UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

DIVISION OF QUALITY ASSURANCE, SAFEGUARDS, AND INSPECTION PROGRAMS
REACTOR CONSTRUCTION PROGRAMS BRANCH

Report No.: 50-458/84-23

Docket No.: 50-458

Applicant: Gulf States Utilities Company

Facility Name: River Bend 1

Inspection At: River Bend 1, West Feliciana Parish, Louisiana

Inspection Conducted: July 30-August 10 and August 20-31, 1984

Inspectors: P. Keshishian — 10/15/84
P. Keshishian, Sr. Reactor Construction Engineer, Team Leader — Date Signed

G. B. Georgiev — 10/15/84
G. B. Georgiev, Sr. Reactor Construction Engineer — Date Signed

K. B. Hooks — 10/15/84
K. B. Hooks, Reactor Construction Engineer — Date Signed

R. L. Lloyd — 10/15/84
R. L. Lloyd, Reactor Construction Engineer — Date Signed

T. K. McLellan — 10/15/84
T. K. McLellan, Reactor Construction Engineer — Date Signed

for P. Keshishian — 10/15/84
W. M. McNeil, Reactor Inspector (Region IV) — Date Signed

S. R. Stein — 10/15/84
S. R. Stein, Reactor Construction Engineer — Date Signed

Consultants: R. M. Compton, D. C. Ford, H. A. Jiminez, J. B. McCormack, O. P. Mallon, W. S. Marini, E. Y. Martindale, R. E. Serb and W. J. Sperko, Jr.

Approved By: — 10/15/84
Robert F. Heishman, Chief
Reactor Construction Programs Branch — Date Signed

10/15/84
J. Nelson Grace, Director
Division of Quality Assurance, Safeguards, and Inspection Programs — Date Signed

TABLE OF CONTENTS

## I. INSPECTION SCOPE AND OBJECTIVES

The objective of this inspection was to evaluate the adequacy of construction and project construction controls at the River Bend Station. This objective was accomplished through review of the construction program, evaluation of project construction controls, and review of selected portions of the Quality Assurance Program, with emphasis on the installed hardware in the field. In addition, the scope and significance of identified problems were determined.

Within the areas examined, the inspection consisted of a detailed examination of selected hardware subsequent to Quality Control inspections, a selective examination of procedures and representative records, and limited observation of in-process work. Interviews were conducted with site personnel from Management, Quality Assurance, Quality Control and various crafts.

For each of the areas inspected, the following was determined:

- Were project construction controls adequate to assure quality construction?
- Was the hardware or product fabricated or installed as designed?
- Were quality verifications performed during the work process with applicable hold points?
- Was there adequate documentation to determine the acceptability of installed hardware or product?
- Are systems turned over to the startup organization in operable condition and are they being properly maintained?

## II. ELECTRICAL AND INSTRUMENTATION CONSTRUCTION

### A. Objective

The primary objective of the appraisal of electrical and instrumentation construction was to determine whether safety-related components and systems were installed in accordance with regulatory requirements, Safety Analysis Report (SAR) commitments and approved vendor and construction specifications and drawings. Additional objectives were to determine whether procedures, instructions and drawings used to accomplish construction activities were adequate and whether quality-related records accurately reflect the completed work.

### B. Discussion

Within the broad categories of electrical and instrumentation construction, attention was given to several specific areas. These included electrical cable, raceways, and equipment, and instrumentation cable and components. Additionally, a review was made of a selected number of documents associated with design change control and nonconformance reporting.

A number of documents were generated by the applicant to record individual observations of the NRC Construction Appraisal Team (CAT) inspectors. Several are referenced directly in the discussions that follow and Table II-1 is a complete listing of the documents initiated as a result of the electrical and instrumentation inspection.

#### 1. Electrical Raceway Installation

##### a. Inspection Scope

Thirty-eight segments of installed Class 1E cable tray, a total length of about 1,400 feet, were selected from various plant areas for detailed examination by the NRC CAT. These segments were inspected for compliance to requirements relative to routing, location, separation, support spacing, identification, protection and physical loading. Additionally, 40 runs of installed conduit, with an aggregate length of about 900 feet, were inspected for compliance to specified requirements such as routing, location, separation, bend radii, support spacing and associated fittings.

Over 40 raceway supports were examined in detail for such items as location, material, anchor spacing, weld quality, bolt torque and installed configuration.

See Table II-2 for a listing of cable tray, conduit and raceway support samples.

The following documents provided the basic acceptance criteria for the inspection:

River Bend Station Unit 1 (RBS) "Specification for Electrical Installation" 248.000 Rev. 7, December 29, 1983

Stone & Webster Engineering Corporation (S&W) Quality Standard QS-10.52 Rev. 0, "Raceway and Cable Installations"

S&W Construction Methods Procedure (CMP) 9.4-3.76, "Electrical Raceway Installation", March 22, 1976

S&W Construction Site Instruction (CSI) 8.1.1, "Procedure for Area Clearance Evaluation", July 19, 1984

S&W Quality Assurance Inspection Plan (QAIP) R1248000F05050G03, "Electrical Conduit, Pull and Junction [Box] Installation Inspection"

S&W QAIP R1248000F05070H00, "Electrical Cable Tray Installation"

S&W QAIP R1248000F05110I05, "Electrical Cable Tray Support Installation"

S&W QAIP R1248000F05200E03, "Electrical Conduit Support Installation Inspection"

S&W QAIP R1248000F05340A01, "Electrical Raceway Support Bracing Installation"

b. Inspection Findings

In the area of electrical raceway, the NRC CAT inspectors observed that in general Class 1E raceway installations were in accordance with applicable design criteria. Important quality attributes such as material type, location, identification and installed configuration were found to be as shown on approved construction drawings. However, several construction deficiencies were identified and are discussed in the following sections.

(1) Raceway Separation

The RBS Final Safety Analysis Report (FSAR) section 8.3.1.4 "Independence of Redundant Systems", specifically section 8.3.1.4.2, provides the basic criteria for acceptable raceway and cable installations at the River Bend Station. In synopsis, this section describes requirements for physical arrangement of raceways and cables in order to comply with the requirements of Regulatory Guide (RG) 1.75 for independence of redundant systems. In general, these requirements specify that physical separation must be maintained between components of redundant divisions. Separation distances are detailed and provision is made for use of fire resistant barriers when the required separation is unattainable. These requirements are restated and refined in the "Specification for Electrical Installation" 248.000, and in design drawings. Additionally, the requirements are reflected in specific attributes of QAIPs

R1248000F05070H00 and R1248000F05050G03 which provide the basis for Field Quality Control (FQC) inspection of Class 1E raceway installations.

The NRC CAT inspectors selected a sample of installed Class 1E raceways which had been final inspected and accepted by the FQC organization. A physical examination of these installations was then performed. During the inspection of these items NRC CAT inspectors observed raceways which did not maintain the required separation between divisions. In Table II-3, raceway segments in the left column do not meet the required minimum separation as installed relative to raceway segments listed in the right column.

Additionally, NRC CAT inspectors identified several raceway installations which did not maintain adequate separation from exposed redundant divisional cables. These deficiencies are discussed in detail in Section II.B.2, below.

In reviewing records for the inspection of these items, NRC CAT inspectors observed that the inspection attributes listed in QAIPs R1248000F05070H00 and R1248000F05050G03 had been signed as acceptable by the FQC inspectors. This would indicate the acceptance of separation attributes even though the installed configuration of the raceway did not meet the specified separation criteria.

Discussions with S&W FQC personnel indicated that the documented acceptance of separation attributes for cable tray was not intended as a final inspection, but only to indicate that fire barriers in the form of tray covers were shown on approved design drawings and would be installed later in construction progress. NRC CAT inspectors noted that this position was not reflected in the applicable inspection plan. Additionally, no procedures were available to assure that approved fire barriers would be installed and inspected. The NRC CAT inspectors concluded that raceway inspection documentation did not accurately reflect the condition of numerous installed raceways relative to attributes of electrical separation.

As a result of these observations S&W FQC personnel issued the following documents designed to clarify the purpose of inspection activities and to assure that final separation inspection would be performed:

- Quality Control Instruction FR1-S10.52-010 "Electrical Separation"; this document was issued to "provide instructions and program requirements to insure that spacial separations required by IEEE 384 as implemented by the Electrical Installation Specification and the Electrical Installation Drawings is accomplished."

- QAIP R1248000F05480000, "Final Separation Inspection"; issued "to provide attributes for the final inspection

of spatial separation requirements applicable to Class 1E Equipments and Circuits in accordance with Regulatory Guide 1.75 requirements."

NRC CAT inspectors reviewed these documents and noted that they provide a comprehensive basis for future inspection of electrical construction activities relative to the attribute of electrical separation.

During the examination of raceway installations NRC CAT inspectors were informed that S&W FQC had elected to reinspect all Class 1E conduit installations. The reason for this decision and details of its implementation are discussed later in this section of the report. However, relative to electrical separation NRC CAT inspectors noted that many of the separation deficiencies identified involved conduit installations. The implementation of a program designed to reinspect conduit installations would therefore be beneficial in assuring that existing separation deficiencies would be identified and corrected.

In summary, the NRC CAT inspectors concluded that the applicant's program of inspections to assure compliance to specified requirements has not been totally effective in identifying electrical separation deficiencies. However, the magnitude of existing deficiencies in this area is considered limited. With regard to actions needed to resolve existing deficiencies, very few instances were identified which will require extensive rework. Further attention by applicant personnel will be required to assure that existing separation deficiencies are identified and corrected.

(2) Electrical Conduit

In July 1984, the applicant instituted a program to track field run conduit loads on seismic supports. This necessitated a reinspection effort for the 400 runs of Class 1E conduit already installed and inspected. Since there had also been changes made to their separation criteria at that time, the applicant decided to reinspect all the Class 1E conduit (including non-Class 1E conduit in the reactor drywell area) for all attributes. At the time of the NRC CAT inspection, the only conduit reinspections that had been completed were 28 runs of Class 1E and non-Class 1E conduit in the drywell area.

The full reinspection of conduit was a logical and comprehensive approach by S&W for implementing their new tracking program and criteria. However, it limited the NRC CAT inspection in that only seven runs of Class 1E conduit had been reinspected and accepted by S&W FQC. Due to the limited scope of FQC final accepted conduit, the NRC CAT inspected all 28 runs of reinspected conduit and an additional 12 runs of Class 1E conduit which had been FQC inspected and accepted prior to the reinspection program.

Although the conduit installation was generally in accordance with specification and drawing requirements, several instances of conduit not meeting the minimum separation criteria were identified. These are included in Table II-3 and the discussion in Section II.B.1.b(1), above. Although few in number, finding separation deficiencies in conduit which had been inspected twice indicates that the inspection for separation attributes was not fully effective.

The NRC CAT inspectors also noted several flexible conduit connectors that were loose. These were found at the connections to motor operated valves located in the reactor drywell area which is subject to harsh environments during a loss-of-coolant accident (LOCA). As a result of this finding, S&W processed an Engineering and Design Coordination Report (E&DCR) C-25,083 which modified the attachment of flexible conduits at threaded hub connections to prevent them from loosening. The E&DCR also indicated that the equipment had been qualified without sealed connections.

The NRC CAT inspectors questioned the use and control of aluminum conduit in containment. RBS FSAR Section 6.2.5.3.2.2 addresses compliance with RG 1.7, "Control of Combustible Gas Generation in Containment Following a Loss-of-Coolant Accident", and stated that the production of hydrogen due to aluminum and zinc corrosion is negligible; the amount of aluminum in containment is assumed to be 27,000 square feet of surface area. The NRC Office of Nuclear Reactor Regulation (NRR) staff, in the RBS Safety Evaluation Report (NUREG-0989), has determined that the applicant's conclusion regarding aluminum and zinc corrosion will require additional NRC review and analysis.

RG 1.7 requires materials that would produce hydrogen due to corrosion be identified and their use limited as much as practical. However, Electrical Specification 248.000 and ED&CR C-24,943 essentially permit unrestricted use of aluminum conduit and junction boxes in containment. In addition, the calculation (PN-222) used to determine the amount of aluminum and zinc in containment for the hydrogen production determinations was found not to include any estimates for conduit and junction boxes. NRC CAT inspectors had also found components in containment painted with zinc containing paint that was not included in PN-222.

S&W established inventory control for zinc through a technical procedure, PTP-36.1 and Project Management Memorandum PMM-82 dated August 4, 1981, which required updates every six months. The procedures did not account for an inventory of aluminum, and discussions with S&W personnel revealed the procedural requirements regarding zinc were not being met.

In summary, hydrogen production in containment is considered an open item by the NRC staff. In addition, the applicant failed to follow their procedure for inventory control of

hydrogen producing materials and the procedure did not address the use of aluminum.

