reinspection the team reviewed functional testing performed on air accumulators and

identified errors that suggest that inadequate attention to proper functional test and appropriate acceptance criteria is still a weakness.

b. Mechanical Components

The team concludes that the licensee's program, which it is developing, should enhance its design staff's ability to implement design modifications to piping, equipment, and supports in a controlled manner. The team's assessment is based on its review of

(1) the licensee's responses to the deficiencies, unresolved items, and observations which the team documented in NRC Inspection Report 50-285/85-22

(2) the licensee's program to regenerate the design basis for the safety-related piping systems at Fort Calhoun

(3) General Engineering Guide GEG-3, "Preparation of Design Packages"

With respect to item (1), the team specifically noted that to address Deficiency D3.1-1, the licensee withdrew an uncontrolled design specification and engaged Stone & Webster to regenerate the system design basis for the safety-related piping systems at Fort Calhoun. The team also noted that to address Deficiency D3.1-2, the licensee withdrew uncontrolled design temperature data and engaged Applied Power Associates to document the operating and accident temperatures for the safaty-related piping systems at Fort Calhoun.

With respect to item (2), the team believes that the licensee's commitment to regenerate the design basis for the safety-related piping systems at Fort Calhoun will provide a controlled and retrievable design basis for the safety-related piping, equipment, and supports installed at Fort Calhoun.

With respect to item (3), the team reviewed General Engineering Guide GEG-3, "Preparation of Design Packages," which the licensee engaged Sargent & Lundy to prepare. The team believes that the procedure if properly followed, should enable the licensee's design staff to implement design modifications in a controlled manner.

In summary, despite its concerns documented elsewhere in this inspection report, the team believes that the licensee has made measurable progress since the last SSOMI by committing to create a controlled and retrievable design basis for safety-related piping, equipment, and supports and by enhancing the ability of its design staff to implement design modifications in a controlled manner.

c. Instrumentation and Control

The team noted several areas of programmatic improvement relative to the initial SSOMI findings. The licensee has developed more explicit procedures which should promote better engineering and control of design changes, provided personnel are adequately trained and the procedures are consistently followed.

One notable example of this improvement was the newly developed General Engineering Guide GEG-3, "Preparation of Design Packages." This document

appears very thorough in addressing the necessary technical attributes of a design change and encourages an engineering thought process in developing a modification. Before this guide was developed, design attributes were treated more superficially in Design Procedure B-2.

For example, GEG-3 provided an outline of a root cause determination process, which should promote better problem definition and design-basis development for changes. It also provided a comprehensive list of design attributes for consideration, with specific reference to supporting engineering guides, e.g., human factors review and ALARA (as low as reasonably achievable) analysis guidelines. Guidance also was provided for systems interaction analysis and 10 CFR 50.59 reviews. The structure, as well as content of the document, was in a practical, readily usable form; it appeared less likely that significant attributes would be omitted in the change process, if GEG-3 were conscientiously used.

The team noted that several of the original SSOMI findings might have been less likely if all of the guidelines had been available for developing the modifications inspected. For example, the definition of environmental and process conditions for procurement specifications might have been more accurate and consistent; separation requirements and design basis might have been more evident to the preparers of the modifications; the definition and solution of the problem for the containment isolation valve limit switches in Deficiency D4.3-1 might have been more consistent.

The team encouraged the licensee to complete these engineering guides, which together with a documented design basis should promote significant improvements to the modification process.

d. Electric Power Systems

Programs were just being established that would ensure a detailed review and verification of future modifications. These new programs also would require interdiscipline review. General Engineering Guideline GEG-9, "Electrical Systems Interaction" prepared by Sargent & Lundy in February 1988, had not been issued formally but promised to provide strong guidance to the design engineer. Recently prepared General Engineering Guideline GEG-27, "Safety Evaluations," and GEG-28, "Preparation of Installation and Test Procedures," if properly implemented could have eliminated many of the original observations in NRC Inspection Report 85-22. Revisions to Standing Order 21, "Station Modification Control," Revision 29, November 1987, and the issuance of GEG-3, "Preparation of Design Packages," November 1987, should strengthen the modification control procedure. Revisions to Design Procedure B-11, "Independent Design Verification," February 1988, should also ensure the accuracy of the design packages.

6. Design Basis Reconstitution Program (DBRP)

Recognizing that the licensee was in the initial stages of developing its DBRP and that the NRC has not established specific guidance for such programs, the team performed a programmatic review of the DBRP, on a sampling basis, to assess whether all the necessary design-basis documentation had been identified (but not necessarily regenerated) within the mechanical components and instrumentation and control (I&C) disciplines. The team sampled some of the available products of the program to assess the completeness of necessary design attributes, but

did not attempt to assess the depth and technical adequacy of the identified design-basis documents.

The DBRP is intended to establish a comprehensive and up-to-date compilation of design records. It will document the original design basis, eliminate the need for using the USAR as a design-basis document, provide documentation of calculational inputs and assumptions, provide licensing commitment tracking, and eliminate the use of uncontrolled documents. There are two types of design basis documents: system design-basis documents and plant-level design-basis-documents. The system design-basis documents are documents which contain a comprehensive listing of design information for a specific system. Plant-level design-basis documents are documents which contain generic design information applicable to multiple systems or which are not system related but contain design basis information for the facility (e.g., pipe stress criteria, seismic criteria, welding criteria).

The team's review included the scope of the DBRP as reflected by the current list of candidate systems, a sample of the system level design-basis document (DBD) for the auxiliary feedwater system, and the intended scope of forthcoming plant-level DBDs. The review of the plant-level DBDs in the I&C area consisted primarily of interviews and discussions with the team's counterparts to assess their intentions, since details of the plant-level DBDs generally were not yet available. In the mechanical components area, the team assessed the licensee's ability to prepare the plant-level DBD in accordance with USAR commitments by compiling a list of design loads and asking the licensee to confirm that each load type was controlled and retrievable through its document retrieval system, since plant-level DBDs had not yet been prepared.

Regarding the scope of the program, the team noted that the following safety-significant systems seemed to be missing: the reactor protection/engineered safety features actuation system, the loose parts monitoring system, and the offsite dose assessment information processing and display system as described in NUREG-0654. Discussions with the licensee indicated that it also intends to include instrumentation specified in Regulatory Guide 1.97 and NUREG-0737 in the program, even though they are not explicitly listed.

Regarding the auxiliary feedwater system DBD, the team was generally impressed by the overall structure and content of the document and the number of attributes addressed in depth. As one example, the team liked the presentation of design requirements in addition to that of design implementation; this approach seemed effective in capturing subtle design insights that could be lost if the "why" as well as the "how" of the design were not adequately documented. The team did identify some design attributes it expected to see, but was unable to find, in the auxiliary feedwater system DBD. These attributes included requirements for instrument channel range, accuracy, and repeatability; requirements for alarms; requirements for trending, recording, and archiving data; and interlock requirements imposed by equipment vendors to assure proper operation of the equipment.

Regarding the plant-level DBDs in the I&C area, the team understood that several engineering guides, standards, analyses, and studies/evaluations were planned. On the basis of its discussions with the licensee, the team expected that in addition to attributes explicitly listed in the program documents, the following were or would be included in the program:

(1) instrument channel uncertainty calculations and techniques

(2) design basis for internal flooding (e.g., pipe breaks)

(3) outdoor-temperature ranges (the team understood that no safety-related instrumentation and controls were exposed to the outdoor environment)

(4) evaluation of the plant annunciator system to form a design basis for the system

(5) I&C grounding and shielding

(6) inclusion of fuse type and fuse rating in the planned instrument bus load study

(7) instrument and tubing installation specifications

In reviewing the plant-level DBDs in the mechanical components area, the team found that the auxiliary feedwater (AFW) piping analyses of record did not incorporate an evaluation of the following items, which are detailed in Deficiency D3.2-8:

(1) a USAR commitment to consider the effects of relative seismic displacements between the containment shell and the auxiliary building on the connected AFW piping,

(2) consideration of the effects of the steam generator nozzle thermal displacements on the connected AFW piping

(3) consideration of the effects of the AFW pump turbine inlet nozzle thermal displacements on the connected piping

(4) consistent consideration of friction forces for pipe support design

As a result, the team concludes in the mechanical component's area that the licensee's current ability to prepare plant-level DBDs such as CS-51, "Seismic Criteria," and ME-10, "Pipe Stress and Supports," was hampered by the lack of controlled documents that specified code of record and design criteria and by a USAR that contained several provisions considered obsolete by the licensee.

In general, the team was favorably impressed by the licensee's efforts to date. It also sensed from its discussions that the licensee seems motivated to establish a thorough and useful design basis to be maintained for the life of the plant.

ATTACHMENT A

STATUS OF FINDINGS

FINDING NO.	STATUS	TITLE
Mechanical Systems Discipline		
D2.1-1	Open	Lack of Design Analysis To Support Sizing of Air Accumulators for Valves YCV-1045 A/B
D2.1-2	Closed	Seismic Requirements not Specified in MR-FC-83-158 Procurement Documents
02.1-3	Closed	Vendor Exceptions to Specifications Not Reflected in Procurement Document
2.1-4	N/A	Item Number Not Used
02.1-5	Closed	Procedural Error Caused Seismic and Stress Analysis for MR-FC-83-158 Not To Be Filed In Modification File
D2.1-6	Closed	Failure To Follow Procedural Requirements for a Normal Modification Resulting in Lack of Required Design Verification Review
D2.1-7	Closed	Incomplete Installation/Testing Procedure in Construction Package for MR-FC-83-158
D2.1-8	Closed	Incorrect Information on Flow Diagram for Main Steam System
D2.1-9	Closed	Incorrect System Description Statements
U2.1-10	Closed	Use of Fluorocarbon-Elastomer Material in High Radiation Environments
D2.2-1	Closed	Incorrect Design Input in Calculation Associated With MR-FC-81-21B
D2.2-2	Closed	Incomplete Consideration of CQE and Seismic Class I Requirements for Portions of MR-FC-81-21B
D2.2-3	Open	Incomplete Installation/Testing Procedure Performed for MR-FC-81-21B
02.2-4	Closed	Incomplete Modification File for a Completed Modification
D2.2-5	Closed	Incorrect Information on Instrument Air Diagram

FINDING NO.	STATUS	TITLE
D2.2-6	Closed	10 CFR 50.59 Safety Evaluation Based Upon Incorrect Assumption and Analysis Methodology
Mechanical Components Discipline		
D3.1-1	Closed	Balance of Plant Design Specifications
D3.1-2	Closed	Design Temperatures for Safety-Related Piping
U3.1-3	Open	Small Bore Pipe Support Spacing
O3.1-4	Closed*	Seismic Qualification of Valves Installed in Class I Piping Systems
U3.2-1	Closed	MR-FC-84-61 Design Input Source and Use
D3.2-2	Closed	MR-FC-83-158 Installation Procedure
D3.2-3	Closed	MR-FC-84-162 Calculation
D3.2-4	Closed*	Junction Box Supports
O3.2-5	Closed*	Containment Pressure Switch Seismic Qualification
D3.2-6	Closed	Steam Generator Nozzle Dams
D3.2-7	Open	YCV-[illegible]5B Valve Restraint
D3.2-8 (new)	Closed*	Auxiliary Feedwater Piping Analysis Design Input Loads
Instrumentation and Controls Discipline		
O4.1-1	Closed	High Power Rate of Change Trip Bypass
O4.2-1	Closed	Delta T Power Loop Analysis
D4.3-1	Open	Limit Switch Circuit Protection by Fusing, MR-FC-84-74A
U4.3-2	Closed	ESF Bypass Switch Keylock Provision, MR-FC-31-102
O4.3-3	Closed	Procurement Requirements on Equipment Vendors
U4.4-1	Open	Design Basis Physical Separation Within Panels
D4.5-1	Closed	Drawing Changes by Procedure A-9, MR-FC-82-178

*Finding closed for this inspection report, but the associated licensing issue needs to be resolved between the licensee and NRR project directorate

FINDING NO.	STATUS	TITLE
04.5-2	Closed	Flow Element Design Basis Conditions
U4.5-3	Closed	Battery Room Fire Hazard Analysis
Electrical Power Systems Discipline		
D5.1-1	Open	Battery Sizing Calculation
U5.1-2	Closed	Battery Charger/DC Bus Coordination
05.1-3	Closed	Power Cable Sizing Criteria
05.1-4	Closed	Pre-Operational Test Requirements
05.1-5	Closed	Inverter Sizing Without Analysis
05.1-6	Closed	Design Interface Control
D5.2-1	Open	Fire Wrap Protection for Cable Raceways
Design Change Control		
D6.1-1	Closed	Safety Evaluation for Non-Safety-Related Systems Described in the USAR
U6.1-2	Closed	Safety Analyses for Emergency Modifications
06.1-3	Closed	Vital AC Inverter Bypass Mode
06.2-1	Closed	Untimely Closeout of Emergency Modifications
D6.2-2	Closed	Modifications to AFW Turbine Steam Supply Valves

(Open) Deficiency D2.1-1, Lack of Design Analysis To Support Sizing of Air Accumulators for Valves YCV-1045 A/B

BACKGROUND

When the modification request, MR-FC-78-43 was initiated in September 1978, an air accummulator sizing calculation was not performed to demonstrate that a sufficient stored volume of pressurized air would be available to close valves YCV-1045 A and B assuming a loss of instrument air and minimum initial accumulator pressure. In response to the finding, the licensee functionally tested the accummulators to ensure that their size was adequate.

STATUS OF FINDING

During the reinspection, the team reviewed the functional test, performed on January 5, 1986, to assess the adequacy of design. The test had the following weaknesses and differed from the modification final design package as follows:

(1) The test acceptance criterion was based on holding valve YCV-1045 A or B shut for 30 minutes, even though the final design description of the modification package indicated that the accumulators were designed to supply air to keep the valve closed for 1 hour. The team was informed that the time was relaxed from 1 hour to 30 minutes on the basis of an engineering judgment that the distance from the control room to the location of the valves, in Room 81, is very short. The design engineer discussed the issue with operations personnel, and they concluded that 30 minutes was long enough. Field Change #2 relaxed the hold time and when it was approved an oversight occurred so that the final design description was not updated.

(2) The functional test did not duplicate the accident condition, and the acceptance criterion was not altered accordingly. Specifically, valves YCV-1045 A and B were not shut against system pressure and the worst-case lowest accumulator pressure was not duplicated. In spite of these shortcomings, the licensee determined that the existing postmodification test produced satisfactory results by comparing the minimum air pressure necessary to close and hold the valve in that position for 30 minutes with the initial accumulator pressure corrected for worst-case conditions.

A related issue was the adequacy of operating procedures to warn of the potential loss of instrument air to the valve operators. Abnormal Operating Procedure AOP-17, "Loss of Instrument Air," Revision 5, February 11, 1986, contained a note warning the operator that valves YCV-1045 A and B are equipped with air accumulators and remain operable for at least 30 minutes, after which they fail open on loss of accumulator air reserves. The team noted that Emergency Operating Procedure EOP-04, "Steam Generator Tube Rupture," Revision 02, February 1, 1988, and Abnormal Operating Procedure AOP-24, "Steam Generator Tube Rupture (PPLS Blocked)," Revision 1, October 8, 1986, did not have a similar warning. The team was informed that Emergency Operating Procedure EOP-20, "Functional Recovery Procedure," Revision 3, March 14, 1988, referred the operator to Procedure AOP-17. Procedure EOP-20 provided the operator

actions for events during which a diagnosis was not possible, for two or more events occurring simultaneously, or for events during which emergency guidance was not available. The team confirmed that under Maintenance of Auxiliaries Procedure MVA-3, "Recovery of Instrument Air," Revision 2, March 14, 1988, the operator was referred to Procedure AOP-17. Because Procedure EOP-20 referred the operator to the AOP containing the caution, the team's concern is satisfied.