(3) Raceway Supports

The examination of raceway supports was accomplished for both conduit and cable tray applications. In general, raceway supports installed outside of the Reactor Building were found to be in conformance with design documents for items such as location, material type, anchor spacing and installed configuration.

With regard to cable tray supports installed inside of the Reactor Building the NRC CAT inspectors identified several design and construction deficiencies. Supports installed in this area were of different material types than those installed outside of containment. As a result of their location, field fabrication was required for many support installations.

NRC CAT inspectors noted several supports which exhibited horizontal members whose lengths exceeded the dimensions shown on the tabulation drawings. The tabulation drawings detail the design dimensions to be followed during the installation of the support.

During the inspection of supports, NRC CAT inspectors reviewed electrical drawing EE-340YY-3 which provides design details for support installation. Note 6 states: "Dimensions Shown Are Recommended. Actual Dimensions Are To Be Determined At The Time Of Installation." It was concluded by the NRC CAT inspectors that this note was in conflict with the stated dimensions. To determine the impact of these dimensional deviations, discussions were held with S&W Engineering personnel to ascertain the method used in establishing seismic loading for Reactor Building cable tray supports. These discussions indicated that dimensions used for seismic loading calculations were based upon figures shown on the tabulation drawings; thus calculations used to determine acceptable support loading were based on information which does not accurately reflect as-built configurations.

As a result of this observation S&W FQC issued a Type C Inspection Report (IR) E4700104 which details this discrepancy and initiates an as-built review of all cable tray supports installed inside of the Reactor Building. This as-built information will then be used by S&W Engineering to determine the actual loading of individual supports.

Additionally, E&DCR C-25,090 was issued to change Note 6 of drawing EE-340YY to read as follows: "Tolerance on length of horizontal members shall be (+/-) 6" except length of cantilever supports shall not exceed 3'-6", uos [unless otherwise specified]. Length of vertical members shall be maximum. Length of bracing members is recommended; actual

length required shall be determined at time of installation in accordance with required details."

NRC CAT inspectors concluded that as-built verification of all Reactor Building cable tray supports and seismic analysis of those found to be out of tolerance will be required to determine that Reactor Building cable tray supports are constructed in accordance with seismic loading limitations.

NRC CAT inspectors also noted that for seismic cable tray supports in all plant areas, bracing members shown on design drawings have yet to be installed. In reviewing cable tray support installations NRC CAT inspectors observed that numerous interferences will result with the installation of axial bracing. Discussions with S&W Engineering personnel indicate that they are aware of interference problems and have begun efforts to alleviate them.

With regard to conduit supports, the NRC CAT inspectors found that some beam stiffeners required by support detail drawings were not installed and inspected although the supports were inspected and accepted. The NRC CAT inspector's concern was that required stiffeners would not be installed. The installation of beam stiffeners in structural supporting steel above conduit supports was treated as an activity separate from the actual support installation. Discussions with S&W FQC revealed that they utilized an unproceduralized system to track these installations. The NRC CAT inspector's concern was not with the adequacy of the system being utilized, but that it needed to be documented to ensure its continued use. The applicant is currently initiating procedure FRI-S10.52-020 to track beam stiffener installations.

Three other isolated deficiencies were identified with the installation or documentation of conduit supports. The following Nonconformance and Disposition Report (N&D) and IRs were issued as a result of the NRC CAT inspection:

- Support CRB-1245 was found with two loose assembly bolts. Applicant subsequently issued IR E4604054 to document this item.

- Support RU-1C-0102 was installed using 4 in. x 4 in. x 1/4 in. tube steel. Detail "LH" on drawing EE-450AL, Rev. 3 requires 4 in. x 4 in. x 3/8 in. tube steel. Applicant issued N&D 7202 and IR E4700116 to document and provide corrective action for this item.

- Support CFB-113 was found to be missing two required 2-in. long groove welds. A review of QC inspection records revealed that this had been documented by FQC on IR E4600372 on February 16, 1984. However, this IR had been transmitted directly to the records vault, thus bypassing the deficiency reporting and corrective action system. The applicant

stated that this was an error and documented the omission on IR E4700113.

c. Conclusions

Raceway inspection documentation does not accurately reflect the installed condition of certain electrical raceways in that some field installations exhibit deficiencies in separation criteria. Additionally, procedural controls did not exist to assure that approved fire barriers will be installed and inspected for items which do not maintain required spatial separation.

Calculations performed to determine loading of Reactor Building seismic cable tray supports were based on design information which does not, in many instances, accurately reflect the installed configuration of raceway supports.

The applicant has not effectively implemented his procedure for inventory of hydrogen generating permanent plant materials installed inside of the containment drywell. Additionally, the procedure itself is inadequate in that it only addresses control of materials containing zinc, and does not address control of other hydrogen generators such as aluminum, which is used extensively for conduit and junction box installations.

2. Electrical Cable Installation

a. Inspection Scope

The NRC CAT inspectors selected a sample of installed Class 1E cable runs that had been previously accepted by FQC inspectors. The sample included high voltage, power, control and instrumentation cabling. For each of the cable runs, physical inspection was made to ascertain compliance with applicable design criteria relative to size, type, location, routing, bend radii, protection, separation, identification and support.

Additionally, the NRC CAT inspectors selected approximately 50 cable ends for examination. These were inspected relative to applicable design and installation documents for items such as lug size and type, proper terminal point configuration, correct identification of cable and conductors, proper crimping of lugs or connectors and absence of insulation or jacket damage. See Table II-4 for a listing of cable terminations examined.

The following high voltage and power cables totaling approximately 2,600 feet were selected from different systems, electrical divisions, and locations:

| Cable | Type |
|---|---|
| 1CSLNRH300 | 500MCM, 4160V |
| 1CSLCOH300 | 750MCM, 4160V |
| 1HVKCRL200 | 250MCM, 480VAC |
| 1ENSARH305 | 500MCM, 4160V |
| 1HVPBBL200 | 250MCM, 480VAC |
| 1CHSCOH306 | 500MCM, 4160V |
| 1HVKBBL200 | 250MCM, 480VAC |
| 1HVRNRK001 | 8AWG, 480VAC |
| 1FSWABL001 | 350MCM, 480VAC |
| 1HVRNRK005 | 2/0, 600VDC |
| 1ENBBBL604 | 500MCM, 125VDC |

The following control cables totaling approximately 900 feet were selected from different systems, electrical divisions and locations:

| Cable | Type |
|---|---|
| 1SASARC002 | 5C/12AWG, 120VAC |
| 1RHSBBC064 | 5C/12AWG, 120VAC |
| 1CSLNRC003 | 5C/16AWG, 120VAC |
| 1CSHAOC707 | 2C/14AWG, 125VDC |
| 1CMSNBC500 | 2C/12AWG, 120VAC |

The following instrument cable totaling approximately 700 feet were selected from different systems, electrical divisions and locations:

| Cable | Type |
|---|---|
| 1CSHNOX423 | 2C/16AWG, Inst. |
| 1CMSDBX400 | 2C/16AWG, Inst. |
| 1RHSBBX401 | 2C/16AWG, Inst. |
| 1CMSARX401 | 2C/16AWG, Inst. |
| 1ICSNRX425 | 2C/16AWG, Inst. |

The NRC CAT inspectors also observed the in-process installation and inspection of two Class 1E cable pulls and the termination of two coaxial cables for reactor in-core instrumentation.

The following documents provided the basic acceptance criteria for the inspections:

RBS "Specification for Electrical Installation" 248.000 Rev. 7, December 29, 1983

S&W QS-10.53 Rev. 0, "Cable Termination and Connections"

S&W CSI 9.0.20 Rev. 4, "Installation Procedures for Multipin and Special Connectors for Field Installed Cables"

S&W QAIP R1248000F05180D04, "Electrical Cable Installation Inspection Plan"

S&W QAIP R1248000F05250C04, "Electrical Power Cable Terminations"

S&W QAIP R1248000F05320B04, "Electrical Installation of Cables in PGCC"

S&W QAIP R1248000F05360F03, "Electrical Instrumentation/ Control and 600 Volt and Below Power Cable Terminations"

S&W QAIP R1248000F05490B03, "Electrical Installation"

b. Inspection Findings

(1) Routing

In general, the routing of Class 1E cable through design designated raceway systems was found to be in accordance with specified criteria.

During the inspection of cable installations NRC CAT inspectors noted that cable 1HVKBBL200 had been routed to junction box JB-0294. The routing indicated on the computer generated pull slip did not agree with the field routing in that the final destination for this cable was shown as JB-0299. Upon further investigation S&W FQC personnel produced a recently issued revision of the cable pull slip which changed the junction box designation to agree with the field routed condition.

No other deficiencies were identified relative to cable routing.

(2) Separation

The inspection of Class 1E cable installations revealed a number of instances in which cable of one electrical division did not maintain separation from cable or raceway of another electrical division. These deficiencies occurred in cable installations that exited design designated raceway and were run free-air before entering an electrical device or additional raceway segments. Although deficiencies of this type were observed in many areas of the plant they were most common in the ceilings of the Cable "A" & "B" areas just below the elevation housing the Class 1E 4160V switchgear and motor control centers in the Control Building.

In reviewing S&W design documents, NRC CAT inspectors noted details which specified the use of cable wrap material as a fire barrier for cable installations that do not maintain the required spatial separation. The material specified was Sil-Temp 188CH or 36CH manufactured by Ametek Haveg Division. NRC CAT inspectors requested qualification reports for this material to determine its acceptability for use as a cable fire barrier. Subsequently, S&W Engineering provided an

in-house position letter which details an engineering analysis of this material for properties such as combustibility, melt temperature, and thermal resistance. Based upon this analysis and the review of additional product information, the S&W position letter concludes Sil-Temp 188CH or 36CH to be acceptable protective wrap material.

NRC CAT inspectors discussed this matter with the NRC Office of Nuclear Reactor Regulation, Power Systems Branch (NRR/PSB) reviewer for the River Bend project. Based upon this discussion, it was determined that further information would be required relative to material properties and application.

The review of design documents also revealed a discrepancy between a cable separation detail and the FSAR commitment to IEEE-384 and RG 1.75. Although this appeared to be an isolated case, the separation design drawings may require a detailed review by the licensee.

NRC CAT inspectors also reviewed cable installations within electrical panels, control boards and Power Generation Control Complex (PGCC) ductways. In plant areas other than the main control room, several separation deficiencies were observed. These were located in the Remote Safe Shutdown Panels, 4160V Switchgear and Diesel Generator Control Panels. However, in each of these instances S&W FQC personnel had previously issued unsatisfactory IRs or N&Ds to identify the deficiencies and initiate corrective actions.

Separation deficiencies identified in PGCC control panels included both field and vendor wiring. However, it was observed that the extent of deficiencies in this area was limited, due in part to the design of the PGCC itself. Refinement of the PGCC concept appears to have eliminated many of the separation problems seen at other facilities. While the scope of deficiencies observed in this area was limited, several items were identified that will require further applicant attention.

(a) As of the date of the NRC CAT inspection final separation criteria for cable and wiring installations in the PGCC had not been approved. NRC CAT inspectors reviewed preliminary reports developed by General Electric Company (GE) personnel on this subject and noted that a detailed reinspection of cable and wiring installations may be required as a result of criteria modifications.

(b) The installation of separation barriers in PGCC ductways has yet to be accomplished. Specific procedural controls will be required to assure that previously accepted Class 1E cable installations are not damaged or altered by this activity.

(3) Cable Spacing

During the inspection of Class 1E cable installations, NRC CAT inspectors noted an apparent discrepancy between the applicant's FSAR commitment to an Insulated Power Cables Engineers Association (IPCEA) standard for derating of power cables and S&W E&DCR C-23,992. The E&DCR specifies that spacing need be maintained only where cable is physically ty-wrapped to the cable tray. This requirement does not agree with the position established in the IPCEA standard for spacing of cables. NRC CAT inspectors discussed this matter with the NRC NRR/PSB reviewer for the River Bend project and concluded that further information will be required before this method of installation can be approved.

Additionally, NRC CAT inspectors identified several cables located in trays 1TH003R and 1TH053R which did not maintain required spacing at the point of ty-wrapping.

As a result of this observation S&W FQC personnel issued IR E4001281 to document this condition.

(4) Cable Damage

During the inspection of medium and high voltage power cables, NRC CAT inspectors noted that cable 1CSHC0H300 exhibits deformation of the outer jacket as it enters conduit 1CH0030A. This cable is a 750MCM, 4160V power feed to the High Pressure Core Spray pump motor. It was determined that the damage was caused as a result of failure to install a Kellums support grip in the 52 feet of vertical run of the cable. The absence of the support caused the weight of the cable pulling against the side of the conduit to deform the cable jacket.

The electrical specification requires a support for this size of cable at intervals not exceeding 40 feet. Subsequent S&W engineering review of this condition has determined that the jacket deformation will not impair the safe operation of the cable.

During the examination of Motor Operated Valve 1E33*F028 [* in equipment designation indicates QA Category I] NRC CAT inspectors noted that the blue conductor of cable 1MSIBBC008 had been damaged by being crushed between the motor operator housing and its cover. As a result of this observation S&W FQC issued a request to have the Gulf States Utilities Company (GSU) Startup organization examine this condition.

These items are considered isolated in that no additional instances of damage were observed.

(5) Tray Fill

The RBS FSAR section 8.3.1.4.4.2 sets forth requirements for limiting cable tray fill to the top of the side rails of the tray. During the inspection of Class 1E cable installations NRC CAT inspectors observed several cable installations in which this requirement had not been met. The following tray segments exhibited this condition:

1TC868R
1TC816R
1TC001R
1TX028R
1TC838R
1TX811R
1TC868R

NRC CAT inspectors reviewed applicable cable installation and inspection procedures and the electrical specification, and observed that the FSAR requirement limiting tray fill had not been incorporated into these documents and thus has not been considered as an inspection attribute.

As a result of this observation S&W Engineering issued E&DCR C-25,075 to revise Specification 248.000 to state: "Cable/cable bundles shall be installed in the trays such that they do not protrude above the tray side rails." Additionally, S&W FQC will revise applicable inspection procedures to incorporate tray fill as an inspection attribute.

(6) Terminations

The examination of Class 1E cable ends indicates that termination activities have been performed in accordance with specified requirements. With regard to items such as location, material types and installed configuration no deficiencies were observed. However, several loose connections were identified by NRC CAT inspectors. These were located in various sections of the 4160V Switchgear 1ENS*SWG1A and in panel H22-P004A junction box.

As a result of these observations, S&W FQC personnel issued unsatisfactory IRs to identify and correct these conditions.

The in-process inspection of coaxial cable terminations for reactor in-core instrumentation indicated that the craft and inspection personnel observed were competent and knowledgeable concerning the requirements of this activity.

(7) Cable Qualification

Cable specifications for various manufacturers of 15 kV and 5 kV power cable, 600 V power and control cable, and 300 V instrumentation and thermocouple extension cable were reviewed as were cable qualification reports for Okonite 600 V power and control cable and Brand-Rex 300 V special instrumentation cable. The cable met the applicable requirements for thermal aging, irradiation, LOCA and flame tests. The flammability test data for Brand-Rex 300 V cable was not available for review and the qualification reports for Anaconda 5 kV and 15 kV cable had not been approved by S&W so were not reviewed by the NRC CAT inspectors.

The specifications and available qualification reports reviewed indicate that the applicable cable met specified requirements.

c. Conclusions

In general, cable installations including terminations have been accomplished in accordance with requirements. Some cable separation deficiencies exist in areas where cable has been run free-air. These conditions will require further attention to assure that identification and subsequent corrective actions are taken.

Additionally, the use and qualification of specified cable fire barriers will require further applicant and NRC attention.

3. Electrical Equipment Installations

a. Inspection Scope

Over 30 pieces of installed or partially installed electrical equipment and associated hardware items were inspected. Samples were selected based on system function, electrical division and safety classification.

The following specific electrical components were inspected in detail:

(1) Motors

The installation of five motors and associated hardware was inspected for such items as location, anchoring, grounding, identification and protection. Also examined were maintenance activities performed for these items. The motors inspected were:

| | |
|---|---|
| Low Pressure Core Spray Pump Motor | 1E21*C001 |
| Residual Heat Removal Pump Motor | 1E12*C002A |
| Residual Heat Removal Pump Motor | 1E12*C002B |
| High Pressure Core Spray Pump Motor | 1E22*C001 |
| RCIC Fill Subsystem Pump Motor | 1E51*F013 |

(2) Electrical Penetration Assemblies

The following containment penetration assemblies were inspected:

| | |
|---|---|
| 1RCP*LVC10A | Low Volt Control |
| 1RCP*LVC21 | Low Volt Control |
| 1RCP*LVI11 | Low Volt Instrumentation |
| 1RCP*LVI15 | Low Volt Instrumentation |
| 1RCP*LVP08 | Low Volt Power |
| 1RCP*MVP01F | Medium Volt Power |

The location, type, mounting and identification were compared with the installation and vendor drawings. The maintenance activities for these items were also examined.

(3) Circuit Breakers

The following Class 1E circuit breakers were examined to determine compliance with the design and installation documents for size, type, system interface and maintenance.

RPS System EPA Breakers (four)
4160V Breakers (two)

The use of circuit breakers with integral undervoltage trip attachments at PBS was also investigated.

(4) Switchgear and Motor Control Centers

The following switchgear and motor control centers (MCCs) were inspected:

| | |
|---|---|
| Motor Control Center | 1ENB*MCC1 |
| Motor Control Center | 1EHS*MCC15A |
| Motor Control Center | 1EHS*MCC2F |
| Motor Control Center | 1EHS*MCC8B |
| 4160V Switchgear | 1ENS*SWG1A |
| 4160V Switchgear | 1ENS*SWG1B |

(5) Station Batteries and Racks

The 125V battery rooms were inspected including the installed batteries, battery racks and associated equipment. The location, mounting, maintenance and environmental control for installation of the batteries were compared with the applicable requirements and quality records.

(6) 125V DC System Equipment

The following equipment comprising portions of the 125V dc systems were inspected for compliance to design documents

for such items as location, mounting (welds, concrete anchors and bolting) and proper configuration.

| | |
|---|---|
| Battery Charger | 1ENB*CHGR1A |
| Battery Charger | 1ENB*CHGR1B |
| Static Inverter | 1ENB*INVO1A |
| DC System Under Voltage Relay | |

(7) PGCC Control Boards

Three power generation control complex control boards were inspected along with various control room relay and annunciation panels, relative to design criteria for location, mounting and configuration.

(8) Motor Operated Valves (MOVs)

Three motor operators for valves were examined in detail.

MOV 1E33*F007
MOV 1E33*F028
MOV 1E51*F013

(9) Diesel Generator Equipment

Several pieces of electrical equipment which perform functions associated with operation of the Standby Diesel Generators were examined in detail. These included:

| | |
|---|---|
| Diesel Generator Control Panel | 1EGS*PNL1B |
| Diesel Generator Relay Panel | 1EGS*PNL2B |
| Time Delay Relays (two) | |

The following documents provided the basic acceptance criteria for the inspections:

RBS "Specification for Electrical Installation" 248.000, Rev. 7, December 29, 1983

S&W QS-10.51, "Electrical Equipment Installations", January 24, 1978

S&W QS-13.12RB, "Material/Equipment Maintenance"

S&W CSI 1.12.1, "Storage and Maintenance of Permanent Plant Equipment"

S&W CMP 9.2-4.76, "Installation of Electrical Equipment", April 9, 1976

S&W QAIP R1248000F05430001, "Electrical Equipment Installation"

S&W QAIP R1248000F05420002, "Electrical Equipment Setting"

b. Inspection Findings

(1) Motors

The installation and condition of the five motors were found to be in accordance with requirements. The Equipment Storage History Cards (ESHCs) were reviewed for maintenance activities and no items of concern were identified.

(2) Electrical Penetrations

Electrical penetrations examined were found to have been installed in accordance with applicable design documents. Items such as location, mounting configuration and materials were also observed to be in accordance with design details.

NRC CAT inspectors noted that the end sealants of several penetration overtubes had been damaged such that they exhibited cracks, chips or in some instances had broken off the assembly altogether. S&W FQC personnel produced N&D 4326 which had identified this condition in October of 1983. The vendor's response to this N&D indicated that the end sealant performs no sealing function but is designed to prevent possible damage to conductor insulation as a result of chafing against the stainless steel overtube during handling and shipment. Included in the vendor response was a diagram depicting certain conditions which the vendor considers to be acceptable because they will not affect the integrity or design of the penetration assemblies. NRC CAT inspectors observed that this diagram does not detail conditions in which the end sealant has completely broken off as was noted during physical examination of the penetrations. As a result of this observation S&W Engineering issued E&DCR C-25,155 which details a response from a vendor representative who performed an onsite examination of this condition. The response indicates that although the end sealant (Polysulfone material) has broken off this will not affect the integrity of the penetration assembly.

A review of the ESHCs for the penetrations revealed an area for concern and a document deficiency. Although the penetration manufacturer recommends maintaining a nitrogen purge of 10-13 psig and leak testing after an "unusually large pressure drop", the ESHCs only require repressurization should the pressure drop below 2 psig. A number of penetrations had recorded pressures of 0 psig with no indication of review, corrective action or leak testing.

While researching an NRC CAT concern, S&W discovered a documentation mixup which had not been properly resolved. The original maintenance activities of two penetrations

(1RCP*NMS10 and 1RCP*LVI15) had been recorded on the other's ESHC due to mismarked shipping containers. When the error was discovered in October 1983, subsequent maintenance activities were recorded on the correct ESHC without correlating the previous entries to the appropriate penetration. At the time of the NRC CAT inspection there was no documentation to indicate that the maintenance records were in error. S&W subsequently issued Type C IR X4640044 to document the mixup. The NRC CAT inspectors consider this an isolated deficiency and resolved by the Type C IR.

No additional concerns were identified.

(3) Circuit Breakers

The condition of 4160V circuit breakers examined was found to be in accordance with requirements. Maintenance activities for these items were also reviewed and no deficiencies were identified.

Discussion with S&W Engineering and a review of the applicants response to NRC Information Notice 83-18 indicates that no circuit breakers with undervoltage trip attachments will be used at RBS.

(4) Switchgear and Motor Control Centers

The installation of the Class 1E 4160V Switchgear 1ENS*SWG1A and 1ENS*SWG1B was found to be in accordance with design details and vendor requirements. Although discrepancies in weld configuration were observed by the NRC CAT inspectors, these items had been specified on approved design change forms and had received the appropriate FQC verification.

Several problems with vendor wiring were identified by the NRC CAT inspectors in two of the MCCs. These include a wire with damaged jacket and insulation, and bent terminal lugs. These conditions were documented and will be investigated by the applicant for generic implications.

Three of the four MCCs, including two site installed "top hats", contained bolts without manufacturer's markings. These are discussed in Section VI, "Material Traceability and Control", of this report.

(5) Station Batteries and Racks

During inspection of the 125V dc station batteries, NRC CAT inspectors noted that battery room ventilation systems were not in operation. Discussion with S&W and GSU personnel revealed that the 125V batteries had been turned over to Startup as a completed installation. However, the battery room ventilation system was considered in temporary operation

and was still the responsibility of the construction organization. In reviewing periodic maintenance data sheets, NRC CAT inspectors observed that recent battery cell temperature readings had exceeded 95 degrees Fahrenheit in some instances. The purpose of the ventilation systems for these areas is to keep gases produced due to the charging of the batteries below an explosive concentration and to keep the room temperature to a level at which the battery is specified to supply its rated current. Section 8.3.2.1.5 of the RBS FSAR specifies current ratings for these batteries based on an average electrolyte temperature of 77 degrees F. In an attempt to determine how long this condition had existed, NRC CAT inspectors reviewed additional maintenance records and noted that current maintenance procedures did not include inspection attributes for verification of proper ventilation in the battery rooms. This matter was discussed with S&W and GSU startup personnel who presented Interim Maintenance Instruction STP-305-1100 which will incorporate the verification of ventilation system operation into the weekly battery surveillance test.

The NRC CAT inspectors concluded that, based upon maintenance data reviewed, the 125V dc batteries had not been adversely affected by this condition. However, relative to the control of "turned over" components and systems it appears that further attention is required to assure that modification of temporary systems and components will not adversely affect completed permanent plant installations.

NRC CAT inspectors also examined the installation of the battery racks. Location and configuration of weld attachments were verified and found to be in conformance with applicable requirements. However, with regard to fastening materials used in the assembly of rack components several material discrepancies were identified. These are discussed in Section VI, "Material Traceability and Control", of this report.

(6) 125V DC System Equipment

The examination of two battery chargers, a static inverter and the dc system undervoltage relay revealed no construction deficiencies. Mounting, location, material type and configuration were observed to be in accordance with applicable design criteria.

(7) PGCC Control Boards

Control boards examined were installed in accordance with applicable design documents.

(8) Motor Operated Valves

During the inspection of the selected MOVs, NRC CAT inspectors observed several minor construction deficiencies.

Two MOVs contained field installed cable and wiring deficiencies. These are discussed in detail in Section II.B.2, above. The examination of MOV 1E51*F013 revealed a chipped insulator on the torque switch assembly. As a result of this observation S&W FQC personnel documented this condition and forwarded the information to the appropriate GSU Systems Test Engineer for resolution.