Another related issue was the testing of the instrument air check valves which isolate the accumulator and associated air-operated valve from the instrument air system upon a loss of instrument air. The licensee has submitted a revised inservice inspection program plan, dated December 15, 1987, to the NRC and has identified the two check valves (Tag Nos. IV-1045 A-C and IV-1045 B-C). The revised plan requires these valves to be functionally tested to the open and closed positions.

This item will remain open pending the (1) completion of a formal calculation to document the adequacy of the postmodification test when corrected for worst-case conditions and (2) revision of the final design description for modification MR-FC-83-158 to correct incorrect information.

RELATED GENERIC ISSUES

See Deficiency D2.2-3 regarding the generic issues related to the adequacy of the overall testing program for the air accumulators and the actions by the licensee required for closure.

(Closed) Deficiency D2.1-2, Sesimic Requirements Not Specified in MR-FC-83-158 Procurement Documents

BACKGROUND

The seismic requirements for the manual and check valves for modification MR-FC-83-158 were omitted from procurement documents even though these valves in conjunction with air accumulators and associated tubing serve a post-accident function to close valves YCV-1045 A and B. At the time of the 1985 SSOMI, neither design analysis nor documented engineering judgment existed to substantiate that the subject valves were seismically qualified.

STATUS OF FINDING

During the reinspection, the licensee provided documentation of the engineering judgment that NUPRO check valve M/N SS-6C-10 and small manual valves purchased for the above modification were seismically qualified (GSE-FC-88-596, memorandum from M. E. Eidem to MR-FC-83-158 file, April 5, 1988). The team reviewed this engineering judgment and found that it was an acceptable basis for concluding that the valves were seismically qualified by similarity for approximately 6g's. However, the licensee could not justify the seismic qualification for 100g's as stated in the April 15, 1986 response to the original SSOMI report. Since the subject valves are qualified for the their intended purpose, the team suggests that the licensee carefully review future submittals with an increased attention to accuracy and less attention to dramatic emphasis.

RELATED GENERIC ISSUES

A generic issue identified during the SSOMI was the use of undocumented engineering judgment in lieu of design analyses. During the reinspection, the licensee issued a new policy A-14, "Use of Engineering Judgment," Revision 0, April 1988. This policy outlines the requirements and documentation necessary when using engineering judgment in place of detailed calculation or analysis in preparing modification packages, 10 CFR 50.59 safety evaluations, and engineering reports. This procedure, when implemented, should improve traceability of final design back to design input. This new policy satisfies the team's concern.

See Observation 03.1-4 for the generic issue related to equipment seismic qualification.

(Closed) Observation 02.1-3, Vendor Exceptions to Specifications Not Reflected in Procurement Document

BACKGROUND

Although the supplier of components for a safety-related modification took exception to the storage requirements of a procurement specification, documentation did not exist of an engineering review and acceptance of the vendor's exception. The observation suggests that the vendor's exception should have been evaluated and, if acceptable, the specification should have been revised to reflect the acceptable alternative.

STATUS OF FINDING

During the reinspection, the licensee revised Administrative Procedure A-5, "Procurement of Material and Labor," Revised April 1988. This revision specified that the technical exceptions received from prospective suppliers should be addressed in the documented evaluation of bids. For a specification pertaining to critical quality equipment all technical exceptions from the recommended bidder must be formally withdrawn by the bidder or from the licensee's purchase document and the specification must be reconciled to include the exceptions. In addition, all changes to purchase documents and specifications must be reviewed and approved in the same manner as that required for the original document. This revision to Administrative Procedure A-5 is responsive to the team's concern.

RELATED GENERIC ISSUES

There is no related generic issue because the specific issue did not result in a safety concern and the programmatic change addresses the general issue.

(Closed) Observation 02.1-5, Procedural Error Caused Seismic and Stress Analysis for MR-FC-83-158 Not To Be Filed in Modification File

BACKGROUND

During the 1985 SSOMI, the team found that a seismic and stress analysis "Generic Air Accumulators Using Propane Tanks Built to DOT Spec. 4BA-240," Revision 0, August 1985, for the air accumulators was not filed with the modification package. At that time, the licensee did not maintain calculations as living documents i.e., calculations maintained in a calculation file and kept current as plant system, structures, components were modified throughout the life of the plant. Instead, calculations were done, as required, for each modification and the modification file was the only controlled location for retention of design calculations. The team made the observation that a better control process for calculations would allow enhanced retrival, use, and revision of design calculations.

STATUS OF FINDINGS

During the reinspection, the team reviewed Administrative Procedure A-11, "Calculation Numbering and Revision Control." Revised March 1987. The procedure was revised to require the indexing of all calculations, with a separate log book for each station both fossil and nuclear. In addition, the main frame computer could be searched using the GSE-1 search program to identify the file location of a calculation. Current and past revisions of calculations were available on microfilm in Document Control. The team examined the log book for the Fort Calhoun Station and witnessed a demonstration of the GSE-1 search program for calculations.

The current method of filing calculations should ensure that calculations can be retrieved and revised. The team observed that old calculations had been added to the index as well as new ones. The computer aided retrieval system appeared to be a very effective tool.

RELATED GENERIC ISSUES

The related generic issue of control of calculations is addressed above.

(Closed) Deficiency D2.1-6, Failure To Follow Procedural Requirements for Normal Modification Resulting in Lack of Required Design Verification Review

BACKGROUND

Normal modification MR-FC-83-158 was not treated in a manner consistent with the requirements of Design Procedure B-2 "Production of Design Description and Evaluation," Revised January 1984. During the 1985 SSOMI, the team found that a construction package was prepared even though the verification of the final design package had not been completed. This situation was further aggravated by the design engineer who determined that the construction package did not require third-party review and who signed a memorandum for the department manager stating that a third-party review was not required.

STATUS OF FINDING

Although the licensee maintained that no deficiency existed, the team confirmed during the reinspection that the following actions had been completed.

Revision 27 to Standing Order G-21, dated April 10, 1987, was issued and included the following changes:

(1) Definition 1.4.25 was included to address independent design verification.

(2) Paragraph 5.6.8 was revised to include the requirements for completion of the independent design verification before the contruction package is approved by the Manager, Fort Calhoun Station. In addition, this paragraph was revised to state that all field changes or procedural changes and any additional calculations or analyses must be completed before the system is accepted.

These revisions addressed the team's concern that construction of a normal modification will not occur before third-party review is completed unless approved by site and engineering management.

Administrative Procedure A-2, "Modification Request Development," was revised in February 1988 to include the following change:

(1) Section 2.4 requires that design verification of all design documents and installation and testing procedures be completed before the final design package is accepted by the Manager, Fort Calhoun Station. Exceptions may be granted by joint agreement between the Manager, Fort Calhoun Station and the Generating Station Engineering (GSE) section manager for certain specialized cases.

For the purposes of construction package approval and system acceptance, any of the following is considered a completed third-party review (independent design verification):

(1) Third-party review in accordance with GSE Procedure B-11 that is completed and signed off as being "in compliance."

(2) Third-party review in accordance with GSE Procedure B-11 that is completed and signed off as being "in compliance except as noted" provided reviewer's comments have been reviewed and resolved by the design engineer. To resolve comments requires a field change/procedural change incorporating any changes suggested by the third-party reviewer and a letter written by the design engineer to the GSE Manager providing comment and resolution.

(3) A letter from the design engineer to the department manager stating that any field changes will not result in design deficiencies that will preclude the modification from performing its intended function. In this case, the department manager will review the letter and document the approval. Examples are field changes that are justified by engineering judgment based on safety margins provided in the original design or because of their similarity to other approved designs. This option is used for design verification of emergency modifications. This approach does not mean that third-party reviews are not performed; instead it means that the design engineer will ensure that the third-party reviews have been completed for each field change and that their net effect will not cause a design-deficient condition to exist.

Design Procedure B-22, "Independent Design Verification," was Revised February 1988 to include the following changes:

(1) Paragraph 4.2 was amended to require all modifications to have a multidiscipline review.

(2) Paragraph 1.0 was clarified to indicate that independent multidisciplinary design verifications will be done for design changes including, those pertaining to critical quality equipment (CQE), limited CQE, non-CQE, and fire protection system and components.

Although the licensee in response to Inspection Report 50-285/85-22 maintained that the observation was not a deficient condition or violation of its procedures, the need for performing design verifications has changed and the method used for performing these reverifications has been improved. On the basis of a programmatic review of the above-referenced procedures, the team's concerns have been satisfactorily addressed; therefore, this item can be closed.

RELATED GENERIC ISSUES

The related generic issue was addressed in conjuction with the resolution of the aforementioned finding.

(Closed) Deficiency D2.1-7, Incomplete Installation and Testing Procedures in Construction Package for MR-FC-83-158

BACKGROUND

The postmodification testing procedure did not provide for the testing of the design function of the air accumulators to shut valves YCV-1045 A and B against a differential pressure of approximately 1000 psig. During installation, these valves were closed and never cycled as part of postmodification testing. The air supplied by normal instrument air header was used to pressurize the actuators instead of air supplied by the accumulators alone. In addition, no acceptance criterion defined acceptable air leakage. After the NRC audit, a new functional test was performed.

STATUS OF FINDING

Weaknesses identified in the functional test performed on January 5, 1986, are identified in STATUS OF FINDING for Deficiency D2.1-1. The functional test corrected the weakness stated in the deficiency with respect to initial closure of valves YCV-1045 A and B with the normal instrument air supply; however, it did not contain adequate acceptance criteria to confirm that the modified system would perform under worst-case accident conditions.

Revision 17 to Standing Order G-21, dated April 10, 1987, was issued to (1) reference Standing Order G-19 for testing requirements; (2) define the requirement for stating the postmodification system/component performance requirements for preparing, performing, and evaluating the test; (3) specify the person responsible for evaluating modification-related test results; and (4) ensure that systems are tested and test results are approved before the systems are returned to service after they have been modified.

The operations engineer and the onsite review committee are responsible for ensuring that the postmodification system/component performance requirements are adequately stated, sufficient steps are included for performing the test, responsibility for evaluating the test results is clearly defined, and adequate assurance exists that testing results are approved before a system is returned to service following a modification.

On the basis of the revision to Standing Order G-21, the team finds that procedural requirements appear to exist to prevent the use of incomplete installation and testing procedures. Weaknesses in the functional test will be corrected as part of closure of Deficiency D2.1-1; therefore, this item can be closed.

RELATED GENERIC ISSUES

The weaknesses in the second functional test contributed to the team's concern that implementation of postmodification testing requirements at Fort Calhoun is generally weak and, therefore, additional licensee attention is needed. Specific action is described as part of Deficiency D2.2-3, which is still open.

(Closed) Deficiency D2.1-8, Incorrect Information on Flow Diagram for Main Steam System

BACKGROUND

During the 1985 SSOMI, the team identified an error on the drawing showing the piping arrangement associated with the main steam isolation bypass valves and the auxiliary feedwater steam warmup lines. The drawing indicated an incorrect arrangement where the piping to the bypass valves taps off the upstream side of the disc and returns to the upstream side, instead of the correct arrangement where the return is between the main steam isolation valve and its associated reverse flow check valve. This error apparently caused the piping connected downstream of the bypass valve to be indicated as being nonsafety-related.

STATUS OF FINDING

During the reinspection, the team reviewed Drawing 11405-M-252, "Flow Diagram Steam," Revision 49, dated February 17, 1988, and found that it correctly shows the piping arrangement associated with the bypass valves and the auxiliary feedwater steam warmup lines.

RELATED GENERIC ISSUES

On the basis of its review, the team finds that this error appears to be isolated and does not warrant a broader review.

(Closed) Deficiency D2.1-9, Incorrect System Description Statements

BACKGROUND

During the 1985 SSOMI review of various modification packages, the team examined the licensee's system descriptions to confirm system design bases and found errors in three system descriptions. In response to this deficiency, the licensee stamped all volumes of the system descriptions as "Uncontrolled Document, For Information Only."

STATUS OF FINDING

During the reinspection, the team confirmed that Notebooks 51 and 54 containing Volumes 1 through 3 of system descriptions had been stamped "Uncontrolled Document For Information Only." On the basis of the evidence that notebooks containing old system descriptions are marked for information only, this item is closed.

RELATED GENERIC ISSUES

A related generic issue is the inability to access the design-basis information when implementing design change. One of the goals of a Design-Basis Reconstitution Project, a program initiated by the licensee, is to organize design-basis records in such a way that a set of system-oriented design-basis documents (DBDs) can be generated from these records. DBDs will be developed for safety systems and systems that may affect operation of safety systems. In addition, plant-level documents also will be developed to address such generic subjects as seismic and fire protection. These DBDs will reflect the current design condition of the plant, combined with a limited historical perspective and the justification for the current plant configuration or generic subject area. The DBDs will be controlled documents to be revised as the plant configuration changes as a result of modifications.

The team briefly examined the Program Plan for Design-Basis Reconstitution Project, Revision 2, dated July 2, 1987. This program, if implemented in accordance with the objectives stated in the Program Plan, should result in a complete set of new design-basis documents. This program is scheduled to produce approximately 10 plant-level documents and 30 system-level documents and is expected to be completed by April 1990.

(Closed) Unresolved Item U2.1-10, Use of Fluorocarbon-Elastomer in a High Radiation Environments

BACKGROUND

The procurement specification for safety-related instrument air check valves associated with modification MR-FC-83-158 permitted the use of Viton as a seat material. Normally this material is not used in high-radiation environments. The original specification specified Buna "N" as a seat material; however, the valve's supplier took exception to the use of this seat material and stated in a letter that Viton would be supplied instead. On the basis of this exception the specification was revised to include Viton as an acceptable material even though the radiation environment remained at 3.0 E6 rads in the procurement specification.

The team was concerned that (1) the use of Viton may not have been appropriate for the instrument air application reviewed and (2) Viton may have been used in other instrument air or safety-related applications even though a high-radiation environment may exist.

STATUS OF FINDINGS

During the reinspection, the team confirmed that the integrated dose has been calculated and that the integrated dose (0 to 1000 hours) is 2.067 E2 rads from the containment atmosphere and 7.686 E2 rads from Room 69. The subject OPPD calculation is ES-86-10, "Post-Accident TID for Room 81 Calculation #64," Revision 1, dated September 1986. It appears that the total integrated dose over a 1000 hour period is less than or equal to 9.753 E2 rads. This value is significantly less that the specified value of 3.0 E6 rads used in the procurement specification. Therefore, the use of Viton as a seat material appears to be warranted in the instrument air check valve application discussed above.

The team confirmed that General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, provides guidelines for determining the environmental conditions for new equipment. The guide specifies that all pertinent environmental conditions for new equipment such as pressure, temperature, and radiation (along with the duration of exposure) should be documented in the Environmental Conditions section. Mild-environment parameters should be taken from ETS-001, and harsh-environment parameters should be taken from the EEQ Manual. Also, GEG-3 suggests that the preparer of a design package describe how the processes, components and equipment installed as part of the modification are suitable for the application and compatible with existing materials and process conditions.

The use of Viton as seat material for the instrument air check valves in Room 81 is warranted based on additional information provided by the licensee. Guidance has been provided that should help in preventing recurrence of specifying and using materials that are incompatible with the environmental conditions. Therefore this unresolved item is closed.

RELATED GENERIC ISSUES

Since it was demonstrated that there was no misapplication of material, the licensee has not determined where else Viton has been used in the plant and,

in particular, in other safety-related instrument air check valve applications. Because the original preparer of the modification package used a specification pertaining to another application and the supplier of small air check valves typically uses Viton seats, the possibility exists that Viton has been used in an inappropriate application. However, the team believes that this likelihood is very small on the basis of the following: (1) the integrated radiation dose to Viton valve seats can be further lowered because of the shielding provided by the valve's metal body and (2) the typical application would not require the check valves to continue to function for long periods after an accident and therefore the integrated dose over the period of required operation would not adversely affect safety function of the check valves.