(9) Equipment Qualification

The specifications and environmental qualification reports were reviewed for Brown Boveri Corporation (BBC) 4.16kV switchgear and Gould, Inc. 480V motor control centers. The environmental qualification reports for the switchgear and MCCs were not approved by S&W at the time of the NRC CAT inspection. However, the NRC CAT inspectors decided to review them based on S&W's assertion that the reports had been through their review process with only minor comments and were ready for approval. The report for the BBC switchgear was a summary with all the referenced component test reports listed as proprietary information. The component test reports were not reviewed by the NRC CAT inspectors as they were available only at the vendor's facility.

Several discrepancies were found in both reports between the body of the reports and referenced environmental tests. These included a flame test certified to a specification other than IEEE-383, and a qualified life and a radiation resistance exposure level not corresponding to the values in the individual test reports.

A telephone conversation with S&W Cherry Hill Operations Center Engineers indicated that these discrepancies had not been identified in their review of the reports and their procedure RBP 3.6.4, "Review of Supplier Equipment Qualification Documentation", does not require any subsequent reviews. It was also brought out during the conversation that the BBC proprietary reports had not been made available by Brown Boveri and had not been reviewed by S&W or the applicant.

The discrepancies in both qualification reports and the lack of review for qualification of switchgear component parts indicates that the review of equipment qualification at RBS requires improvement.

c. Conclusions

The installation of Class 1E equipment and associated hardware at RBS was generally found to be in accordance with applicable design

documents. Inspection activities appear thorough and design changes affecting equipment installation had been appropriately controlled.

Several deviations were observed with regard to the use of indeterminate fastening materials in seismic bolting applications. However, this problem was not generic to electrical equipment installations.

Although equipment qualification reports have not yet been approved, the review of several of these reports indicates the need for additional applicant attention.

4. Instrumentation Installation

a. Inspection Scope

The NRC CAT inspectors selected a sample of seven completed runs of instrument tubing, including 62 supports, for a detailed examination in accordance with specification requirements and as-built drawings.

Seven instrument racks were examined for conformance with requirements such as installed configuration, mounting details, material conformance, identification, and inspection documentation.

Twenty-four instruments were examined for conformance with requirements such as location, mounting details, instrument type, and comparison of as-installed instrument ranges to design parameters.

See Table II-5 for a listing of tubing runs, racks, and instruments included in the sample.

b. Inspection Findings

In general, the installation of instruments, tubing, and racks conformed to the appropriate requirements. Three isolated deficiencies were found and are discussed below:

(1) Tubing support R170(BZ-314EX) was found to be incorrectly identified as R172(BZ-314ND) on the as-built drawing. Comparison of the installed support with the required support detail revealed that the correct support is installed. This was determined to be a simple number transposition error on the as-built drawing. The as-built drawing has subsequently been updated to show the correct support number.

(2) An arc strike was discovered on tubing run 1CC*LTN004C(H) above support R679(BZ-314MT). This was subsequently documented on IR I4000690. The affected area of tubing was removed, and a new section of tube was installed. Since this line had not yet been hydrostatically tested, this item might have been discovered during the detailed inspection required during such testing.

(3) Level indicating switch LIS-B21-N674G had its identification number changed to LIS-B21-N674L by GE Field Deviation Disposition Request LDI-1371. The NRC CAT inspectors found that, although the instrument identification tag had been correctly revised on the front of the main control board, it had not been changed inside of the board.

c. Conclusions

Instrumentation installations appear to be in conformance with requirements. The identified discrepancies stated above are considered to be minor in nature and are not representative of generic deficiencies.

TABLE II-1

DOCUMENTS ISSUED AS A RESULT OF THE NRC CAT INSPECTION

ELECTRICAL AND INSTRUMENTATION

| Document Type[1] | Number | Description |
|---|---|---|
| N&D | 7002 | Cable bend radius |
| N&D | 7139 | Cable damage |
| N&D | 7155 | Separation |
| N&D | 7181 | 1E33*MOVF007 |
| N&D | 7182 | 1E33*MOVF007 |
| N&D | 7202 | Conduit support |
| E&DCR | C-25,075 | Cable tray fill |
| E&DCR | C-25,082 | Cable support |
| E&DCR | C-25,083 | Flex. conduit |
| E&DCR | C-25,155 | Equipment |
| E&DCR | TC-25,234 | Cable tray fill |
| IR | E4000249 | Cable tray |
| IR | E4000266 | Physical condition |
| IR | E4000278 | Terminations |
| IR | E4000289 | Raceway |
| IR | E4000690 | Instrument tubing |
| IR | E4001248 | Separation |
| IR | E4001250 | Separation |
| IR | E4001262 | Separation |
| IR | E4001263 | Separation |
| IR | E4001281 | Cable spacing |
| IR | E4001268 | Separation |
| IR | E4001289 | Cable separation |
| IR | E4001290 | Cable |
| IR | E4001361 | Wire damage |
| IR | E4001369 | Cable damage |
| IR | E4001374 | Raceway |
| IR | E4300330 | Separation |
| IR | E4300331 | PGCC cable |
| IR | E4300362 | Ductway identification |
| IR | E4300363 | Cable routing |
| IR | E4603544 | Housekeeping |
| IR | E4603589 | Separation |
| IR | E4603594 | Separation |
| IR | E4603606 | Separation |
| IR | E4603607 | Separation; conduit identification |
| IR | E4603613 | Separation |
| IR | E4603614 | Physical integrity |
| IR | E4603615 | Separation |
| IR | E4603714 | Separation |
| IR | E4604054 | Conduit support |
| IR | E4604149 | Junction box identification |
| IR | E4630169 | Terminations |
| IR | X4640044 | Penetration records |

TABLE II-1 (Continued)

DOCUMENTS ISSUED AS A RESULT OF THE NRC CAT INSPECTION

ELECTRICAL AND INSTRUMENTATION

| Document Type[1] | Number | Description |
|---|---|---|
| IR | E4700104 | Cable tray support |
| IR | E4700113 | Conduit support records |
| IR | E4700116 | Conduit support |
| FDDR | LD1-2027 | Separation |
| FDDR | LD1-2041 | Ductway identification |
| FDDR | LD1-2072 | Separation |
| FDDR | LD1-2094 | Separation |
| FDDR | LD1-2111 | Separation |
| QCI | FR1-S10.52-010 | Electrical separation |
| QAIP | R1248000F05480000 | Separation inspection |

[1] E&DCR: Engineering and Design Coordination Report
FDDR: Field Deviation Disposition Request
IR: Inspection Report
N&D: Nonconformance and Disposition Report
QAIP: Quality Assurance Inspection Plan
QCI: Quality Control Instruction

TABLE II-2

RACEWAY AND SUPPORT SAMPLES

Cable Tray Sample:

| Tray No. | Drawing | Tray No. | Drawing |
|---|---|---|---|
| 1TL821R | EE-34FC-4 | 1TH800R | EE-34FA-4 |
| 1TK807R | EE-34FD-3 | 1TX808R | EE-34FG-3 |
| 1TK809R | EE-34FD-3 | 1TC828R | EE-34FG-3 |
| 1TK810R | EE-34FD-3 | 1TL605B | (not recorded) |
| 1TK811R | EE-34FD-3 | 1TL606B | (not recorded) |
| 1TK815R | EE-34FD-3 | 1TX819B | EE-34FD-3 |
| 1TH053B | EE-34CA-3 | 1TX818B | EE-34FD-3 |
| 1TH007B | EE-34A-7 | 1TX808B | EE-34FD-3 |
| 1TH006B | EE-34A-7 | 1TX044B | EE-34FD-3 |
| 1TH005B | EE-34A-7 | 1TX045B | EE-34FD-3 |
| 1TC047B | EE-34CC-4 | 1TX032B | EE-34FD-3 |
| 1TC054B | EE-34CC-4 | 1TX033B | EE-34FD-3 |
| 1TC052B | EE-34CC-4 | 1TC506N | EE-34FD-3 |
| 1TC049B | EE-34CC-4 | 1TC507N | EE-34FD-3 |
| 1TC050B | EE-34CC-4 | 1TK501R | EE-34EB-4 |
| 1TC058R | EE-34CE-3 | 1TK502R | EE-34EB-4 |
| 1TC060R | EE-34CE-3 | 1TX501R | EE-34EB-4 |
| 1TC062R | EE-34CE-3 | 1TX502R | EE-34EB-4 |
| 1TH054R | EE-34JF-3 | 1TX503R | EE-34EB-4 |

Cable Tray Support Sample:

| Support No. | Location |
|---|---|
| RB-77AS | Reactor Building Elev 114'0" Az 150 |
| RB-123ES | Reactor Building Elev 141'0" Az 310 |
| CR-18A-1 | Control Building Elev 70'0" B/7 |
| CR-251AS-1 | Control Building Elev 98'0" M/5 |
| AB-544A-1 | Aux. Building Elev 95'9" K/7 |
| AB-235AS-1 | Aux. Building Elev 114'0" D/3 |
| FB-145A-1 | Fuel Building Elev 113'0" G/4 |
| RB-011AS | Reactor Building Elev 114'0" Az 230 |
| CR-62AS-1 | Control Building Elev 70'0" G/4 |

Table II-2 (Continued)

RACEWAY AND SUPPORT SAMPLES

Conduit Sample:

| Conduit Number | Length (feet) | Conduit Number | Length (feet) |
|---|---|---|---|
| 1CX5400A | 40 | 1CC500BG1 | 7 |
| 1CX535ND | 12 | 1CC525ND6 | 16 |
| 1CC525ND7 | 24 | 1CK520ND6 | 16 |
| 1CX5400B | 189 | 1CK520ND2 | 6 |
| 1CC532NF | 10 | 1CC832ND | 7 |
| 1CX540VB | 58 | 1CC829NA1 | 5 |
| 1CX5400E | 23 | 1CC827RT | 44 |
| 1CX500RA | 10 | 1CC832NH1 | 6 |
| 1CX535NE1 | 11 | 1CC500BQ | 8 |
| 1CK500BG | 6 | 1CK520ND1 | 3 |
| 1CC500BP1 | 5 | 1CK500BK1 | 5 |
| 1CC500BP2 | 5 | 1CK500BK2 | 5 |
| 1CC500BP3 | 5 | 1CK500BK3 | 5 |
| 1CK500BK4 | 5 | 1CC500BP4 | 5 |
| 1CC203RC2 | 59 | 1CC027RA | 40 |
| 1CK203RF2 | 4 | 1CL920BC | 59 |
| 1CK200RB | 42 | 1CL054BA | 40 |
| 1CK805BC1 | 4 | 1CK9090A4 | 25 |
| 1CC834BD | 2 | 1CC154BA | 80 |
| 1CL013BB | 12 | 1CX0010D2 | 10 |

Conduit Supports:

| | | |
|---|---|---|
| CFB-011 | CRB-1245 | RU-1A-0019 |
| CFB-113 | LU-2A-0031 | RU-1A-0032 |
| CFB-151-15 | LU-2B-0026 | RU-1A-0068 |
| CFB-151-20 | LU-2B-0041 | RU-1B-0015 |
| CRB-009 | LU-2B-0073 | RU-1B-0088 |
| CRB-020 | LU-1A-0021 | RU-1B-0060 |
| CRB-044 | LU-1A-0032 | RU-1C-0023 |
| CRB-232 | LU-3A-0010 | RU-1C-0052 |
| CRB-406 | LU-3A-0036 | RU-1C-0102 |
| CRB-660 | LU-3B-0009 | RU-1D-0022 |
| CRB-830 | LU-3B-0023 | RU-1D-0081 |
| | | RU-1D-0137 |

Table II-3

RACEWAY SEPARATION

| | |
|---|---|
| 1CX540VB | 1TC511N |
| 1CX940VB | 1TL827R |
| 1CL810NB | 1TL813B |
| 1CL828NH | 1TL816B |
| 1CC154BA | 1CX205NB |
| 1CC154BA | 1CX205ND |
| 1CL54BA | 1TK500R |
| 1CL54BA | 1TC500R |
| 1TX008B | 1TC066N |
| 1TX008B | 1TC067N |
| 1TC028B | 1TC066N |
| 1TC028B | 1TC067N |
| 1TH054R | 1TH066N |
| 1TL004N | 1TK002B |
| 1TL004N | 1TK047B |
| 1TC088R | 1TC047B |
| 1CK920NA | 1TC047B |
| 1TL822R | 1CC806NH4 |
| 1TL821R | 1CX939NT5 |
| 1TX815R | 1TC866N |
| 1TC821R | 1TC866N |
| 1TX502R | 1TX504N |
| 1TX502R | 1TX527N |
| 1TX502R | — 1TC505N |
| 1TX502R | 1TK504N |
| 1TX503R | 1TX504N |
| 1TX503R | 1TX527N |
| 1TX503R | 1TC505N |
| 1TX503R | 1TK504N |
| 1TC001R | 1TC060N |
| 1TC157R | 1TC060N |
| 1TH052B | 1CC110NC |
| 1CJ020NA | 1TH053R |
| 1TH003R | 1TH008N |

Raceway segments in the left column were found to violate minimum separation from the corresponding raceway segments listed in the right column.