On the basis of the foregoing, the team concludes no generic concern exists.

(Closed) Deficiency D2.2-1, Incorrect Design Input in Calculation Associated With MR-FC-81-21B

BACKGROUND

During the 1985 SSOMI, the team found that the modification file contained a calculation sheet that showed that the air accumulator had sufficient volume but that had the following discrepancies:

(1) The volume of stored air used in the calculation was overestimated by 335 percent.

(2) The calculation assumed that the air pressure is 100 psig, even though the instrument air system pressure will range between 80 and 100 psig.

(3) The calculation did not consider system leakage or the period of time that the valve must remain shut.

(4) The calculation sheet was not signed by a checker and a B-2-2 form was not attached to the calculation or included in the modification file.

In response to this finding, the licensee completed a second calculation.

STATUS OF FINDING

During the reinspection, the team reviewed OPPD Calculation FC2007, "Accumulator Sizing," Revision 1, March 26, 1987. In the new calculation, a more appropriate accumulator volume of 1320 cubic inches was used. The minimum air pressure used was 80 psig, the lower limit of the instrument air system pressure. With these initial conditions, the accumulator was demonstrated to be sized properly with a factor of safety of 1.4 on accumulator final pressure.

In a memorandum dated March 21, 1988, GSE-FC-88-509, from D. K. Haas to M. E. Eidem, "Documenting Minimum Instrument Air Pressure," the minimum instrument air pressure was determined to be 76 psig. This pressure correlates to the closing of valve PCV-1753 at a setpoint of 80 psig plus or minus 4 psig to isolate plant air to maintain instrument air pressure. If this new value is included in the calculation, the factor of safety is changed from 1.4 to 1.34.

The calculation sheet for the new calculation was signed by the checker, as were the GSE-B-2-2 form and each page of the calculation.

On the basis of the foregoing, the team's concerns were resolved and the item is closed.

RELATED GENERIC ISSUES

The related generic issues associated with functionality and testing of air accumulators are addressed in conjunction with Deficiencies D2.1-1 and D2.2-3.

(Closed) Deficiency D2.2-2, Incomplete Consideration of CQE and Seismic Class I Requirements for Portions of MR-FC-81-21B

BACKGROUND

During the 1985 SSOMI, the team found that the seismic requirements were not properly addressed in the modification package for completed modification MR-FC-81-21B and identified the following discrepancies:

(1) A purchase order was issued to confirm that the valve and operator assembly supplied was seismically qualified without invoking the requirements of 10 CFR Part 50, Appendix B. In addition, the purchase order did not invoke the requirements of 10 CFR Part 21 and was not identified as applicable to critical quality elements.

(2) The installation/test procedure did not reference Fort Calhoun criteria for routing and support of seismic instrument tubing.

(3) An undocumented engineering judgment was made that the installed configuration of the air accumulator, including base plate and Hilti bolts, was the same or was bounded by a 1985 generic seismic analysis.

STATUS OF FINDING

The licensee confirmed that the subject procurement document was not intended to be used as a basis for seismic design nor was it intended to invoke the requirements of 10 CFR Part 50, Appendix B. Because of similarities between the old and new actuators, it was assumed, on the basis of an engineering judgment, that a new seismic analysis was not required. However, a seismic analysis was performed by another vendor and confirmed acceptable seismic accelerations for valves HCV-438 B and D (Stevenson & Associates, Inc. Report, "Seismic Analysis of Fisher Controls, Fort Calhoun Nuclear Service Valves, Valve Tag Nos. HCV-438 B & D," November 1985).

The licensee initiated a program to confirm the seismic qualification of air accumulators specified as critical quality equipment after water had gotten into the instrument air header. This program confirmed that an analysis was on file and that the as-installed configuration for many plant air accumulators was bounded by the analysis. However, the air accumulators for valves HCV-438 B and HCV-434 D were not included in the program. During the reinspection, the licensee performed a field verification and confirmed that the accumulators for these valves were seismically mounted (GSE-FC-88-611, memorandum from M. E. Eidem to MR FC-81-21B file, April 6, 1988).

The team examined documentation on special training sessions on routing and supporting seismic instrument tubing, and sizing air accumulators and providing seismic support (GSE-FC-86-1510, "Training Sessions," December 16, 1986).

RELATED GENERIC ISSUES

The licensee's reliance on undocumented engineering judgment contributed to the team's concern about excessive use of engineering judgment. During the reinspection, the licensee issued a new Administrative Procedure A-14, "Use of Engineering Judgment," Revision 0, April 1988. This policy outlined the

requirements and documentation necessary when using engineering judgment in place of detailed calculation or analysis in preparing modification packages, 10 CFR 50.59 safety evaluations, and engineering reports. This procedure, when implemented, should improve traceability of final design back to design input. This procedure satisfies the team's concern.

The seismic design adequacy of other plant equipment is being addressed in Observation 03.1-4.

(Open) Deficiency D2.2-3, Incomplete Installation/Testing Procedure Performed for MR-FC-81-21B

BACKGROUND

During the 1985 SSOMI, the team found that the postmodification test procedure for modification MR-FC-81-21B did not require the use of the pressurized volume of the accumulator to shut valves HCV-438 B and D. The installation and test procedure called for the closing of valves HCV-438 B and D using instrument air, then the isolation of air from the instrument air header by closing valves IA-174 and IA-175. In this configuration only a static test was conducted.

The acceptance criterion was to ensure that the valves remained shut for 20 minutes; however, the team found no documented basis that 20 minutes was sufficient time to identify the need to manually close these valves and to have a plant operator perform the required action locally at the valves.

In response to the team's finding, a functional test was completed before the end of the 1987 outage.

STATUS OF FINDING

During the reinspection, the team reviewed Maintenance Order 872293, "Air Accumulator Testing on HCV-438B, HCV-438D, HCV-238, HCV-239, HCV-240, and HCV-712A." The stated purpose of this procedure was to provide instructions for the functional testing of valves with air accumulators specified as critical quality equipment to ensure a safe shutdown in case of loss of offsite power coincident with a design-basis accident, or to mitigate the consequences of such an accident. Tests of valves HCV-438B and HCV-438D were performed on May 14, 1987.

The functional test did not duplicate the accident condition, and the testing instrumentation was not arranged to permit confirmation of the design. Specifically, the test procedure called for the installation of a pressure gage between the valve actuator and its air set (i.e., pressure regulator). Therefore, throughout the test the pressure gage only measured the air set pressure of approximately 31 to 33 psig. In addition, the initial instrument air header pressure was not recorded, even though it could vary from 100 to 76 psig. Likewise, the pressure in the accumulator after the valve was closed was not recorded, nor was the pressure remaining in the accumulator after the valve was held shut for 30 minutes. Therefore, system leakage could not be evaluated. Because unknown system leakage could have been excessive, and minimum instrument air header pressure would not have existed to hold the valve shut (i.e., 30 psig) under worst-case accident conditions.

A memorandum from the licensee documented that the actions of an operator were timed as he simulated manual isolation of valves HCV-438B and D (FC-1669-86, memorandum from W. G. Gates to J. K. Gasper, "Integrated Regulatory Requirement Log Item No. 860192," November 13, 1986). The licensee found that the operation was completed within 6 minutes and thus satisfied the design requirement to allow for 20 minutes of holding air.

This deficiency remains open pending completion of the following actions:

(1) Functional testing of valves HCV-438 B and D when they are shut and as they remain shut for 20 minutes under worst-case accident conditions.

(2) Completion of the program initiated to provide a comprehensive evaluation of systems that depend on air accumulators for proper functioning during an accident. Completion includes development of criteria for functional testing and surveillance testing.

RELATED GENERIC ISSUES

A related generic issue is the adequacy of air accumulators on all safety-related valves. In response to this concern, the licensee initiated a program to

(1) determine the operating criteria for the valves during each applicable postulated accident (i.e., operating pressure and temperature, length of time after an initiating event when valve operation will commence, and length of time the valve operator must function)

(2) determine the criteria for functional testing of each valve operator identified

(3) develop appropriate periodic testing to ensure that the systems continue to function as required

OPPD Memorandum TS-FC-88-120 from R. C. Kellogg to J. J. Fisicaro, dated February 16, 1988 states that Operations Support Analysis Report (OSAR) 87-10 was prepared to document the findings related to the air accumulators. A total of 84 valves were identified as being equipped with air accumulators and 38 were safety-related. It is expected that the OSAR 87-10 report will be completed and reviewed by June 1, 1988, and that all safety-related accumulators will be tested before or during the 1988 outage.

Another related issue is the procedural control to prevent the use of incomplete installation and testing procedures. Standing Order G-21 was revised (Revision 27, April 10, 1987) to (1) reference Standing Order G-19 for testing requirements; (2) define the requirement for stating the postmodification system/component performance requirements for preparing, performing, and evaluating the test; (3) specify the person responsible for evaluating modification-related test results; and (4) ensure that systems are tested and test results are approved before the systems are returned to service after they have been modified.

The operations engineer and the onsite review committee are responsible for ensuring the postmodification system/component performance requirements are adequately stated, sufficient steps are included for performing the test, responsibility for evaluating the test results is clearly defined, and adequate assurance exists that testing results are approved before a system is returned to service following a modification.

GSE Engineering Manual, Section GEG-3, Paragraph 5.9.2, stated that "test procedures shall be included to test the system to assure its function in actual operation." In addition, the verification process specifically addressed functional testing of modifications. B-11 Checklist F, Section 5.8, "Installation/Test Procedures," Item 21 asked, "Does testing demonstrate, as close to practical, the normal, abnormal and emergency function can be

accomplished?" These requirements should ensure that all design changes are adequately functionally tested after installation.

On the basis of the revision to Standing Order G-21, the team finds that procedural requirements appear to exist to prevent the use of incomplete installation and testing procedures. In addition, the licensee has issued for trial use General Engineering Guideline GEG-28, "Preparation of Installation and Test Procedure," Revision 0, February 1988.

In spite of procedural requirements and guidelines, the recurrence of weaknesses in postmodification testing indicates a need for continued licensee attention.

On the basis of the foregoing, the following additional items are required to close out the related generic issues:

(1) training on the development of functional testing and test acceptance criteria

(2) reassessment of completed functional testing of air accumulators performed as part of OSAR 87-10

(3) completion of all functional testing of safety-related air accumulators by the end of the next refueling outage.

(Closed) Observation 02.2-4, Incomplete Modification File for a Completed Modification

BACKGROUND

During the 1985 SSOMI, for completed modification MR FC-81-21B, the team identified information that was missing from the modification file, including (1) records of third-party review or check of a calculation and (2) a specification for the procurement of safety-related check valves or of a third-party verification.

STATUS OF FINDING

In response to this finding, the licensee strengthened procedures and developed guideline documents for the preparation of modification packages. During the reinspection, the team evaluated the following documents:

(1) General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, should prevent recurrence of an incomplete modification file for a completed modification because it prescribes a modification design process. GEG-3 gives a standard approach for the preparation of a design package. Detailed engineering guidelines and associated checklists are provided to assist the design engineer in preparing the design package and documenting various design features, assumptions, and design inputs.

Section 5.5 discusses design analysis required for each phase of a design package. For example, in a final design issue, this section will present an overview of all the analyses that would be done to support the design modification.

Section 5.5.2 discusses the procurement specifications. In a final design issue, all procurement specifications for engineered equipment will be listed.

(2) Design Procedure B-11, "Independent Design Verification," Revised February 1988

(a) Paragraph 4.2 requires that all modifications have a multidiscipline review.

(b) Paragraph 1.0 states that independent multidisciplinary design verifications will be done for design changes including those pertaining to critical quality equipment (CQE), limited CQE, non-CQE, and fire protection system and components.

(3) Administrative Procedure A-11, "Calculation Numbering and Revision Control," Revised March 1987, which was revised to require the indexing of all calculations, with a separate log book for each station (fossil and nuclear). In addition, the main frame computer can be searched using the GSE-1 search program to identify the file location of calculations. Current and past revisions of calculations are available on microfilm in Document Control. The team examined the log book for Fort Calhoun Station and witnessed a demonstration of the GSE-1 search program for calculations.

On the basis of the foregoing, this item is closed.

RELATED GENERIC ISSUES

The programmatic aspects of this issue are discussed above and adequately address the generic issues associated with the content of modification packages.

(Closed) Deficiency D2.2-5, Incorrect Information on Instrument Air Diagram

BACKGROUND

Instrument air header isolation valves, IA-175 and IA-176, were used during the installation and testing of modification MR-FC-81-218. However, these valves did not appear on OPPD Drawing 11405-M-264, the piping and instrumentation diagram (P&ID) for the instrument air system. During a field inspection the team confirmed that the valves were installed in the plant.

STATUS OF FINDING

During the reinspection, the licensee revised P&ID 11405-M-264, Sheet 3, "Instrument Air Diagram Riser Details P&ID," Revision 12, dated April 11, 1988, to include missing instrument air isolation valves IA-174 and IA-175.

RELATED GENERIC ISSUES

Because the licensee had taken no action regarding on this deficiency before the team's reinspection and because of the licensee's previous position that these types of valves that were not specified as critical quality equipment (CQE) were shown at the discretion of the design engineer and his/her supervisor, the team was concerned that other non-CQE valves in the other systems important to safety were not shown on the system P&ID. In an OPPD memorandum (GSE-FC-88-627 from M. E. Eidem to S. K. Gambhir, W. G. Gates, and J. J. Fisicaro, dated April 12, 1988), the licensee indicated their intent to revise the P&IDs or other related drawings to show manual and check valves whose operation or misoperation could affect the function of components served by the instrument air system.

As a general practice, P&IDs for CQE and non-CQE systems should accurately reflect the as-installed condition. Although the licensee's response does not appear to address systems other than the instrument air system, the team found no instances where valves were omitted from other P&IDs. Therefore, on the basis of the licensee's stated intention for the instrument air system, this generic issue is closed.

(Closed) Deficiency D2.2-6, 10 CFR 50.59 Safety Evaluation Based Upon an Incorrect Assumption and Analysis Methodology

BACKGROUND

Modification MR-FC-81-21B caused the post-loss-of-coolant-accident (LOCA) heat load to increase by 3.15 million Btu/hour. During the 1985 SSOMI, the team found that a safety evaluation included in the final design description was weak for the following reasons:

(1) The safety analysis performed did not refer to original design calculations. The lack of original design analyses or their availability did not result in the performance of new calculations.

(2) The qualitative argument used did not reflect a correct understanding of the heat transfer phenomenon between heat removal systems.

(3) The safety evaluation contained an unsubstantiated and inappropriate assumption concerning operator action to secure heat loads under certain accident conditions.

(4) The basis of Technical Specification 2.4 contained incorrect information concerning the heat removal capacity of the component cooling water (CCW) heat exchangers.

STATUS OF FINDING

During the reinspection, the team closed this item on the following basis:

(1) The margin of safety in the Technical Specifications was substantially not affected because of the high margin between the new post-LOCA heat load (maximum design loads on the CCW system following a LOCA plus a new heat load resulting from allowing the reactor coolant pumps to operate) and the heat removal capacity of the CCW system.

(2) Controlled Copy No. 58 of the Technical Specifications was reviewed, and the team confirmed that Technical Specification Section 2.4, "Containment Cooling," has been revised to read, "Three component cooling heat exchangers have sufficient capacity to remove 402 million Btu/hr following a loss-of-coolant accident."

RELATED GENERIC ISSUES

One of the major concerns related to this deficiency was the apparent lack of original design analyses or their availability. The lack of a design analysis did not result in new calculations. Thus, a design engineer had to rely on qualitative arguments instead of quantitative bases. The team reviewed the following guidance and procedures provided to the design engineer to assess if this weakness had been corrected:

(1) GEG-3, "Preparation of Design Packages " Revision 0, December 1, 1987 requires that each functional requirement be referenced to a design-basis document. Where the original design basis is missing, applicable analysis

should be documented to support the design value used for the modification or other justification should be provided.