TABLE II-4

TERMINATIONS SAMPLE

| Cable No. | Destination |
|---|---|
| 1SPARX412 | Remote Shutdown Panel 1C61*P001 |
| 1RSSNRC500 | Remote Shutdown Panel 1C61*P001 |
| 1CMSARX410 | Remote Shutdown Panel 1C61*P001 |
| 1CMSARX431 | Remote Shutdown Panel 1C61*P001 |
| 1CMSARX407 | Remote Shutdown Panel 1C61*P001 |
| 11CSNRC623 | Remote Shutdown Panel 1C61*P001 |
| 1ADSFRC600 | Remote Shutdown Panel 1C61*P001 |
| 1ADSGRC600 | Remote Shutdown Panel 1C61*P001 |
| 11CSARC008 | Remote Shutdown Panel 1C61*P001 |
| 11CSNRC018 | Remote Shutdown Panel 1C61*P001 |
| 1SHSBBC700 | Remote Shutdown Panel 1C61*P001 |
| 1SHSBBC500 | Remote Shutdown Panel 1C61*P001 |
| 1RHSARC030 | Remote Shutdown Panel 1C61*P001 |
| 1RHSARC301 | Remote Shutdown Panel 1C61*P001 |
| 1RHSBBC035 | Remote Shutdown Panel 1C61*P001 |
| 1SWPBBK004 | Motor Control Center 1EHS*MCC14B |
| 1SWPDBK002 | Motor Control Center 1EHS*MCC14B |
| 1HVCNBC701 | Motor Control Center 1EHS*MCC14B |
| 1SWPDBK001 | Motor Control Center 1EHS*MCC14B |
| 1HVKBBC007 | Motor Control Center 1EHS*MCC8B |
| 1HVKDBC003 | Motor Control Center 1EHS*MCC8B |
| 1HVKDBC001 | Motor Control Center 1EHS*MCC8B |
| 1ENARL601 | Static Inverter 1ENB*1NV01A |
| 1SCCBBC553 | CR Termination Mod. 1H13-744B |
| 1SCCBBC574 | CR Termination Mod. 1H13-744B |
| 1SCCBBC524 | CR Termination Mod. 1H13-744B |
| 1SCCBBC501 | CR Termination Mod. 1H13-730D |
| 1CNSBBC001 | CR Termination Mod. 1H13-730D |
| 1SCCBBC523 | CR Termination Mod. 1H13-702D |
| 1ENSBBC311 | CR Termination Mod. 1H13-702D |
| 1ENSDBC303 | CR Termination Mod. 1H13-702D |
| 1RPSNSX401 | H22-P026 |
| 1RPSNSX405 | H22-P026 |
| 1RPSNVX406 | H22-P026 |
| 1RDCYRX752 | Penetration Term. Cabinet 1RCP*TCA01 |
| 1RDYRX754 | Penetration Term. Cabinet 1RCP*TCA01 |
| 1RDCYRX762 | Penetration Term. Cabinet 1RCP*TCA01 |
| 1RDYRX760 | Penetration Term. Cabinet 1RCP*TCA01 |
| 1RHSNRK002 | 1EHS*MCC2E |
| 1RHSNRK001 | 1EHS*MCC2E |
| 1RHSARX800 | 1ENS*SWG1A |
| 1RHSARC068 | 1ENS*SWG1A |
| 1RHSCPC700 | 1ENS*SWG1A |
| 1RHSARC505 | 1ENS*SWG1A |

TABLE II-4 (Continued)

TERMINATIONS SAMPLE

| Cable No. | Destination |
|---|---|
| 1RHSCBC301 | 1ENS*SWG1B |
| 1RHSCBX800 | 1ENS*SWG1B |
| 1HPARC507 | (not recorded) |
| 1HVKCRC200 | (not recorded) |
| 1HVKARC011 | PGCC Term. Cabinet |
| 1HVKARC001 | PGCC Term. Cabinet |
| 1HVKARC013 | PGCC Term. Cabinet |
| 1SCCARC501 | PGCC Term. Cabinet |
| 1SCCARC503 | PGCC Term. Cabinet |
| +1RDCYBX720 | In-Core Monitor |
| +1RDCYBX737 | In-Core Monitor |

-In-process coaxial terminations.

Table II-5

INSTRUMENTATION SAMPLE

| Tubing Run | Approx. Length (feet) | Qty. of Supports |
|---|---|---|
| 1C33*LTN004C(H) | 40 | 7 |
| 1B21*LTN095A(H) | 60 | 14 |
| 1B21*LTN095A(L) | 50 | 13 |
| 1C33*FTN003D(H&L) | 8 | 1 |
| 1E22*PTN052 | 24 | 6 |
| 1E22*PTN051 | 20 | 4 |
| 1B21*LTN095B(L) | 90 | 17 |

Instrument Racks

| | | |
|---|---|---|
| H22P004 | H22P024 | H22P027 |
| H22P005 | H22P026 | H22P041 |
| H22P015 | | |

Instruments

| | | |
|---|---|---|
| PIS-B21-N694A | LIS-B21-N673L | 1B21*LT-N080A |
| PIS-B21-N694E | LIS-B21-N673R | 1B21*LT-N080B |
| LIS-B21-N691B | PIS-B21-N667C | 1B21*LT-N080C |
| LIS-B21-N691F | PIS-B21-N667G | 1B21*PT-N078A |
| PS-B21-N694B | LIS-B21-N691A | 1B21*LT-N095B |
| PS-B21-N694F | LIS-B21-N691E | 1E22*PT-N051 |
| LIS-B21-N673C | LIS-B21-N674L | 1E22*PT-N052 |
| LIS-B21-N673G | 1B21*LT-N081A | 1E22*PI-R001 |

## III. MECHANICAL CONSTRUCTION

### A. Objective

The objective of the appraisal of mechanical construction was to determine if installed and Quality Control (QC) accepted mechanical items conformed to engineering design, regulatory requirements and licensee commitments.

### B. Discussion

The specific areas of mechanical construction evaluated were piping, pipe supports/restraints, concrete expansion anchors, mechanical equipment, and heating, ventilating and air conditioning (HVAC) systems. To accomplish the above objective, a field inspection of a sample of QC accepted hardware was performed in each area. In addition, certain programs, procedures and documentation were reviewed as required to support or clarify hardware inspection findings.

#### 1. Piping

##### a. Inspection Scope

Piping depicted on the twenty-five Stone & Webster Engineering Corporation (S&W) and two Reactor Controls, Inc. (RCI) isometric drawings listed in Table III-1 was inspected. These isometrics depicted approximately 700 feet of large bore and 100 feet of small bore piping which had been QC accepted by S&W and approximately 150 feet of RCI scope piping for which as-built walkdowns had been performed and verified. As indicated in Table III-1, the majority of inspected piping was ASME Class 2 although some Class 1 and Class 3 piping was inspected. Pipe sizes within the scope of the inspection ranged from 3/4 inch to 12 inches. Features examined included configuration (i.e. piping layout orientation and dimensions), component identification, component and support location, valve orientation, and clearance from other plant hardware and structures.

Documentation associated with as-built verification and with QC activities was also reviewed.

The following S&W documents provided the basic acceptance criteria for the inspection:

Quality Assurance Inspection Plan (QAIP) No. R1228312F0507, Rev. B through Change 01 "Field Fabrication/Erection of Pipe As-Builts"

QAIP No. R1228312F0512, Rev. 0 through Change 04 "Field Fabrication/Erection of Small Bore Pipe As-Built"

QAIP No. R1777777F0526, Rev. B through Change 01 "Clearance Inspections"

Construction Site Instruction (CSI) No. 8.0.3, Rev. 5 and Rev. 6 "Category I, ASME III Piping and Pipe Support As-Built Drawings"

Engineering & Design Coordination Report (E&DCR) No. C-14095, Re: "ISI Weld Designations"

Specification 228.160, Rev. 4, "Piping Installation"

Memorandum - G. C. Pentek to C. Woodcock, et al., dated July 23, 1984 - Subject: Distribution of Rework Control Forms

Nonconformance and Disposition Report (N&D) No. 6010, Re: ISI clearance violations

TEL-CON-NOTE (Record of conversation) - E. Dalasta to B. Salter dated 8-10-84, Re: Orientation of MOV F087B

River Bend Project Procedure (RBP) 18.13-2 "Design Verification of ASME III Piping Systems"

b. Inspection Findings

Various discrepancies were noted during the inspection of piping systems. Table III-1 lists the NRC Construction Appraisal Team (CAT) inspection observations. These are related to the text discussion by unit system on isometric drawing designations. For example, isometric no. 091-CDB for the Unit 1 Residual Heat Removal System (RHS) is referred to in the text as 1-RHS-091-CDB.

The inspection plan for erection of pipe as-builts (QAIP R1228312F0507) requires pipe support location to be verified during as-building. Elevations for two pipe supports depicted on Isometric 1-RHS-091-CDB were omitted and not specified during the as-building process. Since these elevations are required to complete the design to as-built reconciliation, they would presumably be requested by engineering to prevent discrepancies between design and construction. Therefore, this omission represents a minor error during as-building and FQC inspection.

The inspection plan also requires "5D pipe bends" and short radius elbows to be identified as such. The default assumption for pipe direction change is that of a long radius elbow. In one instance, on Isometric 1-RHS-087 CDA, an installed 5D bend is not identified. In this case, means to determine the difference between the designed and constructed piping does not exist, resulting in the incorrect analysis of a long radius elbow.

Inspection plan QAIP R1228312F0507 also requires components to be verified to isometric material lists. Drawing 1-RHS-041 CDB lists one spool piece as 1-RHS-041-2-231. The spool, however, is marked 1-RHS-041-2-251. A Construction Revision Notice (CRN) which specifies rewelding for this piece is available and identifies it as 1-RHS-041-2-231. It is concluded therefore, that the

correct spool is in place, that the remarking of the spool is in error, and that this situation represents Field Quality Control (FQC) error relative to mark number verification only.

The procedure which describes handling of large bore piping as-built drawings, CSI 8.0.3, directed the as-built drawing copy be sent to engineering for design to as-built analysis reconciliation prior to QC verification. The current practice is to distribute only QC verified drawings for reconciliation. Draft revisions of the procedure which correctly describes current practice were available and the procedure revision was issued during the NRC CAT inspection.

Revision 4 of Isometric 1-ICS-078 CDA was as-built, FQC verified and transmitted for reconcilation subsequent to Revisions 5 and 6. Revisions 5 and 6 of drawing 1-ICS-078CDA depicted a vent valve and associated vent piping which was installed after preparation of Revision 4. As a result, the reconciliation would be performed with an incorrect drawing. This example is the result of several steps taken outside of the prescribed procedure of CSI 8.0.3 by site construction and the as-built coordination group. During discussion of this example, S&W noted that the piping verification procedure, RBP 18.13-2, directs written communication to be used by engineering to identify approval of as-builts including document numbers and revisions. The implication of this requirement is that the reconciled and current drawing revision numbers would be compared and the discrepancy noted. Regarding the same matter, S&W also noted that the ASME field QC office possesses as yet unreleased procedures which would require thorough comparison of the reconciled as-built drawing to the latest file copy drawing prior to issuance of N-5 data reports. However, reviews of RBP 18.13.2 and the uncontrolled ASME QC procedure do not indicate comparison of the reconciled and file drawing copies to be explicitly required.

E&DCR No. C-14095 which amends Specification 228.160 specifies minimum axial clearances from welds which require volumetric in-service inspection. In two instances associated with Isometric Nos. 1-RHS-035 CDA and 1-RHS-036 CDA, the minimum clearances specified are not maintained. Both cases result from the location of pipe clamps too close to welds which require volumetric examination.

The inspection plan for field fabrication/erection of small bore pipe as-builts (QAIP R1228312F0512) requires piping to be verified within specified tolerances. The dimensional discrepancy noted in Table III-1 for Isometric 1-CCP-076 CDA exceeds those tolerances.

c. Conclusions

Although several hardware and procedural discrepancies were observed, S&W piping inspected generally conforms with design documents. The exceptions noted appear to be isolated cases.

Review and, as required, revision of site procedures for clarity and correctness as well as review of current site practice against procedures is warranted.

The procedure for controlling final document review prior to issuance of N-5 data reports should be finalized and issued.

The RCI piping inspected conformed to design documents.

2. Pipe Supports/Restraints

a. Inspection Scope

Safety-related pipe supports/restraints are fabricated, installed and inspected by two contractors. RCI is responsible for the Control Rod Drive (CRD) System and S&W is responsible for the remainder. Hardware for both contractors was examined by the NRC CAT.

(1) RCI

Supports SP #2, 3 and the 4-7 structure at the 90 degree side for the CRD insert and withdraw piping were inspected. These items were inspected for proper configuration, clearances, gaps, member size, and fastener identification and joint makeup (spot check). The mounting bolts of the hydraulic control units (HCUs) to the multifunction steel support at 90 degrees were also examined for completeness and bolt-size. See Table III-2 for the RCI pipe support/restraint inspection sample.

Documentation such as FQC surveillance reports and nonconformance reports were also examined for timeliness, completeness, accuracy and conformance to requirements.

S&W FQC surveillance logs were also examined. RCI and S&W FQC inspectors were interviewed concerning their knowledge of requirements and the scope of their activities.

Acceptance criteria for the field inspections were contained in the following documents:

S&W Specification 228.180 "Shop Fabrication, Field Fabrication, Field Erection of Control [Rod] Drive System Piping"

RCI Quality Assurance Instructions

RCI Procedure PC-1, Rev. 5, "Pipe Clamp Procedure for Welded U-Type Clamps"

RCI Procedure PC-2, Rev. 3, "Pipe Clamp Procedure for Friction Type Clamps"

Procedure ABWD-1, Rev. 3, "Instruction for As-Built Inspection/Verification Walkdown"

Applicable RCI design and construction drawings with outstanding change documents.

(2) S&W

Thirty-seven FQC accepted QA Category I supports/restraints which provided a variety of types, sizes, systems and locations were selected for inspection. These supports/restraints were inspected for configuration, clearances, member size and damage. In addition, approximately 100 unidentified supports/restraints were observed at random in the field for obvious deficiencies such as loose or missing fasteners, damage and improper clearances, locking devices or angularity. Eleven final documentation packages that were ready for final FQC documentation review were examined for completeness and accuracy. The proper handling of design changes and construction problems through the Construction Revision Notice (CRN) and Conditional Construction Revision Notice (CCRN) program was also checked. See Table III-2 for the S&W pipe support/restraint inspection samples.

Acceptance criteria for the field inspections were contained in the following documents:

S&W Specification 228.312, Rev. 3, Addendum 1, "Field Fabrication and Erection of Pipe Support, ASME III, Code Class 1, 2 & 3 and ANSI B31.1"

S&W QAIP No. R1228312F05010G02, Rev. 3, Addendum 1 "Field Fabrication/Erection of Pipe Support As-Builts "

S&W QAIP No. R1228312F05020F03", Rev. 3, Addendum 1 "Field Fabrication/Erection of Pipe Supports"

S&W CSI 8.0.3, Rev. 5 "Category 1, ASME III Piping and Pipe Support As-Built Drawings"

S&W RBP 18.10 "Handling Changes to QA Category I Pipe Supports, Piping, Instrumentation and Supports Onsite"

Berge Patterson pipe support catalogue and related engineering data sheets and applicable S&W detail drawings

b. Inspection Findings

See Table III-3 for a listing of the specific NRC CAT observations from the inspection of pipe supports/restraints.

(1) RCI

Only two dimensional discrepancies were noted in the inspection of the CRD insert and withdraw piping supports/ restraints.

Fabrication and installation activities were essentially complete on the CRD system and the as-built inspection and verification program was just being started by RCI engineering. Discussions with RCI and S&W FQC inspectors and site FQC, engineering and craft supervision indicated that personnel were knowledgeable of requirements and responsibilities. Review of S&W surveillance reports indicates a close review of RCI activities and identification and resolution of a number of problems. S&W FQC provides full time surveillance coverage and participates in biweekly management meetings in which quality problems can be addressed. RCI programmatic problems identified previously at other sites appear to have been addressed at River Bend. Nonconforming conditions appear to be properly identified and documented - not buried in surveillance reports.

The as-built program as detailed in RCI procedure ABWD-1 is thorough and detailed, although no supports/restraints have yet been as-built verified. The NRC CAT inspectors consider that participation of FQC in the form of verification or surveillance of engineering staff's as-built efforts would be a useful improvement to the current procedure.

The design, installation and inspection of the CRD insert/ withdraw line axial restraint friction clamps were discussed with the RCI project engineer. The clamp redesign test reports were reviewed by the NRC CAT. No problems or concerns were identified.

(2) S&W

At River Bend, pipe supports/restraints are installed and in-process inspected by FQC (primarily for attributes) to individual control drawings. During and after installation, these control drawings are redlined by field engineering to reflect field changes to these original drawings (Conditional Construction Revision Notices) as well as any other variations from the control drawing. The support/restraint is then inspected by QC to this field (engineering) as-built drawing. After FQC signature, this drawing enters a complex cycle of QC, field engineering, design reconciliation and FQC documentation review and is reissued as the Final As-Built Control Drawing (FABCD).

Of the approximately 7300 Safety Category I large and small bore pipe supports/restraints at River Bend, approximately 4500 (62 percent) have been FQC accepted to the as-built drawing. Final engineering and FQC document reviews are only about 10 percent complete.

Discrepancies were identified by the NRC CAT on 12 of the 37 supports/restraints in the primary sample and on the CRD housing clamp restraints. Sixteen discrepancies were noted on the approximately 100 adjacent (random observation) supports/restraints inspected. The majority of these discrepancies involved improper or inadequate locking mechanisms for fasteners or incomplete as-built information. Supports/restraints with these types of deficiencies included seven of 12 in the primary sample, the CRD housing clamps and 10 of 16 in adjacent support/restraints. Other discrepancies included a missing structural steel stiffener, wrong pipe clamp installed, improper gaps on box restraints, misaligned struts, unprotected snubbers, potential incompatability of snubber assembly components and several instances of staging tied to as-built strut and structural steel restraints. See Table III-3 for a listing of specific NRC CAT observations from the inspection of supports/restraints.

The problem with improper or inadequate fastener locking included unbent or missing cotter pins, no staking of threads, loose or missing locknuts, and inadequate lockwiring. These deficiencies indicated both inadequate FQC inspection (unstaked threads as a minimum) and alteration of completed and accepted work by construction personnel. The broad extent of this indicates a lack of attention to detail and a disregard for the importance of following proper procedures for changes to FQC accepted hardware. A comprehensive inspection program for these specific features appears warranted prior to system operation.

One concern was identified with the FQC activities related to the as-built inspection. FQC personnel were not documenting on unsatisfactory Inspection Reports (IRs) or N&Ds the dimensional deviations (outside of construction tolerances) noted between the as-built hardware and the control drawing. FQC only signed off on the as-built drawing that the actual conditions are as indicated on the redlined drawing. Engineering reviewers were, by procedure, reviewing all as-built dimensions for technical acceptability. However, this approach bypassed the QA review, trending, and generic problem identification aspects of the IR and N&D systems.

A significant concern involved the apparent incompatability of specified Bergen Patterson pipe clamps and rear brackets with Pacific Scientific snubbers. This incompatability could affect the proper functioning of the snubber due to inadequate clearances that prevent necessary snubber endbearing connection rotation. After this concern was raised by the NRC CAT, site personnel indicated that a clearance problem with snubber and pipe clamps had been identified recently by S&W field engineering, but the problem had not yet been documented on an N&D or other appropriate document. Subsequently, the problem was noted on N&D 6992 for the snubbers that field engineering had inspected (all Safety Category

II-non ASME, non safety-related). This was also addressed as a potential 10 CFR 50.55(e) to the NRC Region IV office. N&D 6985 was issued to address the snubber clearance problems noted by the NRC CAT. In addition to the technical issue, the NRC CAT has the following concerns with this problem and the related site corrective actions:

(a) The delay in issuance of report N&D 6992.

(b) N&D 6992 and the 10 CFR 50.55(e) report (which was written nine days after N&D 6985 was written) specifically limits the extent of the problem to certain sizes of snubbers, on one system, in one area, on non-ASME snubbers. The NRC CAT observed the same problems on ASME snubbers and problems with rear bracket clearance as well.

(c) Freedom-of-motion and clearance verifications are not part of the FQC inspection program (checklist).

(d) Some of the snubbers listed on N&D 6992 had been through the engineering as-built review process and transmitted to FQC without identifying the problem.

The NRC CAT noted several instances where decking and staging was tied off to as-built, QC accepted ASME supports/restraints (struts and support steel) with chains and wire. This is another example of a lack of proper handling of completed and accepted hardware by construction personnel.

Another instance of improper const n activity was noted on a 3/4-in. ASME Class 1 pipe ni e on QC as-built accepted line 1WC-222-D. This nipple had been permanently bent (approximately 5/16 inch in a 4 inch run) to allow easier fitup of a pipe anchor on this line. The N&D written for this condition required cutout and replacement of this pipe section.

The documentation packages reviewed had gone through the final fabrication and installation control review by construction, FQC and the ANI, but had not had the final FQC documentation verification. In general, documentation packages were found to be satisfactory, but in several instances CCRNs were used to approve or rework hardware that had not been properly installed per drawing requirements (BZ-31QE,72AA,71K). These conditions should have been more properly identified on N&Ds.

c. Conclusions

(1) RCI

Pipe supports/restraints fabricated and installed by RCI were generally found to be in conformance with design and procedural requirements. Although site personnel have identified a number of problems with the RCI work efforts, the quality

program of RCI and especially the oversight by S&W FQC have been effective in assuring quality hardware.

(2) S&W

In general, supports/restraints did not exhibit extensive major technical deficiencies. However, the FQC inspection of supports/restraints has not been totally effective in assuring that installed hardware conforms to design requirements. Evidence of lack of attention to detail was evident with the improper fastener locking mechanisms, unprotected snubbers, staging and decking tied to ASME struts, and the deformed pipe nipple. The snubber assembly incompatability problem is potentially significant and may have generic implications. Of major concern to the NRC CAT is the improper identification and inadequate engineering disposition of the snubber incompatability question.

3. Concrete Expansion Anchors for Pipe Supports

a. Inspection Scope

Fifty-two concrete expansion anchors installed on 14 pipe supports/restraints were inspected for proper size, spacing, edge distance, damage, locknuts, washers and residual torque (indication of anchor preload). Table III-4 provides a listing of anchors inspected and inspection results. Eight completed expansion anchor installation inspection reports were reviewed for completeness and conformance to procedural requirements. Acceptance criteria for these field inspections were contained ~~in~~ the following documents:

S&W Specification 210.371, Rev. 2, Addendum 2, "Installation of Drilled-In Expansion Type Concrete Anchors"

S&W Construction Methods Procedure (CMP) 3.4-8.77, Rev.0 "Installation of Drilled-In Concrete Anchor Bolts"

S&W QAIP No. R1210371F0503OJ01 "Installation of Drilled-In Expansion Type Concrete Anchors"

b. Inspection Findings

Relatively few concrete expansion anchors have been used in safety-related pipe support/restraint applications at River Bend; embedded plates and supplementary steel use is predominant. S&W FQC personnel stated that less than 250 expansion anchors had been installed on safety-related pipe supports/restraints. The anchors to be inspected were selected on a variety of systems at random during plant walkdowns and ranged in diameter from 5/8 inch to 1 inch. As-installed features were compared to specification and detail drawing requirements. Nuts were torqued to the S&W specified test torque (80 percent of installation torque). If nuts rotated below the test torque, they were torqued to minimum installation torque. Breakaway torque and nut rotation to achieve installation

torque were recorded. Of 52 anchors tested, 14 rotated at less than the test torque with breakaway torques ranging from 40 to 75 percent of installation torques. All but one anchor met the S&W specification "Test Criteria" of achieving installation torque within one turn. The one anchor would not torque above 50 percent of installation and continued to slip and will require replacement. The remaining features inspected by the NRC CAT were in conformance with requirements.

Three of the eight expansion anchor inspection reports reviewed did not specify the current revision status of the applicable inspection plan.

c. Conclusions

In general, the concrete expansion anchors inspected by the NRC CAT were installed in accordance with design and procedural requirements. Expansion anchor inspection reports did not always document applicable inspection plan revisions.

4. Mechanical Equipment

a. Inspection Scope

Nine pieces of mechanical equipment were inspected for proper orientation, support configuration and foundation bolting. Equipment examined included tanks, unit coolers, heat exchangers and fans. See Table III-5 for a listing of equipment inspected. Other unrecorded equipment was also observed during plant walkdowns for obvious deficiencies.