(2) Standing Order G-21, "Station Modification Control," Revision 29, November 19, 1987, and GSE Design Procedure B-2, "Production of Design Description and Evaluation Nuclear Modifications," Revised December 1987, identified the following as reference documents for determining the design basis of an existing system, component, or structure for the purpose of modifications and safety evaluations:

- Updated Safety Analysis Report in conjunction with any pending change
- Technical Specifications including Basis section
- safety evaluation reports for Technical Specifications amendments
- design drawings

Additionally, if the calculations or actual design requirements were not available, the design changes will be based on the assumption that no design margins exist unless otherwise justified on the basis of conservative assumptions and/or field verification. Alternatively, the calculations will be redone to establish design margins, and design bases will be recreated on an as-needed basis.

3. OPPD Nuclear Production Division Policy/Procedure E-1, "10 CFR 50.59 Safety Evaluations," guides the preparer in identifying and reviewing plant-specific design, operating, and technical documents that describe the affected structures and system components and their respective safety function(s). These documents include, but are not limited to, design basis documentation and calculations, related design changes, related licensee event reports, previous safety analysis, operating instructions/procedures, surveillance tests, and system descriptions.

(4) General Engineering Guide GEG-27, "10 CFR 50.59 Safety Evaluation," Revision 0, February 1988, states that design-basis information, analyses, and supporting system interaction evaluations necessary to perform a safety evaluation were developed as part of other sections of the design package. The purpose of the safety evaluation section is to abstract the salient conclusion and supporting information developed in those sections to develop a logical presentation of the potential safety issues involved with the modification.

(5) Administrative Procedure A-11, "Calculation Numbering and Revision Control," Revised March 1987, was revised to require the indexing of all calculations with a separate log book for each station (fossil and nuclear). In addition, the main frame computer can be searched using the GSE-1 search program to identify the file location of calculations. Current and past revisions of calculations are available on microfilm in Document Control. The team examined the log book for Fort Calhoun Station and witnessed a demonstration of the GSE-1 search program for calculations.

On the basis of the foregoing, the team found that the licensee had stressed the need to refer to controlled sources when performing a safety evaluation and had provided a means of recovering old analyses. Although the USAR typically is not considered a design document but is instead a compilation of design and accident information, the interim use of this document until design-basis documents are available should be with the awareness that some of the information may no longer be valid.

In general, programmatic activities since the SSOMI should result in improved safety evaluations. The specific concerns pertaining to this deficiency have been resolved. Thus, the related generic issue is considered closed.

(Closed) Deficiency D3.1-1, Balance-of-Plant Design Specifications

BACKGROUND

Deficiency D3.1-1 documented the licensee's use of the design specifications contained in OPPD Contract No. 763 to define the design basis for balance-of-plant piping and equipment. However, the licensee did not control Contract No. 763 in accordance with the requirements of its quality assurance manual.

STATUS OF FINDING

To address Deficiency D3.1-1, the licensee withdrew Contract No. 763 from use as a design document. It is documenting the regenerated system functional basis for each safety-related piping system at Fort Calhoun in a system design-basis document (SDBD). Each SDBD references a series of plant-level design-basis documents (PLDBDs) such as PLDBD-CS-51, "Seismic Criteria," and PLDBD-ME-10, "Pipe Stress and Supports," which specify the governing design criteria for the system piping, equipment, and supports.

On February 18, 1988, the licensee provided the NRC with a list of the SDBDs and PLDBDs under preparation. At that time, the licensee indicated that the PLDBDs would be completed by January 1989, and the SDBDs would be completed by January 1990. This item is therefore closed.

RELATED GENERIC ISSUES

The licensee's inconsistent use of design input data to implement modifications to existing piping, equipment and supports is a generic issue related to Deficiency D3.1-1. However, the team believes that the use of PLDBDs such as PLDBD-CS-51, "Seismic Criteria," and PLDBD-ME-10, "Pipe Stress and Supports," should enable the licensee's design staff to specify design input data for use in future modifications in a consistent manner.

(Closed) Deficiency D3.1-2, Design Temperatures for Safety-Related Piping

BACKGROUND

In response to IE Bulletin 79-14, the licensee engaged Gilbert/Commonwealth (G/C) to reanalyze a number of safety-related piping systems at Fort Calhoun Station. Deficiency D3.1-2 documented the licensee's transmittal of operating and accident temperature data to G/C in 1980 which the licensee did not control in accordance with its quality assurance manual.

STATUS OF FINDING

To address Deficiency D3.1-2, the licensee engaged Applied Power Associates (APA) to document the operating and accident temperatures for the safety-related piping systems at Fort Calhoun Station. APA's report is entitled "Documentation of the Source of Operating and Accident Pipe Temperatures/Fort Calhoun Station," APA Report No. AOR 103.83.07, dated October 1987. The licensee has documented APA's report as Operations Support Analysis Report (OSAR) 86-11. Deficiency D3.1-2 is therefore closed.

The reinspection team notes that OPPD Memorandum GSE-FC-87-1838, dated November 10, 1987, summarized the licensee's comparison of the operating temperature differentials documented in OSAR 86-11 with the temperature differentials that it transmitted to G/C in 1980. The memorandum documents temperature differentials that were larger than the temperature differentials that the licesee originally provided to G/C for parts or all of the following piping systems:

(1) reactor coolant system
(2) safety injection system
(3) containment spray system
(4) component cooling system
(5) chemical and volume control system
(6) raw water system

The licensee identified significant increases in the temperature differentials for portions of the chemical and volume control system, but noted that no analysis documentation existed for this small-bore piping.

The team noted that NRC Region IV documented the licensee's lack of thermal analysis documents for safety-related small-bore piping in NRC Inspection Report 50-285/85-03, dated May 23, 1985. The team asked the licensee to provide the NRC with the details of its proposed corrective action program to address the open issues pertaining to safety-related small-bore piping at Fort Calhoun Station (see Unresolved Item U3.1-3).

The licensee also identified significant increases in the temperature differentials for five piping subsystems in the raw water system. Stone & Webster (S&W) was reviewing the load capacities of some of the pipe supports in the affected piping subsystems. OPPD Memorandum GSE-FC-88-461, dated March 11, 1988, indicated that S&W's review was scheduled for completion by April 15, 1988. On the basis of the results of S&W's review, the licensee may reanalyze the affected raw water piping subsystems.

RELATED GENERIC ISSUES

The licensee's documentation and transmittal of design information are generic issues related to Deficiency D3.1-2. OPPD Memorandum TS-FC-86-182, dated March 10, 1986, indicates that OSARs documented and developed in accordance with Technical Services Procedures N-TSAP-5 and -6 were controlled documents that meet the requirements of the licensee's quality assurance manual. The team, therefore, believes that design information which the licensee documents and transmits in accordance with these technical services procedures will meet the requirements of the licensee's quality assurance manual.

(Open) Unresolved Item U3.1-3, Small Bore Pipe Support Spacing

BACKGROUND

Unresolved Item U3.1-3 documented the licensee's use of a nomograph to field-route small-bore piping that did not implement the 12-Hz minimum horizontal frequency criterion stipulated in USAR Appendix F, Section F.2.2.2, for piping connected to the containment.

STATUS OF FINDING

The licensee's program to address the lack of design-basis documents for safety-related small-bore piping was summarized in OPPD Memorandum GSE-FC-88-506, dated March 21, 1988. The licensee intended to address Unresolved Item U3.1-3 as part of the program that was summarized in the memorandum. The purposes of the program were to

(1) develop in-house software for piping analysis, based on design specifications prepared by OPPD

(2) prepare and license a set of seismic criteria as an alternative to the current USAR seismic criteria

(3) formulate program to address issues pertaining to safety-related small-bore piping using items (1) and (2).

With respect to item (1), the licensee purchased a version of the SUPERPIPE computer program and associated software from Impell Corporation. Impell had already benchmarked the in-house version of SUPERPIPE, and the program and associated software would soon be accessible on the licensee's computer facilities. The software requirements which OPPD specified for the computer programs were documented in an OPPD report entitled "System Requirements Specification and Software Design Description for SUPERPIPE and Supporting Programs, Version 22C," Revision RD1.0, dated November 3, 1987.

With respect to item (2), Impell generated a set of alternate seismic criteria for the licensee that were documented in two Impell reports entitled "Alternate Seismic Criteria & Methodologies for Fort Calhoun Station," Volume 1, "Criteria & Methodologies," Report No. 01-1390-1650, Revision 0, dated January 1988; and "Alternate Seismic Criteria & Methodologies for Fort Calhoun Station," Volume 2, "Justification of Criteria & Methodologies," Report No. 01-1390-1650, Revision 0, dated January 1988.

OPPD Memorandum GSE-FC-88-385, dated March 1, 1988, indicated that the generating station engineering staff had issued the referenced Impell reports to the licensing staff for eventual submittal to the NRC.

With respect to item (3), OPPD Memorandum GSE-FC-88-506 noted that the licensee's formulation of a program to address the issues related to small-bore safety-related piping was contingent on NRC's acceptance of the alternate seismic criteria that Impell prepared for the licensee. The licensee planned to implement the program summarized in the memorandum in the summer of 1989 and to complete work by June 1, 1991.

The reinspection team noted that the licensee's latest response to the SSOMI, dated April 10, 1987, did not summarize its corrective action program for safety-related small-bore piping.

The team also noted that the alternate seismic criteria that Impell prepared for the licensee specified a number of design criteria that represent relaxations of current USAR commitments. For example, Impell proposed that piping vibratory modes be combined by random vibration principles, rather than by the square root of the sum of the squares (SRSS), and that ASME Code Case N-411-1 damping values be used to analyze safety-related piping systems instead of the 0.5-percent damping currently specified for the seismic analysis of safety-related piping systems in USAR Appendix F, Table F-2.

Unresolved Item U3.1-3, therefore, remains open pending the licensee's submittal to the NRC of the proposed methodology, scope, and time frame of its corrective action program to address the issues related to safety-related small-bore piping. The team noted that several of the alternate seismic criteria in the referenced Impell reports represent relaxations of current USAR criteria.

RELATED GENERIC ISSUES

The licensee's inconsistent implementation of the seismic criteria contained in USAR Appendix F is the generic issue that is related to Deficiency D3.1-2. The team recommends that the licensee review USAR Appendix F and replace seismic criteria that is no longer implemented with comparable criteria that it considers compatible with current design practice.

(Closed) Observation 03.1-4, Seismic Qualification of Valves Installed in Class I Piping Systems

BACKGROUND

Observation 03.1-4 noted a lack of documentation supporting the seismic qualification of valves and valve operators installed in safety-related piping systems at Fort Calhoun Station. However, the licensee is a member of a utility group that is addressing the lack of seismic qualification documents for some components in older plants in response to NRC Unresolved Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants."

STATUS OF FINDING

The licensee was resolving the valve seismic qualification issue and related issues addressed in USI A-46 through the Seismic Qualification Utility Group (SQUG). The NRC was currently reviewing a draft SQUG report entitled "Generic Seismic Qualification Procedure for Nuclear Plant Equipment," dated March 27, 1987. A memorandum to SQUG members from R. E. Schaffstall of KMC, Inc. (SQUG Status Review Meeting, Implementation Schedules for USI A46, dated March 8, 1988) indicated that SQUG would issue Revision 0 of its report to member utilities for review by April 30, 1988, and to the NRC by May 31, 1988. The memorandum indicated that the NRC would issue a generic safety evaluation report (SER) by June 30, 1988. The NRC was expected to request plant-specific schedules from SQUG members within 60 days of the issuance of the SER.

The reinspection team participated in a telephone conference on April 6, 1988, with NRC Mechanical Engineering Branch (MEB) and Region IV staff to discuss the seismic qualification requirements for the safety-related manually operated valves installed at Fort Calhoun Station. During the conference, the MEB staff informed the team that MEB's program to resolve the seismic qualification issues addressed in USI A-46 assumed that installed safety-related equipment was in conformance with current plant USAR licensing criteria. As indicated in Observation 03.1-4, the licensee could not confirm that safety-related valves and valve operators installed at Fort Calhoun Station were qualified in accordance with the seismic criteria specified in USAR Appendix F for safety-related equipment. In a letter from NRC (J. Calvo) to OPPD (K. J. Morris) dated July 28, 1988, the NRC staff accepted, subject to certain conditions, OPPD's proposal to delay the resolution of seismic qualification of equipment until the resolution of USI A-46.

The team is, therefore, closing Observation 03.1-4 for the purposes of the SSOMI, since the licensee's program to qualify the safety-related valves and valve operators installed at Fort Calhoun Station is to be resolved with the NRC's Office of Nuclear Reactor Regulation.

RELATED GENERIC ISSUES

The lack of seismic qualification of equipment installed in older plants to current licensing criteria is the generic issue related to Observation 03.1-4. In response to Unresolved Safety Issue A-46, the licensee is attempting to verify the seismic adequacy of other active mechanical and electrical equipment in addition to valves and valve operators.

(Closed) Unresolved Item U3.2-1, MR-FC-84-61 Design Input Source and Use

BACKGROUND

Unresolved Item U3.2-1 documented the licensee's inadequate references to the design basis and the undocumented use of engineering judgment in Modification Request MR-FC-84-61.

STATUS OF FINDING

OPPD Memorandum GSE-FC-86-770 ("Documentation of Engineering Judgment: Union Mass on Safety Injection Tank," dated August 6, 1986) indicates that the installation of the 1-inch, 2.5-pound union above the safety injection (SI) tank would induce negligible additional forces, moments and stresses on the SI tank nozzle. Unresolved Item U3.2-1 is therefore closed.

RELATED GENERIC ISSUES

The adequate preparation of modification request packages and the adequate documentation of engineering judgment are generic issues related to Unresolved Item U3.2-1.

The reinspection team reviewed General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, which Sargent & Lundy prepared for the licensee, and believes that the procedure provides adequate guidance to licensee personnel involved in the preparation, documentation, and review of design packages for Fort Calhoun Station.

The licensee's interim instructions to its design staff to document the use of engineering judgment were detailed in OPPD Memorandum LIC-86-060, dated March 7, 1986. A procedure entitled "Use of Engineering Judgment," Revision 0 was issued in April 1988.

The team believes that the licensee's proposed procedure, when implemented in conjunction with the plant-level design-basis documents that the licensee is preparing, should substantially reduce the incidence of undocumented engineering judgment in design modification packages.

(Closed) Deficiency D3.2-2, MR-FC-83-158 Installation Procedure

BACKGROUND

Deficiency D3.2-2 documented the licensee's failure to specify adequate seismic support spacing criteria for instrument tubing in Modification Request MR-FC-83-158.

STATUS OF FINDING

The licensee's initial response to the SSOMI documented in Attachment A to OPPD Letter LIC-86-106, dated April 15, 1986, qualified the subject tubing by analysis. During the reinspection, the team confirmed that the licensee had revised Modification Request MR-FC-83-158 to incorporate an OPPD calculation entitled "Tubing Support Distance Calcs/Air Accumulators for YCV-1045 A & B," Revision 0, dated December 18, 1985. Deficiency D3.2-2 is therefore closed.

RELATED GENERIC ISSUES

The adequate preparation of modification request packages is a generic issue related to Deficiency D3.2-2.

The reinspection team reviewed General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, which Sargent & Lundy prepared for the licensee, and believes that the procedure provides adequate guidance to licensee personnel involved in the preparation, documentation, and review of design packages for Fort Calhoun Station.

The licensee also revised Part II of Fort Calhoun Station Unit No. 1 Standing Order G-30, "Field Changes to Modification Construction Drawings," on April 4, 1987. The team believes that implementation of the revised procedure, which governs field changes to modification design documents such as drawings and work instructions, should ensure the documented qualification of field-routed instrument tubing in plant modifications.