The following documents provided the acceptance criteria for the inspection of mechanical equipment:

S&W Quality Standard QS-10.31-RB, Rev. 0, Change Notice 1, "Mechanical Inspection"

Specification 229.160, "Mechanical Installation-CAT I"

S&W CMP 7.2, "Installation of Mechanical Equipment"

Applicable structural and manufacturers' detail design drawings and operating manuals.

b. Inspection Findings

No discrepancies were noted between as-installed hardware and applicable design documents. S&W FQC had recently performed a 100 percent reinspection of installed equipment as a result of previous NRC CAT report findings at other sites. The NRC CAT inspectors identified a question as to the adequacy of the design drawing requirements for the end connection details of the Reactor Water Cleanup System Regenerative Heat Exchanger supports. The one end that had slotted holes to allow for

thermal expansion had no washers shown under the bolt head and a snug tight fit was specified for these joints. Although no requirement for use of washers on slotted holes for non-high strength bolts was identified, good shop practice would indicate washers be used. The snug tight fit defined on the drawing as "tightened by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench" may impair the sliding capability of these supports. S&W FQC and engineering were evaluating this installation condition at the end of the NRC CAT inspection.

See Section VII, "Design Change Control," of this report for a discussion of a related concern with the Standby Diesel Generator Exhaust Silencer foundation.

c. Conclusions

The mechanical equipment inspected conformed to design and procedural requirements. One question relating to the adequacy of a design drawing was identified.

5. Heating, Ventilating and Air Conditioning

Fourteen Seismic Category I supports/restraints, approximately 250 feet of ducting and associated in line components and accessories and approximately ten fire dampers were inspected. See Table III-6 for a listing of the HVAC hardware inspected. Restraints were examined in the Auxiliary, Reactor, Fuel and Control Buildings. Features examined were location, configuration, member size, member connection details and support to duct connection details. Duct, accessories and dampers were inspected for conformance to design drawings and specification requirements regarding location, size, stiffener size and location, proper identification and joint makeup.

The following S&W documents provided the acceptance criteria for the inspection of HVAC hardware installations:

QAIP No. R121650F0501, Rev. 01 through Change 05 "Fabrication and Erection of Seismic Duct and Equipment Supports"

QAIP No. R1216140G05020V0 "Erection of HVAC System"

RBP 18.11-1 dated April 7, 1983 "QA Category I Duct Support-Erection Drawings and Control of Onsite Changes"

Specification 216.140, Rev. 2, Addendum 3 "Field Erection of Ventilation and Air Conditioning Systems and Refrigerant Piping"

Specification Number 216.150 Rev. 3, "Fabrication and Erection of Seismic and Nonseismic Duct Supports and Duct Equipment Supports"

Drawing Number 1-DSED-N7000-8 Sheets 1 through 4 and including Duct Support Construction Revision Notices A through K

Procedure SEP 106.1E "Preparation of Erection Drawings and Handling Changes to Category I Duct Support Drawings Onsite"

Applicable duct layout drawings and fire damper schedules

b. Inspection Findings

Approximately 90 percent of the Category I duct supports had been FQC accepted by S&W at the time of the NRC CAT inspection. Supports inspected by the NRC CAT had all been previously FQC accepted. During the inspection, workmanship appeared good and no installation deficiencies were found. One procedural problem was noted involving the use of generic design drawing N7000. This drawing authorizes changes to virtually every structural design aspect of most duct supports. However, the basic design drawings (BZ and DSEDs) that are used for support fabrication, erection and inspection do not reference N7000. The use and applicability of this drawing is not detailed in site procedures. Therefore, there may be significant differences between the individual support design drawing and the as-built condition with no reference to preauthorized changes, i.e., the generic drawing.

Duct and in line accessories generally conformed to design and procedural requirements. NRC CAT observations are listed in Table III-6. One dimensional discrepancy and one case of improper flexible coupling assembly were observed. Two issues of greater concern and extent were noted: lack of fire barrier sealing around fire damper to wall joints and clearance violations between safety related seismic ducting and installed piping.

The requirement to caulk seal around fire dampers was added to the HVAC specification by E&DCR C12,157 in March of 1983. However, the E&DCR did not explicitly specify that this requirement was applicable to all plant fire dampers. Lacking explicit direction, per site procedures, FQC applied the requirement only to inspections performed after the effective date of the E&DCR. Many fire dampers had been installed and inspected prior to this time. When the question about the lack of sealant on fire damper *DMPF51 [* in equipment designation indicates QA Category I] was raised by the NRC CAT, engineering indicated that the sealing requirement applied to all fire dampers. E&DCR C-14,330 has now been issued to change the specification to backfit this requirement. The major concern is that engineering initially failed to address generic considerations when evaluating a technical issue. Refer to Section III.B.2, above, for a discussion of a similar concern related to pipe support snubbers.

Several instances were observed where the interdisciplinary seismic and thermal growth clearance criteria of site specifications were violated. All of these instances involved non-ASME pipe. Because only the ASME pipe will receive an as-built walkdown, the

one chance to identify these potential clearance problems and get engineering resolution is during the final area walkdown. While this walkdown is obviously necesssary, it is not practical to assume that a short term area walkdown after construction is essentially completed will identify all of these violations, especially in poorly accessible locations. Therefore, it is necessary that construction forces adhere to site specifications and procedures to get pre-installation engineering approval to deviate from established clearance criteria. A number of instances of clearance violations were also noted during the NRC CAT pipe support/restraint walkdown and have been frequently noted by site personnel during ASME piping and support as-built inspections.

Capacities indicated on fan and unit cooler nameplates matched FSAR specified rates. Fire damper installation types and location were as specified on design drawings.

c. Conclusions

HVAC hardware generally conformed to design and procedural requirements and FSAR commitments. Improper engineering disposition on the original specification change regarding fire barrier sealing of fire dampers and violation of specification interdisciplinary clearance requirements during installation are issues for which action is warranted. Site engineering procedures should include explicit instruction regarding the applicability and use of the generic design drawing for HVAC supports, N7000.

—

TABLE III-1

PIPING INSPECTION SAMPLE AND OBSERVATIONS

Stone & Webster - Large Bore

| System | Package | Isometric | Diameter (Inches) | Class | Observations |
|---|---|---|---|---|---|
| RHS | AX-71AA | 231 CDA | 8 | 2 | -- |
| | | 041 CDA | 4 | 2 | -- |
| | | 091 CDB | 6 | 2 | Elevation of support struts 1-BZ-71TV and 1-BZ-71TW not specified |
| | | 087 CDA | 4 | 2 | Pipe 5 diameter bend not identified as such |
| | | 040 CDA | 4 | 2 | -- |
| | | 086 CDA | 4 | 2 | -- |
| | | 042 CDA | 4 | 2 | -- |
| | | 041 CDB | 4 | 2 | Spool piece 1-RHS-041-2-231 incorrectly marked as 1-RHS-041-2-251 |
| | | 091 CDA | 6, 3/4 | 2 | -- |
| ICS | AX-76D | 008, Sh 1 CDB | 6 | 2 | -- |
| | | 028 CDA | 4 | 2 | -- |
| | | 078 CDA | 4 | 3 | Vent valve and associated vent piping not included on as-built |
| RHS | AX-71AT | 008 CDA | 12 | 2 | -- |
| | | 200 CDA | 6 | 2 | -- |
| | | 033 CDA | 8 | 2 | -- |
| | | 035 CDA | 8 | 2 | Inservice inspection clearance not maintained between support clamp of 1-BZ-71VQ and adjacent elbow weld |
| | | 036 Sh 2 CDA | 8 | 2 | Inservice inspection clearance not maintained between support clamp of 1-BZ-71LJ and adjacent valve weld |
| | | 036 Sh 1 CDA | 8 | 2 | -- |
| ICS | AB-1 | 014 CDA | 12 | 2 | -- |
| | | 012 CDB | 12 | 2 | -- |
| CSH | AX-83A | 045 CDA | 10 | 1 | -- |
| | | 041 CDA | 10 | 1, 2 | -- |

TABLE III-1 (Continued)

PIPING INSPECTION SAMPLE AND OBSERVATIONS

Stone & Webster - Small Bore

| System | Isometric | Diameter (Inches) | Class | Observations |
|---|---|---|---|---|
| CCP | 076 CDA | 1 1/2 | 3 | Riser dimensioned as 3'10" measures 2'11" |
| CCP | 069 CDD | 3/4, 1 1/2 | 3 | -- |
| LSV | 022 CDA | 1 | 2 | -- |
| Reactor Controls-Stress Isometrics | | | | |
| I/W | SA 2448 | 1 | 2 | -- |
| I/W | SA 2442 | 1 1/4 | 2 | -- |

TABLE III-2

PIPE SUPPORT/RESTRAINT INSPECTION SAMPLE

Reactor Controls, Inc.

Support/Restraints SP 102,103; PSR-104,-105,-106 and -107 for Quadrant I consisting of welded U-clamps, axial friction clamps and supporting structural steel for the 37 1-inch withdraw piping lines and 37 1-1/4-inch insert piping lines for the ASME Class 2 CRD system.

Stone & Webster

| BZ Drawing | System | Size (Inches) | Location | Type | ASME Class |
|---|---|---|---|---|---|
| 83CL | CSH | 10 | RB | Snubber | 1 |
| 83CM | CSH | 10 | RB | Spring | 1 |
| 83CP | CSH | 10 | RB | Snubber | 1 |
| I83BW | CSH | 10 | Aux. | Spring | 2 |
| 108JF | CSH | 16 | Tun. | Box | 2 |
| 108GY | CSH | 10, 12, 16 | Tun. | Box | 2 |
| 108HK | CSH | 12, 12, 16 | Tun. | Box | 2 |
| 13AF | CLG | 12 | Aux. | Spring | 2 |
| 76Q | ICS | 6 | Aux. | Strut | 2 |
| 76D | ICS | 4 | Aux. | Snubber | 2 |
| 76F | ICS | 6 | Aux. | Box | 2 |
| 76G | ICS | 4 | Aux. | Box | 2 |
| 76AD | ICS | 6 | Aux. | Box | 2 |
| 13AX | ICS | 12 | RB | Box | 2 |
| 13P | ICS | 12 | Aux. | Snubber | 2 |
| 13BM | ICS | 1 1/2 | Aux. | Anchor | 2 |
| 13BN | ICS | 2 1/2 | Aux. | Spring | 2 |
| 13BR | ICS | 4 | Aux. | Snubber | 2 |
| 13Y-CD-10F1 | ICS | 4 | Aux. | Box | 2 |
| 13S | ICS | 8 | Aux | Spring | 1 |
| 13T | ICS | 8 | Aux. | Strut | 1 |
| 71DZ-CD | RHS | 14 | Aux. | Strut | 2 |
| 71EA-CD | RHS | 14 | Aux. | Spring | 2 |
| 71ET-CD | RHS | 14 | Aux. | Strut | 2 |
| 71GH | RHS | 10 | Aux. | Strut | 2 |
| 71GB | RHS | 10 | Aux. | Strut | 2 |
| 71QE | RHS | 4 | Aux. | Strut | 2 |
| DTM-084-038 | DTM | - | Aux. | Box | 2 |
| 71KV | RHS | 4 | Aux. | Box | 2 |
| 71KJ | RHS | 4 | Aux. | Box | 2 |
| 71NC | RHS | 6 | Aux. | Strut | 2 |
| 71NF | RHS | 6 | Aux. | Strut | 2 |

TABLE III-2 (Continued)

PIPE SUPPORT/RESTRAINT INSPECTION SAMPLE

| BZ Drawing | System | Size (Inches) | Location | Type | ASME Class |
|---|---|---|---|---|---|
| 902U | MSS | 24 | RB | Spring | 1 |
| 902AG | MSS | 24 | RB | Spring | 1 |
| 902AD | MSS | 24 | RB | Spring | 1 |
| 970N | RCS | 20 | RB | Spring | 1 |
| 970AV | RCS | 20 | RB | Spring | 1 |

RB = Reactor Building
Aux. = Auxiliary Building
Tun. = Tunnel

(Document Packages Reviewed)