(Closed) Deficiency D3.2-3, MR-FC-84-162 Calculation

BACKGROUND

Deficiency D3.2-3 documented the licensee's inadequate qualification of two redesigned containment ventilation duct supports in Modification Request MR-FC-84-162. The team also concluded that painting the redesigned support steel structures, as specified by the licensee, instead of galvanizing them was not in accordance with the licensee's requirements.

The team closed part of Deficiency D3.2-3 on the basis of the additional calculations that the licensee prepared during the SSOMI and the licensee's initial response to the SSOMI documented in Attachment A to OPPD Letter LIC-86-106, dated April 15, 1986. In its response, the licensee noted that the calculations that it prepared after the SSOMI audit confirmed the adequacy of the redesigned duct supports. However, the team kept Deficiency D3.2-3 open pending the licensee's preparation of a controlled document that specified shop and field surface preparation of seismic Category I materials.

STATUS OF FINDING

To address the remaining open item in Deficiency D3.2-3, the licensee engaged Sargent & Lundy to prepare a document that specified shop and field surface-preparation procedures for seismic Category I materials in the containment. The licensee documented Sargent & Lundy's report as OPPD GSE Engineering Standard CTS-3, "Selecting, Specifying, Applying and Inspecting Paint and Coatings," which the licensee approved for use on August 27, 1987. Deficiency D3.2-3 is therefore closed.

RELATED GENERIC ISSUES

The adequate preparation of modification request packages is a generic issue related to Deficiency D3.2-3.

The reinspection team reviewed General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, which Sargent & Lundy prepared for the licensee, and believes that the procedure provides adequate guidance to licensee personnel involved in the preparation, documentation, and review of design packages for Fort Calhoun Station.

(Closed) Deficiency D3.2-4, Junction Box Supports

BACKGROUND

Deficiency D3.2-4 documented Unistrut supports for the junction box to valve YCV-1045B that did not meet the seismic provisions of USAR Appendix F.

STATUS OF FINDING

The reinspection team closed Deficiency D3.2-4 on the basis of the licensee's initial response to the SSOMI documented in Attachment A to OPPD Letter LIC-86-106, dated April 15, 1986. In its response, the licensee noted that it had installed a qualified seismic support for the junction box during the 1985 refueling outage. The team reviewed Modification Request MR-FC-85-201 to confirm the licensee's design, qualification, and installation of the new supports for the junction box and adjacent conduit. Deficiency D3.2-4 is therefore closed.

RELATED GENERIC ISSUES

The possibility that other installed junction boxes and conduit may lack supports that meet the seismic provisions of USAR Appendix F is the generic issue related to Deficiency D3.2-4.

OPPD Memorandum GSE-FC-88-622, dated April 7, 1988, indicated that the licensee planned to address this generic concern under the scope of Unresolved Safety Issue A-46. Therefore, this item becomes an open licensing issue to be resolved between the licensee and NRC's Office of Nuclear Reactor Regulation.

(Closed) Observation 03.2-5, Containment Pressure Switch Seismic Qualification

BACKGROUND

Observation 03.2-5 noted that the replacement pressure switches in Modification Request MR-FC-83-83 warranted a more thorough analysis to provide additional assurance of the equipment's seismic qualification.

STATUS OF FINDING

In response to Observation 03.2-5, the licensee revised modification Request MR-FC-83-83 to incorporate an equipment qualification review checklist for the replacement pressure switches and a calculation entitled "Junction Box Mounting Support Adequacy/MR-FC-83-83," Revision 0, dated December 13, 1985. Observation 03.2-5 is therefore closed.

RELATED GENERIC ISSUES

The possibility that other installed replacement pressure switches may lack complete seismic documentation is the generic issue related to Observation 03.2-5.

OPPD Memorandum GSE-FC-88-622, dated April 7, 1988, indicated that the licensee planned to address this generic concern under the scope of Unresolved Safety Issue A-46. Therefore, this item becomes an open licensing issue to be resolved between the licensee and NRC's Office of Nuclear Reactor Regulation.

(Closed) Deficiency D3.2-6, Steam Generator Nozzle Dams

BACKGROUND

Deficiency D3.2-6 documented the licensee's procurement of seismic Category I critical quality equipment (CQE) removable steam generator nozzle dams without requiring the vendor to qualify the nozzle dams to the seismic provisions of USAR Appendix F.

The team closed part of Deficiency D3.2-6 on the basis of the licensee's initial response to the SSOMI documented in Attachment A to OPPD Letter LIC-86-106, dated April 15, 1986. In its response, the licensee noted that the nozzle dam vendor had prepared a seismic analysis that qualified the steam generator nozzle dams. However, the team kept Deficiency D3.2-6 open pending the licensee's preparation of a procedure that would establish guidelines for the licensee's procurement of CQE materials and services.

STATUS OF FINDING

To address the remaining open item in Deficiency D3.2-6, the licensee issued Technical Services Procedure N-TSAP-14, "Determination and Procurement of CQE and Limited CQE Items and Services," December 1986. Deficiency D3.2-6 is therefore closed.

RELATED GENERIC ISSUES

The possibility that the licensee procured other CQE equipment without specifying the required seismic provisions of USAR Appendix F is the generic issue related to Deficiency D3.2-6.

To address this generic concern, the licensee reviewed a majority of the requisitions issued since 1982 to confirm that the procurement specifications for hardware, services, and software were properly prepared, or that procurement specifications that were inadequately prepared did not result in the procurement and use of inappropriate or deficient hardware, services, or software.

The licensee identified three purchase orders that required quality assurance certification. OPPD memorandum TS-FC-87-170B, dated July 21, 1987, summarized the review that the licensee and Combustion Engineering conducted to confirm that these purchase orders met the licensee's CQE requirements.

(Open) Deficiency D3.2-7, YCV-1045B Valve Restraint

BACKGROUND

Deficiency D3.2-7 documented the following deficiencies in the calculation of record for the auxiliary feedwater piping subsystem in the vicinity of control valve YCV-1045B:

(1) The valve operator was restrained by a rod attached to a stairpost. The licensee had not implemented a commitment to the NRC to replace the strut.

(2) The licensee's as-built drawing did not show either the valve operator or the existing rod restraint.

(3) The vendor drawing for the valve operator could not be obtained to verify the valve and operator weights and operator offset dimension.

(4) The valve operator restraint was not modeled in the stress analysis.

(5) There were no calculations that combined deadweight, thermal, and seismic pipe stresses in the vicinity of the valve.

(6) There were no calculations that combined deadweight, thermal, and seismic loads for the supports adjacent to the valve. The supports appeared to be overloaded.

(7) The computer runs were not referenced and, therefore, were not adequately controlled.

With respect to item (1), the licensee reanalyzed the piping subsystem with the valve operator restraint removed, and concluded that the operator restraint was not required on the basis of the pipe stress levels and support loads in the vicinity of the valve (study run CYG1 was executed on December 14, 1985, to address the NRC's SSOMI concerns; computer run CFSR was executed on April 9, 1987, to be the computer run of record). The licensee removed the valve operator strut on January 19, 1987, via Modification Request MR-FC-86-89.

The team noted, however, that the licensee has a licensing commitment to restrain control valve operators that induce seismic bending stresses greater than 1500 psi in the supporting pipe. As noted in USAR Appendix F, Section F2.2.2:

> Special seismic restraints (either rigid or snubbers) were provided on control valve mechanisms to prevent overstress when the control mechanism forms a mass center outside the pipe center line and generates over 1500 psi bending stress on the piping system due to earthquake G loading.

The control valve operator strut was originally installed to satisfy the USAR Appendix F criterion, since the architect-engineer (A/E) computed a seismic bending stress of 10,686 psi in the supporting pipe resulting from the eccentric mass of the valve operator. The valve operator weighed 197 pounds and had an offset dimension of 30.5 inches with respect to the centerline of the supporting 2-inch Schedule 80 pipe.

Computer run CFSR computes a total seismic bending stress in the supporting pipe of 10,149 psi. However, the licensee did not implement the referenced USAR Appendix F criterion since the seismic restraint was removed even though the seismic bending stress induced in the pipe by the valve operator exceeded 1500 psi.

The licensee maintained that the piping configuration was adequately qualified in the vicinity of the valve, since the pipe stresses were within allowable limits and the loads induced in the adjacent pipe supports were within design capacity. However, the reinspection team noted that the USAR Appendix F criterion, which the A/E originally specified to limit the magnitude of the seismic stresses induced in the supporting pipe, additionally limited the magnitudes of the valve operator accelerations and stresses when the valve body was also seismically restrained. In newer plants, valve operator functionality is confirmed by comparing the seismic accelerations computed at the location of the operator center of gravity with the maximum allowable operator accelerations specified by analysis or test.

The team therefore noted that the licensee could not guarantee the functionality of control valve YCV-1045B or other control valves during a seismic event unless it invoked the USAR Appendix F 1500-psi criterion, or a comparable criterion.

The team noted, however, that the licensee was a member utility in the Seismic Qualification Review Group (SQUG), which is addressing Unresolved Safety Issue (USI) A-46, and that USI A-46 addresses the generic seismic qualification of motor-operated valves in older plants.

The team recommended that the licensee review USAR Appendix F and replace seismic criteria that it no longer implements with comparable criteria that it considers compatible with current design practice. The licensee should conduct this review before it prepares plant design-basis documents (PLDBDs) such as PLDBD-ME-10, "Pipe Stress and Supports," and PLDBD-CS-51, "Seismic Criteria," which it had scheduled for completion by January 1989, and which it intended to reference in the system design-basis documents that it was also preparing.

The licensee also should seek NRC review of the alternate seismic criteria that Impell prepared, amend the USAR accordingly, and incorporate these additional provisions in the PLDBDs (see Unresolved Item U3.1-3 for a discussion of the licensee's proposed alternate seismic criteria).

With respect to item (2), the licensee has not yet updated OPPD Drawing D-4318, sheet 1 of 3, Revision 2, dated June 26, 1986, to incorporate the computer model node point for the valve operator. The drawing was both the as-built drawing and the piping stress isometric drawing for the auxiliary feedwater piping subsystem.

With respect to item (3), the licensee did not have a controlled document that specified the weight of valve YCV-1045B and the weight and offset dimension of the valve operator. The licensee retrieved a document prepared by the A/E that tabulated valve data, but this document was not controlled. The licensee indicated that uncontrolled design data retrieved from the A/E will be addressed as part of its design-basis reconstitution program.

For modifications to existing designs, the licensee should verify valve data by accessing the appropriate valve vendor drawings or by corresponding with the valve vendor.

With respect to item (4), the licensee removed the valve operator strut so that the computer model was consistent with the as-built configuration.

With respect to item (5), computer runs CYG1 and CFSR provided normal and accident load combination pipe stresses at the valve location which were below code allowable valves.

With respect to item (6), the licensee provided the team with the following pipe support calculations that Gilbert/Commonwealth prepared as part of MR-FC-81-127 and that qualified the pipe supports adjacent to valve YCV-1045B:

(1) Calculation AFW-50, MSSP-50, Revision 0, dated October 2, 1981
(2) Calculation AFW-14, MSSP-14, Revision 0, dated September 28, 1981
(3) Calculation AFW-49, MSSP-49, Revision 0, dated October 12, 1981

The team noted that the licensee generally could not access the original calculations that the A/E prepared to generically qualify the pipe supports on safety-related small-bore (2-inch and less) piping. The team recommended that the licensee's evaluation of the generic load capacities of safety-related small-bore pipe supports be addressed as part of the licensee's program to resolve open issues pertaining to safety-related small-bore piping. As noted in Unresolved Item U3.1-3, the team recommended that the licensee present this program to the NRC.

With respect to item (7), the licensee had not completed the design verification of computer run CFSR executed on April 4, 1987, which was the computer run of record that supports Modification Request MR-FC-81-127.

The team noted that the licensee has the following two SSOMI licensing commitments to the NRC that required that the calculations to support Modification Request MR-FC-81-127, as well as other modifications, be completed by May 1, 1988:

(1) licensing commitment RRD Item 87-278, which required action to close out emergency modifications requiring seismic updates

(2) licensing commitment RRD Item 87-145, which required the licensee to address and resolve the accessibility of computer program analyses.

STATUS OF FINDING

Item (1) remains open pending until the licensee qualifies valve YCV-1045B and other control valves to the current USAR Appendix F 1500-psi criterion or to a comparable criterion that it considers is consistent with current design practice.

Item (2) remains open until the licensee revises the referenced drawing to incorporate the node point for the valve operator.

Items (3), (4), (5) and (6) are closed.

Item (7) remains open until the licensee completes the design verification of computer run CFSR.

RELATED GENERIC ISSUES

The licensee's inconsistent implementation of the seismic criteria contained in USAR Appendix F is the primary generic issue that is related to Deficiency D3.2-7.

The team recommends that the licensee review USAR Appendix F and replace seismic criteria that it no longer implements with comparable criteria that it considers compatible with current design practice.

Maintenance and use of design information and proper use and documentation of engineering judgment are additional generic issues related to Deficiency D3.2-7.

The team believes that the use of plant-level design-basis documents (PLDBDs) such as PLDBD-CS-51, "Seismic Criteria," and PLDBD-ME-10, "Pipe Stress and Supports," should enable licensee design staff to maintain design information in accordance with the requirements of the licensee's quality assurance manual.

The use of General Engineering Guide GEG-3, "Preparation of Design Packages," Revision 0, December 1, 1987, which Sargent & Lundy prepared for the licensee, should enable licensee design staff to use design information in a controlled manner.

Finally, the team noted that an OPPD procedure entitled "Use of Engineering Judgment" was in draft form and was scheduled to be issued by May 1, 1988. The team believed that the procedure, when implemented in conjunction with the plant-level design-basis documents that the licensee was preparing, should substantially reduce the incidence of undocumented engineering judgment in design modification packages.

(Closed - New Item) Deficiency D3.2-8, Auxiliary Feedwater Piping Analysis Design Input Loads

BACKGROUND

During the week of April 4, 1988, the team reviewed the auxiliary feedwater (AFW) system design-basis document SDBD-FW-AFW-117, which Stone & Webster prepared for the licensee, and which the licensee issued for trial use on March 1988. The licensee was preparing a series of plant-level design-basis documents (PLDBDs) that the AFW system design-basis document (and other SDBDs) will incorporate by reference. These PLDBDs should specify the design-basis loads required to qualify the AFW system.

Since it could not review the PLDBDs, the team asked the licensee to confirm that several USAR Appendix F licensing commitments and piping code design requirements were currently controlled and accessible and that it had used these criteria in the AFW piping analyses of record.

The licensee engaged Gilbert/Commonwealth (G/C) to analyze the AFW system in response to Office of Inspection and Enforcement Bulletin 79-14 and performed additional analysis to address Generic Letter 81-14.

FINDING

The team found that the associated stress analysis did not consider seismic anchor movements between structures, equipment nozzle thermal movements, and friction loads for pipe supports. Specifically,

(1) G/C did not consider the effects of seismic anchor movements (SAMs) on the AFW piping supported between the containment and auxiliary buildings, as required by Section F.2.2.2 of USAR Appendix F. The AFW piping in the vicinity of containment penetration M-97 was shown on OPPD Piping Isometric Drawings D-4236, Revision 1, sheet 1 of 1, and D-4238, Revision 2, sheet 7 of 7. The USAR did not tabulate SAMs, and the licensee could not provide the team with a design document that tabulated SAMs or specified consideration of SAMs.

(2) G/C did not consider the effects of the steam generator nozzle thermal displacements (TAMs) on the piping shown on OPPD Piping Isometric Drawing D-4236, Revision 1, sheet 1 of 1. G/C's reanalysis of the AFW piping subsystem resulted in an erroneous replacement of a snubber adjacent to the steam generator nozzle with a strut. In 1986, licensee plant staff noted that the strut was damaged. Licensee design staff determined that G/C had not considered the steam generator TAMs, and computed the TAMs in OPPD Calculation FC 001502, dated May 1, 1987. The licensee reanalyzed the affected piping and prepared Modification Request MR-FC-87-23 to remove the strut.

(3) The licensee did not consider the effects of the turbine-driven AFW pump turbine inlet TAMs on the piping shown on OPPD Piping Isometric Drawing D-4318, Revision 2, sheet 1 of 3. As a consequence, the turbine inlet nozzle thermal loads tabulated in Attachment 6 of the AFW SDBD did not include the effects of TAMs. With respect to items (2) and (3), the licensee could not provide the team with a design document that specified consideration of equipment TAMs.

(4) The licensee indicated that piping friction forces for pipe support design were evaluated on a case-by-case basis, but that it could not provide the team with a design document that specified consideration of pipe support friction loads.

Item (1) was an example of the licensee's failure to implement a licensing commitment.

With respect to items (2) and (3), Section 1-719.7.3 of USAS B31.7, the piping code of record for the AFW system, required consideration of equipment nozzle thermal displacements.

Finally with respect to item (4), Piping Specification No. 1 in Contract No. 763 (an uncontrolled document) required the design of pipe supports in accordance with the criteria of Sections 120 and 121 of USAS B31.1, which specified consideration of friction effects on pipe supports.

RELATED GENERIC ISSUES

The team reviewed only three design attributes that would have been addressed in the PLDBDs had these documents been available and identified problems in all three areas. Therefore, the adequacy of the 79-14 Program implemented by G/C for the licensee was questionable and was viewed by the team as a failure to meet licensing commitments. This issue is closed for the purpose of this inspection report, but remains an open licensing issue to be resolved between the licensee and the NRC's Office of Nuclear Reactor Regulation.

(Closed) Observation 04.1-1, High Power Rate of Change Trip Bypass

BACKGROUND

Observation 04.1-1 concerned a design modification (FC-84-46, "High Power Rate of Change Trip Alarm," Revision 0, March 6, 1984) intended to change the operation of a reactor protection system bypass alarm so that the alarm would actuate only when the corresponding trip function (high power rate of change) was in effect and not automatically bypassed. The existing alarm was continuously active below 10 E-4-percent power and above 15-percent power; during these conditions the trip bypass was automatically in effect, and the existing alarm was thereby actuated. The licensee's basis for the modification was to improve the "black board" characteristics of the annunciator system during normal plant operation. However, the SSOMI team had observed that the "black board" basis in this case conflicts with the requirement of IEEE Std. 279-1968, "Criteria for Protection Systems in Nuclear Power Generating Stations," Section 4.13, that continuous indication of any protective action bypass be provided in the control room. The team had noted that the final design package and the 10 CFR 50.59 analysis had not identified the design basis specified in IEEE Std. 279.

STATUS OF FINDING

Following further review by the licensee after this finding was identified, this modification was cancelled (GSE-FC-85-1276, "Resolution of CAT/MOT Team Findings for MR-FC-84-46," December 31, 1985).

RELATED GENERIC ISSUES

To address the remaining generic concerns, the team requested that the licensee review all annunciator modifications performed under the "black board" improvement program to verify that no other reactor protection/engineered safety features actuation bypass alarms had been modified in conflict with the requirement of IEEE Std. 279 cited above. In addition, the team asked the licensee to demonstrate that its design-basis reconstitution program and the subsequent design-basis verification will address the requirements of IEEE Std. 279 for bypass indication, noting that the reactor protection system was not included in the licensee's design-basis document (DBD) priority list (GSE-FC-88-17, "IRR Log No. 870172, Select and Prioritize Candidate Systems for Design Basis Document Development," January 7, 1988) or plant-level DBD (GSE-DB-88-17, "Attachment II, Plant Level Design Basis Document," April 7, 1988).

In response to the team's request, the licensee reviewed the 17 "black board" modifications and provided a summary of these modifications to the team ("Review of 'Blackboard' Modifications Associated With the Fort Calhoun Station Annunciator Upgrade Program," received from W. Gartner, April 5, 1988). The team agreed with the licensee's conclusion that none of these modifications involved protection system bypass indication; therefore, the team's generic concern about past modifications is resolved. Regarding the team's concern about future modifications, the licensee provided a letter from the contractor supporting the DBD development effort (Stone & Webster Letter DB-100, from Beach to S. Gambhir, "Control Circuit Bypass Indication Design Basis Project," April 5, 1988); this letter stated that the design requirements for bypass indication would be included in the contractor's effort and that the licensee should ensure that other organizations developing DBDs for Fort Calhoun include

these requirements wherever applicable. On the basis of team's understanding that the licensee will ensure that these requirements of IEEE-Std. 279 are also appropriately addressed if other contractors are involved, this item is closed.

(Closed) Observation 04.2-1, Delta T Power Loop Analysis

BACKGROUND

Observation 04.2-1 concerned the evaluation by the technical services staff of replacement resistance temperature detectors (RTDs) and temperature transmitters (FC-84-140, "Delta T Power Process Loops") provided for measurement of reactor coolant system hot- and cold-leg temperatures; these instruments provide inputs to the reactor protection system. The SSOMI team found that the evaluation had not identified the channels as safety-related or as having calculations involving critical quality equipment (CQE), the analysis (OSAR-85-83, "Uncertainty Evaluation for MR-FC-140," September 30, 1985) presented input values and final results without a traceable calculation, and the applicable technical services procedure (N-TSAP-5, "Operations Support Analysis Report Documentation," Revision 1, May 1985) did not contain the CQE identification requirement of a similar GSE procedure (Generating Station Engineering Procedure B-9, "Technical Calculation Production, Checking, and Approval," January 1984). The team's generic concern was the consistant implementation of design changes among the licensee's various responsible design organizations.

STATUS OF FINDING

During the inspection, the licensee retrieved the calculation showing the square-root-of-the-sum-of-the-squares (SRSS) method to determine channel uncertainty (Technical Services Procedure N-TSAP-6, Form 6-1, "Analysis Objectives and Methods Record," page 2, Revision 1, May 1985); the reinspection team found that this document provided a traceable calculation and method.

RELATED GENERIC ISSUES

Regarding the team's SSOMI concern about determining the safety significance of evaluations by the technical services staff after the SSOMI, the licensee revised Procedure N-TSAP-5, "Operations Support Analysis Report Documentation," Form 5-1, Revision 2, March 1986, to include a checkoff for safety-related/CQE system components. This action resulted in consistent CQE identification requirements for GSE and technical services staff and resolved the team's generic concern.

On the basis of the above clarification and corrective action, this item is closed.

(Open) Deficiency D4.3-1, Limit Switch Circuit Protection by Fusing, MR-FC-84-74A

BACKGROUND

Deficiency D4.3-1 concerned the isolation of electrical faults caused by postaccident submergence of limit switches for nine safety-related pilot solenoid-operated valves. The licensee had provided low-current, fast-acting fuses in the indicating light branch of the valve control circuits with the intent of retaining valve operability and sacrificing position indication, since the limit switches had not been rigorously qualified for submergence. Successful isolation of the faulted limit switch depends on coordination of the solenoid circuit fuse and the limit switch branch fuse. The SSOMI team had found that the design package (MR-FC-84-74A, "Fuse Protection for Certain Limit Switch Circuits," and Design Package Checker's Checklist, FC-84-74A, Revision 0, May 31, 1985) had not substantiated that the fuses were coordinated. The team had also observed from the manufacturer's catalog data that the circuit interruption time differential may be only 10 milliseconds or less (Bussmann "MIN" fuse catalog, 10 and 15 ampere ratings, and Bussmann "KTK" fuse catalog, 0.25 and 0.50 ampere ratings), which would not ensure reliable isolation of the faulted limit switches. As a result, continued operability of charging line isolation valves HCV-238 and HCV-239 could not be ensured for long-term core cooling following an accident. The team's generic concern was that an identified technical assumption (i.e., that the fuses would coordinate properly) had not been verified during development of the modification design package.

STATUS OF FINDING

After the SSOMI, at the licensee's request, the manufacturer conducted five repetitive tests to demonstrate successful coordination of the 10-ampere Bussmann "MIN-10" and 0.5-ampere Bussmann "KTK-1/2" fuses. Bussmann reported that the overall test results were successful [letter from S. R. Coble (Bussmann) to R. Clemens (OPPD), "Fuse Coordination," dated October 10, 1985]; however, the licensee was unable to retrieve a vendor test report documenting the test methodology, conditions, and certification. In addition, a subsequent field modification had changed the control circuit fuse rating from 10 amperes to 7 amperes to protect replacement electrical penetration feedthrough assemblies that had been added to the circuit (Calculation Sheet MR-FC-84-74A, "Fuse Protection for Containment Limit Switches, Field Change No. 6 to SRDCO-85-31," November 13, 1985). The replacement fuses were also changed from the MIN-10 to the KTK-7 type. Thus, the final configuration of the fuses is different from the configuration tested (with respect to rating and type), and supporting documentation was not evident for the tested configuration. Accordingly, the team still has concerns about the demonstrated ability of the fuses to successfully coordinate under design-basis conditions.

The team identified two additional concerns with respect to USAR requirements governing the design basis for seven of the nine valves that are the subject of this finding. The first concern involves the basis for sacrificial isolation of the position indication limit switches. Specific USAR commitments for containment isolation (USAR Section 5.9, page 5.9.-5, Revision 3, July 1987) require that "the status of all automatic [containment isolation] valves, open or closed, is indicated in the control room." The intended sacrificial isolation violates this requirement for the seven containment isolation valves.

The second concern regards a USAR commitment (USAR Section 5.9, page 5.9-5, Revision 3, July 1987) to "incorporate fail-safe provisions" for automatically operated valves. Valves HCV 438A and C (component cooling water supply to the reactor coolant pumps) as well as the charging line valves previously cited do not meet the USAR commitment, since these valves are energized to close [OPPD Drawing (schematic diagram) 11405-EM-438, Revision 10]. Apart from the USAR discrepancy, the team is primarily concerned about the potential for defeating containment isolation if the fuses for the two component cooling water valves should fail to coordinate. The charging valves are of less concern in this regard because they would not be required to close until later in the accident, the fuses are in the control room, and more time would be available to replace upstream fuses (if necessary to restore operability).

To address its concerns about fuse coordination and the discrepancy in the USAR containment isolation commitment, the team asked the licensee to provide a basis whereby postaccident operation will not be unduly compromised by loss of position indication due to postaccident flooding or by failure of the subject fuses to coordinate properly. The following points need to be addressed:

(1) the means available to the operator to detect and respond to these situations in a timely fashion

(2) the required and allowable operator response time, based on the flooding scenarios

(3) assurance that any operator action is appropriately governed by existing procedures

(4) resolution of any inconsistencies between USAR Section 5.9 and the as-built design with respect to position indication and "fail-safe provisions" required by the USAR

(5) the degree of dependence on successful fuse coordination

This item remains open pending either revision of the USAR requirements cited above with a basis provided for these exceptional valves, or rigorous demonstration of the qualification of these limit switches for postaccident submergence.

RELATED GENERIC ISSUES

There are no additional generic issues associated with this finding other than those previously discussed.

(Closed) Unresolved Item U4.3-2, ESF Bypass Switch Keylock Provision, MR-FC-81-102

BACKGROUND

Unresolved Item U4.3-2 concerned apparent inconsistencies in requirement documents for a modification that would add keylock bypass switches to engineered safety features actuation channels for pressurizer low pressure and steam generator low pressure (MR-FC-81-102, "Bypass or Trip of ESF Channels Without Jumpers," Revision 0, August 14, 1985). The SSOMI team had noted that the final design modification package contained no requirement for keylock cylinder combinations and the number of keys needed to control bypass of individual trip channels. Cylinder locks and keys were stipulated by the purchase order for the switch enclosures (Purchase Order 98505-CB, August 5, 1985), but Technical Services Review and Evaluation Form B (OPPD Form B, "Technical Services Review and Evaluation," April 25, 1983) requested that different keys be used for individual trip and bypass functions; the latter requirement was not reflected in the purchase order or the final design modification package. The team's generic concern was that OPPD Design Procedure B-2, "Production of Design Description and Evaluation," January 1984, appeared to have been violated in that the technical description and design evaluation did not appear to contain all of the requirements necessary to establish an unambiguous design configuration.

STATUS OF FINDING

After the SSOMI, the Generating Station Engineering staff recommended cancellation of this modification [GSE-FC-87-2098, "RRD Item 860199, Bypass Switches (MR-FC-81-102)," December 30, 1987]. Although the team believes that the proposed change could be an improvement in the means provided for administrative control of channel bypass it acknowledges that the original design basis does not require manual bypass capability using keylock switches; the basis for channel inoperability requirements is provided in Amendment 88 to the Technical Specifications (OPPD Docket No. 50-285, Fort Calhoun Station, Amendment 88, May 9, 1985) and does not require the proposed switches.

RELATED GENERIC ISSUES

Regarding the SSOMI team's generic concern about the design modification process, the licensee developed GEG-3, "Guidelines for Preparation of Design Packages," Revision 0, November 1987. This procedure provides more uniform, specific, and comprehensive guidelines for unambiguously defining the intended design configuration. For example, Section 5.6.16 requires that the modification preparer evaluate the possibility of operator error involved with the change. On the basis of the licensee's improved design procedures and its intent to train personnel in their effective implementation (GSE-FC-87-1330, Subject: IRR Log Item 87-0185, Program Plan for Updating/Improving Existing Procedures, December 15, 1987), this item is considered closed.

(Closed) Observation 04.3-3, Procurement Requirements on Equipment Vendors

BACKGROUND

Observation 04.3-3 concerned the inconsistent documentation of equipment performance requirements and of vendor compliance during the procurement process for certain Class 1E isolation devices (FC-83-109, "Transfer of P250 Points to the ERFC"), keylock bypass switches (resolved under Item U4.3-2), and replacement pressure switches for containment high-pressure channels (FC-83-83, "Containment Pressure Switches"). The SSOMI team had noted that consideration should be given to improving the effective use of design requirement documents as inputs to the design engineer and to improving traceable verification that the vendor performance data meet the design requirements.

STATUS OF FINDING

Regarding the specific design requirements for the isolation devices and pressure switches, the team reviewed the licensee's procurement file and specifications (157-TR-02, "Test Report on Isolation Testing and Measurements of the TEC Model 156 Series Isolators, Including Shorts, Opens, and 120 Vac Fault With Fuses Shorted," Revision 2, September 12, 1981, and GSE File No. 14915, Specification No. 6.20, Sheet 1, Revision 3) to ensure that the instruments were procured to appropriate specifications; no discrepancies were found.

RELATED GENERIC ISSUES

In response to the team's generic concerns about the documentation of performance specifications and conformance, the Generating Station Engineering staff improved these aspects of its procurement process by issuing General Engineering Guides GEG-3, "Guideline for Preparation of Design Packages," Revision 0, November 1987, and GEG-2, "Guideline for Preparation of Procurement Specifications," Revision 0, August 1987; and by revising QADP-12, to improve its receipt inspection process by the addition of a checklist. These documents provide more specific and generally comprehensive technical and procedural guidance for developing and verifying design requirements. However, the team was unable to determine from these documents how electrical isolation requirements (a design attribute of this finding) would be established for specifications. The licensee advised the team that isolation requirements were being addressed by Electrical Design Criteria EDC-1, "Electrical CQE Equipment Independence Criteria," Revision 0, March 1988, and the team was given a draft copy. Since this document had not been issued, the team did not formally review it, but it noted that Section 7 addresses electrical isolation. On the basis of the licensee's commitment to establish a specific design basis for electrical isolation for guidance in the preparation of specifications, this item is closed.

After the reinspection, EDC-1 was issued and the electrical isolation requirements were included. The team made several observations regarding this document, which are presented in the discussion of Unresolved Item U4.4-1, "Design Basis Physical Separation Within Panels."

(Open) Unresolved Item U4.4-1, Design Basis Physical Separation Within Panels

BACKGROUND

Unresolved Item U4.4-1 concerned the apparent lack of a quantitative/measurable design basis for the separation of redundant safety-related internal panel wiring and the separation of safety-related and nonsafety-related internal panel wiring. The SSOMI team had reviewed both current and previously implemented design modifications. As specific concerns, the team identified the basis for the use of braid as a separation barrier (Purchase Specification GSEE-0505, Alpha Wire Corp., Revision 0, April 28, 1977); the basis for allowing internal panel wiring for redundant divisions to be in contact (MR-FC-77-40 "Undervoltage Protection," Revision 0, August 13, 1978); the basis for allowing a multiple wafer switch to serve as a separation barrier between safety-related and nonsafety-related panel wiring (MR-FC-81-102, "Bypass or Trip ESF Channels Without Jumpers," Revision 0, August 14, 1985); and violation of a panel wiring separation requirement imposed by the GSE Wire List Form (drafting form for direction of construction), Note 2.

STATUS OF FINDING

A commitment made in 1970 in Appendix G of the Final Safety Analysis Report for Fort Calhoun requires that physical individual channel components and wiring be physically separated wherever such separation is practicable; IEEE Std. 279-1968, "Proposed IEEE Criteria for Nuclear Power Plant Protection Systems," Requirement 4.6, requires that redundant channels "shall be independent and physically separated to accomplish decoupling of the effects of unsafe environmental factors, electric transients, and physical accident consequences documented in the design basis, and to reduce the likelihood of interactions between channels during maintenance operations or in the event of channel malfunction." The team found no analysis demonstrating that the wiring configurations cited above meet these specific requirements to which Fort Calhoun had been licensed.

Regarding the violation of the wire list form requirements prohibiting common harnessing of redundant trains, the licensee explained that the form was a document used for providing wiring instructions for the construction effort and the footnoted requirements could not be achieved when modifying original panels and were not considered a consistent design basis.

Regarding the use of multiple wafer switches as a separation barrier between safety-related and nonsafety-related panel wiring, the licensee stated in its response [LIC-86-106, "SSOMI (Design) 50-285/85-22," Attachment A, Item UA.4-1, April 15, 1986] that this practice is consistent with Section 7.2.2.1, paragraph 3 of IEEE Std. 384-1981, ("IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits"), which allows separation of isolation device input/output wiring to be less than six inches if the separation is not less than the distance between input and output terminals. The team finds this acceptable only if the ability of the isolation device to withstand maximum credible levels of voltages and fault currents has been demonstrated by analysis and test (also a requirement of IEEE Std. 384-1971). The team found no such analysis or test. Consequently, the team believes the design basis is incomplete for supporting this practice.

Regarding the practice of common routing/bundling of panel instrumentation and control wiring and the use of metallic braid as a barrier, the licensee retrieved the minutes of meetings with the control room panel vendor (Meeting minutes, Gibbs & Hill/General Electric NID at Gibbs & Hill office, September 21-29, 1970, Scope: [Panel] Separation Criteria) during the followup inspection. These minutes indicated that safety-related panel wiring must incorporate a copper braid shield and overall jacket to permit the common bundling of wiring for as many as four redundant safety divisions. The team found no analysis to support this use of the braid as a barrier. Discussions with the licensee and a review of the wiring specifications indicated that the braid is ungrounded and provides 85-percent coverage. The team concludes that the braid does not appear to provide a significant barrier to propagation of either electrical faults or localized combustion, although it may provide mechanical protection during installation or modification. Accordingly, the team finds that the licensee has not demonstrated a design basis for the use of this braid as a separation barrier.

The licensee issued EDC-1, "Electrical CQE Equipment Independence Criteria," Revision 0, March 1988, after the SSOMI followup inspection. The licensee gave the team a draft of these criteria during this inspection. The draft document indicated that the practice of commonly bundling the braided wire has apparently been continued for wiring modifications to safety-related panels more recently procured to the requirements of Regulatory Guide 1.75 and IEEE Std. 384 (e.g., the alternate shutdown panel). The team finds that this common bundling practice represents an unacceptable relaxation of the criteria stipulated when the panels were procured unless a basis were established justifying exceptions.

The approved EDC-1 examined after the followup inspection deleted specific reference to this wiring modification practice, but did not appear to prohibit common bundling of different safety division wiring; the document equivocally states, "Wires of different classification are not generally bundled together." Again, the reinspection team found no analysis or test to support any exceptions to Regulatory Guide 1.75 and IEEE Std. 384, which were the separation criteria levied when these newer panels were procured.

The team did not formally review EDC-1 beyond the scope of the concerns of this finding; however, it made the following cursory observations regarding several other provisions of the document that could affect instrumentation and control design:

(1) EDC-1 permits the use of circuit breakers actuated solely by overcurrent as well as fuses to be used as isolation devices; these are exceptions to Regulatory Guide 1.75.

(2) Where credit for fuse coordination is permitted under the Fort Calhoun design basis, sufficient margins of coordination must be rigorously demonstrated, documented, and maintained. Deficiency D4.3-1, "Limit Switch Circuit Protection by Fusing MR-FC-84-74A," supports this generic observation.

(3) Separation criteria for instruments and instrument lines must also include requirements for hazardous areas (e.g., areas containing high energy lines, major rotating apparatus, or other potential sources of high energy), where the specified minimum distances may not be sufficient.

In summary, the team finds that the licensee has made significant progress in reconstituting the electrical independence criteria that apply to the original design as well as to more recent modifications. Specific and quantitative criteria are provided in EDC-1. However, the team concludes that the required analyses and tests supporting the practice of common or proximate routing of internal instrumentation and control panel wiring of redundant safety divisions (and safety/non-safety divisions) are not evident. This is especially important in the case of modifications to newer panels to ensure their design basis is not degraded by subsequent modifications. Accordingly, this unresolved item remains open pending the licensee's establishment of an acceptable design basis for this practice. This design basis must be appropriately supported by analyses or tests that consider maximum credible faulted conditions on the circuits of interest.

RELATED GENERIC ISSUES

No additional generic issues have been identified other than those just discussed.

(Closed) Deficiency D4.5-1, Drawing Changes by Procedure A-9, MR-FC-82-178

BACKGROUND

Deficiency D4.5-1 concerned a modification request (MR-FC-82-178, "HEPA Filter DP Indication," Revision 0, January 23, 1984) for adding local air filter differential pressure gauges, for which a sepia print of the piping and instrumentation diagram (P&ID) was not issued for developing the modification. This apparently did not conform to Generating Station Engineering Procedure A-9, "Document Control," Section 2.3.3.4, August 1983, which requires the design engineer to request a sepia print of an existing drawing that requires revision (such as the P&ID).

STATUS OF FINDING

In its response and in discussions with the followup team, the licensee clarified the intent and meaning of this provision of Procedure A-9. Sepia prints are issued to (1) provide a mechanism for showing the proposed design change during the development of the modification without changing the document of record until the modification is installed and "as-built" and (2) inform all who use the drawing of record about a pending modification that may affect the drawing.

Regarding the first purpose, the team agrees that in this case, the modification was adequately defined by the engineering sketches provided with the design package and the P&ID sepia print was not required to describe the change. Regarding the second purpose, the team asked how users of the P&ID would be informed of the change. The licensee cited the requirement of Standing Order G-21 "Station Modification Control," Form J, Revision 23, April 10, 1987, that P&IDs (and all other control room drawings) must be updated before system acceptance; this would ensure that users are informed of the change.

The licensee also clarified the meaning of the Procedure A-9 requirement, "when an existing drawing needs revision during the preparation of an MR, a request for a sepia of that drawing is made," by stating that the intent is to limit sepia print production to only those drawings that need revision to install the modification, not to all drawings that may eventually need revision. In this particular example, the licensee judged that the modification was simple and did not have a significant impact on the P&ID.

On the basis of the licensee's clarification of the intent and meaning of Procedure A-9, the team concludes that this item is closed.

RELATED GENERIC ISSUES

The team does not agree with the portion of the licensee's response stating that the modification "did not have significant impact on the P&ID," since the addition of the two instruments represented a significant change in functionality, even though the change itself was comparatively minor. As a matter of good practice, a consistent threshold of "significant drawing impact" should be defined and maintained when issuing sepia prints under Procedure A-9.

(Closed) Observation 04.5-2, Flow Element Design Basis Conditions

BACKGROUND

Observation 04.5-2 concerned discrepancies in specified environmental conditions for replacement flow elements in the component cooling water system. The values specified were not consistent with design-basis conditions specified in GSEE-0802, "General Requirements for CQE (Class 1E) Electrical Equipment Required for Use in Controlled Access Areas of the Auxiliary Building Outside Reactor Containment," Revision 0, July 14, 1980.

STATUS OF FINDING

The team had determined that although the actual values were technically acceptable, a generic concern remained.

RELATED GENERIC ISSUES

In response to the team's generic concern, the Generating Station Engineering (GSE) staff improved this aspect of its procurement process by issuing General Engineering Guides GEG-3, "Guideline for Preparation of Design Packages," Revision 0, November 1987, and GEG-2, "Guideline for Preparation of Procurement Specifications," Revision 0, August 1987. These documents provide more specific and generally comprehensive technical and procedural guidance for developing and specifying system performance requirements (Section 5.4.2 of GEG-3) and environmental conditions (Section 5.4.3.1 of GEG-3).

On the basis of these programmatic improvements to the specification process, this item is closed.

(Closed) Unresolved Item U4.5-3, Battery Room Fire Hazard Analysis

BACKGROUND

Unresolved Item U4.5-3 concerned a masonite/fiberboard fuse block enclosure located in each battery room that had not been identified in the battery room fire hazard analysis (FHA); since the coating specifications could not be determined, the combustibility of the material also could not be determined.

STATUS OF FINDING

In response to this finding, the licensee painted the enclosures of concern with fire-retardant paint [Maintenance Order 92 858044, December 23, 1985 (completed December 27, 1985], and performed a new FHA for Fort Calhoun Station ["Fire Areas 37, 38 (Battery Rooms 1 & 2)," Revision 0, October 12, 1987]. In reviewing the documentation of these corrective actions, the reinspection team noted the following:

(1) The maintenance order (MO) for the repainting did not indicate a stock number or other unique identifier for the coating used, although when signing off on the completion of the repainting, craft personnel noted that fire-retardant paint had been used [MO 92 858044, December 23, 1985 (completed December 27, 1985)]. The team asked the licensee how assurance was provided that the proper fire-retardant paint had been used. The licensee referred the team to a memorandum that listed acceptable fire-retardant coatings (FC-730-85, memorandum listing acceptable fire-retardant coatings, dated May 1985) and stated that this memorandum is the basis for the application of fire-retardant paints.

    On this basis, together with consideration of the notation craft personnel had written on the MO, the team concludes that the repainting was done correctly. The team further concludes that more positive identification of the coating material should be provided on the MO, and understands that the licensee intends to do so.

2. Through an oversight in the updated FHA, consideration of the combustible loading of the enclosures in question had still not been included. The licensee corrected the updated FHA ["Fire Areas 37, 38 (Battery Rooms 1 & 2)," Revision 1, April 7, 1988] during the inspection to include the enclosures, and there was no significant effect on the analysis or conclusions.

RELATED GENERIC ISSUES

The team considered the generic implications of the oversight in the FHA and resolved them as follows:

(1) The oversight appears to be an isolated instance involving comparatively low combustible loading (much lower, for example, than the battery case).

(2) The fuse block enclosures are in separate fire areas.

(3) This type of fuse block enclosure would not be expected to reflect common practice in safety-related areas of the plant.

(4) The licensee's housekeeping procedures have been improved to provide more specific restrictions and checklists regarding potential fire hazards posed by such materials as wood (Standing Order G-6, "Housekeeping," Revision 18 May 15, 1987).

(5) Preparation of design packages is now governed by GEG-3, ("Guideline for Preparation of Design Packages," Revision 0, November 1987, Section 5.6.1, "Fire Protection," which requires that fire-protection requirements be considered.

On this basis, this item is closed.

(Open) Deficiency D5.1-1, Battery Sizing Calculation

BACKGROUND

Deficiency D5.1-1 concerning the battery sizing calculation developed for the 1984 modification, MR-FC-84-119, used an unverified 1979 load profile without justification. In response to this SSOMI team finding, the licensee, aided by an outside consultant [Applied Power Associates (APA)], revised the dc load profile. This new load profile will increase the required ampere-hours removed from the battery by 21-percent and 19-percent on dc buses 1 and 2, respectively.

STATUS OF FINDING

The APA battery sizing calculation contained two assumptions that the reinspection team wanted confirmed. The first involved the minimum battery temperature. Cell temperature affects battery capacity. The APA calculation assumed a minimum temperature of 70°F. Historic monthly surveillance data supplied by the licensee for 1984 and 1987 indicated that the battery temperature had remained above the minimum temperature used in the calculation. The battery surveillance procedure, ST-DC-1, contained an acceptance criterion for maximum cell temperature of 90°F; however, no surveillance criterion existed for minimum temperature. In response to this concern, ST-DC-1 was revised (April 8, 1988) to alert operations personnel to the minimum allowable battery temperature.

The second assumption questioned in the sizing calculation involved the lack of a correction factor for battery capacity degradation. This implied that the fully charged battery capacity remained above 100-percent. The team reviewed the battery performance test performed in 1985 following the battery modification and the service test performed during the 1987 refueling outage in an attempt to confirm the battery capacity. The team was not able to confirm the existing capacity because of inconsistent test data and incorrect test acceptance criteria. In response to this concern, the licensee corrected the surveillance test acceptance criteria. The team was also informed that the licensee is in the process of obtaining the battery manufacturer's (EXIDE) assistance to analyze the test results in order to establish the degree of capacity remaining in the batteries. The licensee indicated to the team that the results of this analysis will be factored into the battery calculations and surveillance procedures.

This item will remain open pending the licensee's confirmation that the battery's existing capacity is greater or equal to the capacity required in the calculation.

RELATED GENERIC ISSUES

A generic issue related to this finding concerns the independent review program. The licensee has issued Design Procedure B-11, which satisfactorily addresses independent design verification concerns.

(Closed) Unresolved Item U5.1-2, Battery Charger/DC Bus Coordination

BACKGROUND

During the 1985 refueling outage, the licensee replaced the original 200-ampere battery charger with a new 400-ampere unit. The new charger had the capability to limit current up to 500 amperes (when recharging a discharged battery or other dc transient). The new dc breaker connecting the charger to this dc bus was only rated at 400 amperes and could trip at 500 amperes. No test or setup procedures had been written before the 1985 SSOMI took place. In response to this finding, the licensee prepared Test Procedure MO-871643, which reduced the current limit value to 380 amperes to ensure that the bus breaker would not trip on battery recharge.

STATUS OF FINDING

The team reviewed Test Procedure MO-871643 and found it acceptably ensured that the current limit of the battery charger was reduced to approximately 380 amperes.

RELATED GENERIC ISSUES

A generic issue related to this finding is the adequacy of postmodification test procedures. The licensee recently had General Engineering Guides GEG-9, "Electrical System Interaction," and GEG-28, "Preparation of Installation and Test Procedures," prepared to address these concerns on a generic basis.

(Closed) Observation 05.1-3, Power Cable Sizing Criteria

BACKGROUND

During the 1985 SSOMI, the team noted that the licensee had no formal cable sizing criteria other than a vague reference in the Updated Safety Analysis Report to industry standards (Insulated Power Cable Engineers Association) that did not specifically apply to the installation conditions proposed for modification MR-FC-84-119. In response to the team's immediate concern, the licensee prepared Calculation FC-00476, "Cable Sizing Calculations for Modification Request MR-FC-84-119," December 20, 1985, which addressed voltage drop and ampacity for the affected cables.

STATUS OF FINDING

The team considers that the application of the generic power cable sizing guidance is sufficient to close this item.

RELATED GENERIC ISSUE

The licensee contracted with Stone & Webster Engineering Corp. (SWEC) to develop a generic design procedure for determining cable ampacity. The draft procedure, which was presented to the licensee on March 24, 1986, was still under review when the team returned for the followup inspection. In response to the generic concern raised again during the followup inspection, and following review by Sargent & Lundy Engineers (S&L), the licensee issued a generic cable sizing guidance document (EEG-2, "Guideline for Power Cable Sizing," Revision 0, April 1988).

(Closed) Observation 5.1-4, Pre-Operational Test Requirements

BACKGROUND

The SSOMI team found that Modification Request MR-FC-84-119 "Battery Charger and Inverter Replacement" had not contained any requirement to set the battery charger's high voltage alarm or to provide for maintenance of the two cells removed from each safety-related battery. In response to this item, that alarm was reduced to 140 volts and documented in a postmodification test conducted on November 14, 1985. The licensee stated that it will not maintain the spare cells as critical quality element (CQE) items; therefore, no separate maintenance is required on the spare cells.

STATUS OF FINDING

The team reviewed Test Procedure MO-871643 (May 11, 1987) and verified that the dc high-voltage alarm was still set at 140 volts. The alarm response procedure, OP-10-A15, also identifies the high dc voltage alarm as set at 140 volts. However, the team noted that the battery surveillance procedure, ST-DC-2 issued on January 23, 1987, did not contain alarm acceptance criteria. In response to this observation, the licensee prepared Maintenance Procedure MP-EE-22A on March 29, 1988, to verify the battery charger alarm setpoints on a periodic basis. The team considers this response acceptable.

RELATED GENERIC ISSUE

In response to the generic concerns related to the preparation of modification installation and test procedures, the licensee issued Engineering Guide GEG-28 in February 1988.

(Closed) Observation 05.1-5, Inverter Sizing Without Analysis

BACKGROUND

During the 1985 SSOMI, the team observed that the licensee had replaced the original inverters with new smaller-size units without comprehensively analyzing the inverter loading. In response to the team's concern, the licensee prepared an inverter sizing calculation for Modification Request MR-FC-84-119, March 5, 1986.

STATUS OF FINDING

The team reviewed the inverter sizing calculation and noted that the continuous load calculated for all four inverters was below the continuous rating of 7.5 kVA. The team noted that the licensee recognized that the potential load of 7.478 kVA on inverter A left little margin and the calculation suggested some nonsafety-related load transfer.

The team has been told that the electrohydraulic control load (panel AI-50) was moved from safety-related inverter A to nonsafety-related inverter 2 by modification MR-FC-86-42 to ease the loading on inverter A. The team finds this response adequate to resolve the immediate concern.

RELATED GENERIC ISSUES

In response to the generic issue raised by this finding, the licensee had an electrical system interaction guideline, GEG-3, prepared in February 1988 to ensure that electrical system loading is considered in modifications. The Generating Station Engineering electrical department has designated an electrical load coordinator, and recent modifications have been reviewed by engineering personnel to identify electrical load changes. Electrical load study update forms are now issued for each modification before closeout. In addition, other load studies will be performed on the 480-volt and 4160-volt systems as part of the design-basis reconstitution program.

(Closed) Observation 05.1-6, Design Interface Control

BACKGROUND

During the 1985 SSOMI, the team noted that Electrical Modification Request MR-FC-84-119 had not been reviewed by the structural reviewers or by the HVAC reviewers. In response to this concern, the licensee implemented a multidisciplinary independent review program.

STATUS ON FINDING

The team reviewed Design Procedure B-11, "Independent Design Verification," February 1988, and considers the procedure acceptable.

RELATED GENERIC ISSUE

Multidisciplinary review of modifications is being addressed on a generic basis by General Engineering Guide GEG-3, "Preparation of Design Packages."

(Open) Deficiency D5.2-1, Fire Wrap Protection of Cable Raceways

BACKGROUND

During the 1985 SSOMI, the team noted that the licensee had been using unverified derating factors for cables in conduit wrapped with a fire-protective material. These factors had been obtained from the material manufacturer's (3M) computer program, but the computer program had not been verified and gave results that did not agree with actual test data. The licensee responded that the team had only reviewed preliminary calculations and identified other calculations that were being developed in accordance with its procedures for developing calculations pertaining to critical quality equipment (CQE). The licensee identified those calculations as follows:

(1) FC-85-25-001, "Load Study MCC 3A1, 3B1, 3C1," Revision 1, October 7, 1985

(2) FC-85-25-002, "Cable Ampacity Deratings - Power Feeder Cables for MCC 3A1, 3B1, 3C1," Revision 1, October 9, 1985 (for cable conduit)

(3) FC-85-25-003, "Cable Ampacity Derating - Directly Wrapped Power Cables," Revision 1, February 4, 1986

STATUS OF FINDING

The team reviewed Calculation FC-85-25-003 covering the installation of fire wrapping directly on the power cables. The calculation was based on cable characteristics (resistance and diameter) from Insulated Cable Engineers Association (ICEA) standards rather than from the specific cable data used at Fort Calhoun as detailed in the Rockbestos Cable Schedule (Dwg. #W-LIST, File #47122). Also, the licensee had assumed unconservative thermal conductivity at 350°F for the fire wrapping; this assumption was not appropriate for the Fort Calhoun application with 90°C rated cable (i.e., 200°F). The team used standard Neher McGrath heat transfer methods (similar to those used to develop the ICEA ampacity standards) and estimated that the errors noted above would result in the allowable ampacity of the fire-wrapped motor control center MCC-3C1 feeder cable (EA 140) dropping below the licensee's calculated cable load developed in Calculation FC-85-25-001. This item will remain open pending revision of the cable derating capacity calculation and the providing of justification to the NRC for the existing cable.

RELATED GENERIC ISSUES

No additional generic issues were related to this item since the calculations reviewed were all inclusive.

(Closed) Deficiency D6.1-1, Safety Evaluation for NonSafety-Related Systems Described in the USAR

BACKGROUND

Deficiency D6.1-1 concerned five nonsafety-related modifications affecting systems or equipment described in the Updated Safety Analysis Report (USAR) that lacked a safety evaluation in their design packages. The USAR had to be revised to reflect the modifications. The SSOMI team had noted that 10 CFR 50.59 requires a safety evaluation to be included if the USAR would be changed by facility modifications; no distinction can be made in this regard between safety-related and nonsafety-related systems.

STATUS OF FINDING

In response to this deficiency, the licensee has taken several corrective actions:

(1) Safety evaluations for the five modifications in question have since been performed (LIC 87-086, April 10, 1987).

(2) Appropriate USAR changes have been made regarding the modifications (RRD 87-0122).

(3) A commitment has been made in the Fort Calhoun Station Design Basis Reconstitution Project Program Plan, July 2, 1987, page 31, to review modification packages for safety-related modifications and nonsafety-related modifications that could affect safety-related systems; this review will include all modifications installed after the license is issued and is intended to confirm the adequacy of safety evaluations.

(4) OPPD Procedures A-2, B-2, and G-21 were revised to require safety evaluations for all modifications affecting facilities or procedures described in the USAR, including drawings.

(5) A revised procedure for preparing safety evaluations has been developed and implemented (GEG-27, "10 CFR 50.59 Safety Evaluation," Revision 0, February 1988).

(6) Procedure GEG-3 requires a safety evaluation during the preparation of modification packages (GSE-DB-88-17, "Attachment II, Plant Level Design Basis Document," April 4, 1988).

(7) A training program regarding the 10 CFR 50.59 process was conducted for the licensee's staff.

Although the team did not perform a technical review of all corrective actions, on the basis of the programmatic changes cited above, this item is closed.

RELATED GENERIC ISSUES

No additional generic issues have been identified other than those discussed above.

(Closed) Unresolved Item U6.1-2, Safety Analyses for Emergency Modifications

BACKGROUND

During the 1985 SSOMI, the team found a number of emergency modifications to critical quality element (CQE) items for which a safety evaluation was not included in the final design package. The licensee admitted that although these modification packages did contain a safety evaluation for the construction phase, no safety evaluation could be located for the design phase.

STATUS OF FINDING

The licensee revised Standing Order G-21, "Station Modification Control," to require that safety evaluations be included for all phases of construction and design. The licensee has also stated that it has reviewed all previous emergency modifications and has prepared safety evaluations on all related to critical quality elements.

The team reviewed the applicable Section 2.3, "Emergency Modification Requests," of Standing Order G-21 (page 19, April 10, 1987) and confirmed the requirement for preparing safety evaluations during both the design and construction phases and including them in the final design package. In addition, General Engineering Guide GEG-27 provides guidance on safety evaluations for all types of modifications.

RELATED GENERIC ISSUES

No additional generic issues were related to this item.

(Closed) Observation 06.1-3, Vital AC Inverter Bypass Mode

BACKGROUND

Observation 06.1-3 concerned a deficiency in the safety evaluation included with Modification MR-FC-84-119 ("Battery Charger and Inverter Replacement, Lowering Terminal Voltages and Battery Discharge Breakers"): the safety evaluation failed to address any effects on the Technical Specifications of operating one or more instrument buses in the bypass mode. The licensee's original interpretation was that the instrument bus would only be considered inoperable if it was powered from an inverter; the licensee changed its first interpretation to define operable as "being powered from the bypass transformer" (TS-FC-86-807, December 1, 1986); in GSE FC-87-507 (March 31, 1987) the licensee required the instrument bus to be powered from an inverter if it is to be considered operable.

STATUS OF FINDING

Operating Instruction OI-EE-4-6, Revision 35, September 24, 1987, prohibits more than one safety-related instrument bus from being powered in the bypass mode when the reactor coolant system temperature is above 300°F. The reinspection team agrees with the present interpretation of instrument bus operability requiring that the safety-related inverter be operable and connected to the instrument bus.

RELATED GENERIC ISSUES

No additional generic issues were related to this observation.

(Closed) Observation 06.2-1, Untimely Closeout of Emergency Modifications

BACKGROUND

During the 1985 SSOMI, the team reviewed the closeout of emergency modifications and found that six modifications lacked the after-the-fact design packages as long as 42 months after the modification was installed. The licensee responded that marked-up drawings were prepared and forwarded to the Generating Station Engineering (GSE) staff so that it could prepare the after-the-fact design packages (FC-1339-86, September 2, 1986).

STATUS OF FINDING

Section 2.3 of Standard Order G-21, "Station Modification Control," Revision 29, November 19, 1987, states that the final design package for emergency modifications must be (1) independently verified before the system or equipment is placed in operation and (2) independently reviewed by the System Acceptance Committee (SAC) within 14 days after the system or equipment becomes operational. The reinspection team considers this acceptable. Three of four open emergency modification items identified by the SSOMI team were verified closed by review of Memorandum FC-1339-86. The fourth modification was verified as a component change not requiring a modification.

RELATED GENERIC ISSUES

The regional followup inspection (IR 50-285/88-02) verified that the use of emergency modifications had been severely restricted since the 1985 SSOMI. A review by the regional staff of six selected recent emergency modifications indicated that the final design packages for all six had been issued.

(Closed) Deficiency D6.2.2, Modifications to AFW Turbine Steam Supply Valves

BACKGROUND

From March 1980 to January 1985, the licensee failed to meet the requirements of 10 CFR 50.59: the licensee made a change to the facility as described in the Updated Safety Analysis Report (USAR) but failed to conduct and document a review to determine that the change did not involve an unreviewed safety question. The change to the facility involved the modification of the auxiliary feedwater (AFW) pump turbine common steam admit valve (YCV-1045) from the "fail close" to the "fail open" design mode (the change was completed in March 1980) without the addition of a safety-related air accumulator system for the individual "fail open" steam supply valves (YCV-1045 A and B). The inability to close the "fail open" steam supply valves on the loss of nonsafety-related instrument air would result in an additional fission product release path, not analyzed in the USAR, for a steam generator tube rupture incident. Therefore, the change involved an unreviewed safety question because the consequences of an accident previously evaluated in the USAR may have been increased.

In addition, the USAR incorrectly reflected the as-built configuration for the containment penetrations associated with YCV-1045 A and B. USAR Table 5.9-1 shows these penetrations (M-94 and M-95) as Type IVD. Type IVD contains a single power-operated valve that is normally open, fails closed, and whose accident position is closed. The SSOMI team noted that although this depiction is correct for the main steam isolation valves, the AFW steam supply taps off on the upstream (containment) side of the main steam isolation valves, and that these valves are normally closed, fail open, and have an open accident position. In addition, the main steam isolation valve bypass valves are not shown.

STATUS OF FINDING

This finding is closed for the following reasons:

(1) The team has confirmed that the air accumulators have been installed and tested (see D2.1-1).

(2) FSAR Table 5.9-1 has been deleted and superseded by Figure 5.9-13, Sheets 1 through 65. Penetrations M-94 and M-95 are depicted on Figure 5.9-13, Sheets 62 and 63, respectively. This figure shows the correct configuration and valve positioning normal, failed, and accident conditions.

(3) (a) OPPD Nuclear Production Division Policy/Procedure E-1, "10 CFR 50.59 Safety Evaluation," and (b) General Engineering Guide GEG-27," 10 CFR 50.59 Safety Evaluation," Revision 0, February 1988, have been prepared since the SSOMI. The procedure and the guidance document have been reviewed and should enhance the depth and completeness of 10 CFR 50.59 evaluations.

(4) Standing Order G-21, "Station Modification Control," Revision 29, November 19, 1987, states in Section 2.3 that the final design package for emergency modifications must be independently verified before the system or equipment is placed in operation and must be independently reviewed by the System Acceptance Committee (SAC) within 14 days after

the system or equipment becomes operational. In essence, the modification control procedure has been revised to maintain administrative control of "emergency" modifications to the same level as "normal" modifications. The modification control procedure now requires that safety evaluations which address both the design and the installation and testing aspects of the modification be completed before the start of construction. These safety evaluations are required to be reviewed by engineering personnel, who are responsible for the design bases, before the start of construction.

(5) The licensee reviewed those emergency modifications that had modification completion reports (MCRs) completed. [Note that a modification completion report and System Acceptance Committee review form should be submitted to the Generating Station Engineering staff (GSE) within two weeks following the acceptance of a modification.] The review was conducted to confirm that two safety evaluations had been performed: one as part of the design package and one as part of the installation and construction phase. The licensee reviewed 71 emergency modifications which represented the set of emergency modifications installed since the modification process started and that have modification completion reports as of April 10, 1987. The team selected three modifications (FC 85 35, FC-84-83, and FC-85-161) and confirmed that two safety evaluations were included in the modification file. The team did not assess the technical adequacy of these safety evaluations.

(6) The team examined documentation that indicates all completed CQE-related emergency modifications installed since initial full-power operation, and have an MCR received by April 10, 1987, that do not require seismic updates, have been closed. All known drawings and applicable plant procedures have been updated (GSE-FC-87-1032, memorandum from S. Gambhir to J. Fisicaro, "Closeout of RRD Item No. 87-277," dated June 24, 1987).

(7) The team confirmed that personnel performing activities associated with 10 CFR 50.59 evaluations had been trained. The team compared the individuals who attended 10 CFR 50.59 Safety Evaluation Training (QAPD Memorandum FC-T-297-88, dated April 6, 1988) with the personnel qualified for performing reviews of safety evaluations (FC-1986-87, memorandum from T. L. Patterson to PRC Chairman, dated January 4, 1988).

RELATED GENERIC ISSUES

The related generic issues are included in the preceding discussion.