BZ71PX
BZ71JB
BZ71AP
BZ71K
BZ72AA
BZ31PG
BZ30DJ
BZ30DE
BZ30BN
BZ74GF
BZ31QE

TABLE III-3

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATIONS

| Support/Restraint | Observation (Inspection Report or N&D Issued) |
|---|---|
| RCI: | |
| PSR-107A | Specified 5 ft. 9 15/16 in. +/- 1 in. dimension from azimuth 90 degree to center of attachment of pc 30/2; measured 6 ft. 1/2 in. |
| PSR-105A/PSR-106A | Specified 40 degree +/- 3 degree angle between piece 40/13 and 11/2; was measured at 33 degrees. (Drafting error; angle changed on identical supports for Quadrants II, III and IV. ECN issued to revise drawing). |
| S&W Primary Sample: | |
| BZ Drawing No. 902AD | Field welds locking turnbuckle and rod not yet made (spring adjustment/setting not complete) but as-built signoff not indicated to be partial. |
| 970AV | Loose locknut. |
| 71QE | Required structural steel stiffener not installed (IR P 4300676) |
| 13BM and DTM-084*038 | Studs substituted for bolts (allowed by notes) but their use not reflected on as-built Bill of Material. |
| 13S | Two loose locknuts |
| 71GB | Unspread cotter pin |
| 71NC | 1. Pipe clamp bolts single nutted and unstaked.<br>2. Wrong pipe clamp part installed (PC 2600-7 vs.2600-3 specified) (N&D6989) |
| 71KJ | 1. 1/32 in. gap under pipe, dead weight should have no gap (IRP4300675)<br>2. Total lateral gap was 1/64 in., 1/32 in. minimum required |
| 71DZ | Strut paddle to clamp alignment out of tolerance (IR P4300634) |
| 83CP | 1. Bearing slipping from strut paddle (IR P4300632)<br>2. Decking being temporarily supported from restraint steel |

TABLE III-3 (Continued)

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATIONS

| Support/Restraint | Observation (Inspection Report or N&D Issued) |
|---|---|
| 71GH | Strut paddle to clamp alignment out of tolerance (N&D 6988) |
| CRD Housing Clamps | Broken/loose lockwire (IR 720) |
| S&W Adjacent Supports/Restraints: | |
| 13AF | Clamp stud single nutted and unstaked on one side (IR P4300631) |
| 19AHE | Missing cotter pin (IR P4300763) |
| 74BQ | Snubbers unattached & unprotected by rear bracket and used to store coiled electrical cord (N&D P4500091) |
| 19CF | Zero lateral gap, "daylight" minimum required (N&D 6984) |
| 71RN | Unbent cotter pins (IR P4300730) |
| 17HQ, 71FM, 71GX | Required freedom of movement cannot be obtained due to minimal clearance between snubber and rear brackets or pipe clamps (N&D 6985) |
| 83BU | Loose locknut (N&D 6986) |
| 83AF | Loose locknut |
| 83P | Loose locknut (IR P4300638) |
| 83BZ | Loose locknuts and broken cotter pin (IR P4300635) |
| CSH 046*004 | No double nuts or staking (IR P4300674) |
| 76E | No double nuts or staking (IR P4300633) |
| 78BE | Unbent cotter pin |
| Anchor on line WCS-222-D | 3/4 pipe nipple permanently bent (5/16 in. in 4 inches) to install anchor (N&D 7187) |

[* in equipment designation indicates QA Category I]

TABLE III-4

CONCRETE EXPANSION ANCHOR SAMPLES AND OBSERVATIONS

| BZ Drawing Number | Diameter - Number of Bolts Checked | Number of Bolts Moving Prior to Achieving 80% Installation Torque | Number of Turns To Installation Torque |
|---|---|---|---|
| LSV-001-003 | 1"-2 | 0 | -- |
| CSH-025*006 | 1"-5 | 2 | 1, 12 |
| DER-969-PSR-1 | 1"-4 | 1 | 1/12, 1/12 |
| 19APQ | 1"-4 | 0 | -- |
| 19AQQ | 5/8"-3 | 1 | 5/12 |
| CS-010-004 | 3/4"-4 | 2 | 1/6, 1/12 |
| DTM-656-PSR-1 | 1"-4 | 2+ | 1/6, 0 |
| 108ARJ | 1"-8 | 1 | 1/12 |
| LSV-013-002 | 3/4"-3 | 1 | 2/3 |
| LSV-013-003 | 3/4"-2 | 1 | 1/3 |
| EGA-194*PSR4 | 3/4"-2 | 1 | Would not Torque |
| EGA-195*005 | 3/4"-4 | 0 | -- |
| 19APN | 3/4"-4 | 1 | 1/12 |
| 19APP | 7/8"-3 | 1 | 1/12 |
| TOTALS | 52 | 14 | |

Notes: 1. Breakaway torques ranged from 44 to 94 percent of the inspection torque (40 to 75 percent of installation torque).

2. All but one anchor met the S&W "Test Criteria" of reaching installation torque within one turn.

+ Base plate was not yet grouted. The existing gap probably caused the slippage.

[* in designation number indicates QA Category I]

TABLE III-5

MECHANICAL EQUIPMENT INSPECTION SAMPLE

| | |
|---|---|
| HVK TK 1B | Chilled Water Compression Tank |
| HVR*UC1O | HVAC Unit Cooler |
| G33*EB001A, B&C | Reactor Water Clean Up Regenerative Heat Exchangers |
| HVP*FN6C | Standby Diesel Generator Building Supply Air Fans |
| HVR*FN11A & 11B | Auxiliary Building Annulus Mixing Fans |
| GTS*FN2B | Auxiliary Building Standby Gas Treatment Units Decay Heat Fans |

[* in equipment designation indicates QA Category I]

TABLE III-6

HVAC INSPECTION SAMPLES AND OBSERVATIONS

(Supports/Restraints)

| Restraint Mark Number | Building |
|---|---|
| 1 HVR* | |
| DSR 2500 | Auxiliary |
| DSA 2502 | Auxiliary |
| DSA 2508 | Auxiliary |
| DSA 3233 | Reactor |
| DSA 3092 | Reactor |
| DSR 3093 | Reactor |
| DSA 3047 | Reactor |
| DSA 3320 | Reactor |
| DSR 3344 | Reactor |
| DSA 4009 | Fuel |
| DSR 4041 | Fuel |
| DSA 4048 | Fuel |
| DSR 7753 | Control |
| DSA 7784 | Control |

(Ducting/Accessories)

| EB Drawing | Bldg. | Observations |
|---|---|---|
| 39A-9 and 39F-10 | Control | 1. Various construction equipment stored inside of completed duct near an access door. (IRM 4400677)<br>2. The designation for damper DMP-86 had been inadvertently deleted from drawing by previous change. |
| 45C-8 and 45D-8 | Auxiliary | 1. Six inch fire protection pipe in contact with duct companion angle<br>2. No fire barrier sealant around damper *DMPF51<br>3. 1/2 inch clearance between duct and cable tray support<br>4. Flexible connection at discharge of *UC-4 did not have required length of flex material (IR M4400677)<br>5. Zero clearance to 4 inch DFR system pipe<br>6. Access door inaccessible due to cable tray routing |
| 15J-8 | Reactor | 1. 3 ft. 9 in. dimension from center of register to end of segment was actually 5 ft. 7 in.<br>2. 1/4 in. clearance to CNS pipe line |

TABLE III-6 (Continued)

HVAC INSPECTION SAMPLES AND OBSERVATIONS

Fire Dampers

| | |
|---|---|
| *DMPF49 | *DMPF17 |
| *DMPF48 | *DMPF18 |
| *DMPF51 | *DMPF4 |

[* in equipment designation indicates QA Category I]

## IV. WELDING AND NONDESTRUCTIVE EXAMINATION (NDE)

### A. Objective

The objective of the appraisal of welding and nondestructive examination (NDE) was to determine if Quality Control (QC) accepted work related to welding and NDE activities was controlled and performed in accordance with design requirements, Safety Analysis Report (SAR) commitments, and applicable codes and specifications.

An additional objective was to determine if personnel involved in welding and NDE activities were trained and qualified in accordance with established performance standards and applicable code requirements.

### B. Discussion

To accomplish the above objectives, welds and welding details for piping, pipe supports/restraints, structural steel installations, pipe whip restraints, heating, ventilation and air conditioning (HVAC) installations, electrical supports, and instrumentation and control tubing were inspected. The inspected welds were selected to provide a representative sample of the applicant's contractor-welding activities in terms of welding processes used, materials welded and existing weld-joint configurations. Considerations such as physical location, difficulties to weld and limited accessibilities were also included in the sample selection.

NDE activities were appraised through the review of radiographs for both field and vendor-fabricated welds, the review of NDE procedures and personnel qualifications, the inspection of the calibration status of NDE equipment and the witnessing of in-process NDE activities.

During the inspection of NDE activities, the NRC Construction Appraisal Team (CAT) inspectors reviewed samples of radiographic film in final storage in the vault at the applicant's facility. In addition, the CAT inspectors reviewed a sample of film which was stored at several vendor facilities and was brought to the site for this inspection. No significant problems were identified in the area of field fabricated pipe welds. However, several irregularities were identified in the areas of vendor film and shop fabricated pipe welds. The shop welds were fabricated by B. F. Shaw Company and the applicant had previously identified similar weld discrepancies which were reported to the NRC in accordance with the provisions of Part 50.55(e) of Title 10 of the Code of Federal Regulations (10 CFR 50.55(e)). Detailed discussion concerning these irregularities is included later in this section.

The welding and NDE activities were examined in order to ascertain compliance with the governing construction codes and specifications. This effort involved the review and inspection of the following areas and contractors:

Field Fabrication and Contractors

Field fabrication and pipe supports - Stone and Webster Engineering Corporation (S&W)

Main steam, reactor recirculation system and reactor internals fabrication and installation - ITT Grinnell; Associated Piping and Engineering Corporation, and Sun Shipbuilding Company

Control rod drive mechanism piping installation - Reactor Controls, Incorporated (RCI)

Electrical installation and electrical supports - S&W

Instrumentation tubing installation and instrumentation supports - S&W

Heating, ventilation and air conditioning installation and supports - S&W

Structural steel fabrication and erection - S&W

Fuel storage pool and refueling cavity liner fabrication - S&W

Mechanical equipment installation - S&W

Fire protection system fabrication and installation - Automatic Sprinklers Corporation of America (ASC)

Biological shield wall fabrication and installation - Chicago Bridge and Iron Company (CB&I)

Containment liner and containment penetration fabrication and installation - Graver Energy Systems

Turbine and turbine generator installation - General Electric Company (GE)

Shop Fabricators and Manufacturers

B. F. Shaw Company - shop fabricated piping

Metal Bellows Corporation - bellows manufacturer

Carrier Corporation - chiller and cooler manufacturer

RECO Industries, Inc. - Tank fabricator

Temp Flex Division - expansion joint fabricator

Texas Pipe Bending Company - material supplier

Lebanon Valve - valve manufacturer

Whiting Corporation - crane manufacturer

Velan Valve Corporation - valve manufacturer

Atwood & Morrill Co., Inc. - valve manufacturer

Fisher Controls - valve manufacturer

Struthers Wells Corporation - heat exchanger manufacturer

W. J. Woolley Company - equipment and personnel hatches

Hahn & Clay Corporation - drywell head assembly fabricator

The results of the inspection activities involving each of these areas and contractors are documented as follows in this section of the report:

1. Pipe and Pipe Supports Fabrication

a. Inspection Scope

(1) Welding Activities

The NRC CAT inspectors reviewed activities relating to the fabrication contracts in the areas of piping system welds, support/restraint welds, welding procedures, welder's qualifications, NDE procedures, personnel qualifications, and the review of radiographic film for shop and field fabricated welds. Welding by Teledyne Brown Engineering and Bergen-Patterson (BP) on preassembled pipe supports/restraints was also inspected as a part of this inspection. Field welding involving pipe fabrication was performed by Stone and Webster Engineering and the B. F. Shaw Company supplied the shop fabricated piping spools.

The NRC CAT inspected 32 pipe supports/restraints involving approximately 350 welds in order to verify conformance of welding to drawing requirements and confirm the visual acceptability of the welds. See Table IV-1 for a listing of supports subjected to detailed inspection. Additionally, another 65 supports/restraints involving 700 welds were also visually inspected for appearance in order to verify the quality of the completed welds. See Table IV-2 for a listing of supports inspected.

The NRC CAT inspection of piping welds consisted of visual inspection during walkdown of piping systems and inspection of pipe welds located near the supports/restraints being inspected.

Approximately 91 piping spools involving 1200 ASME Class 1, 2 and 3 welds were inspected. Thirty-seven of those piping spools were subjected to detailed inspection which included the review of pertinent QC documentation while the remaining 54 spools were only visually inspected. Both field and shop welds were inspected in order to assure compliance with the requirements of the ASME Code. Some of the surfaces of the inspected welds had been blended for inservice inspection. See

Tables IV-3 and IV-4 for a listing of piping spools inspected. In addition, the welder qualification test records for 22 welders and 11 welding procedures were reviewed for compliance with applicable specifications, procedures and the ASME Code requirements.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities for the pipe fabrication area included the review of 61 shop and 79 field fabricated welds which involved 1618 film. The field welds were fabricated by S&W and the shop fabricated pipe spools were supplied by B. F. Shaw Company. Ten additional welds were reviewed in conjunction with the inspection of the Main Steam and Reactor Recirculation systems and reactor internals. These welds were fabricated by ITT Grinnell, Associated Piping & Engineering, and Sun Shipbuilding Company. In addition, 12 NDE procedures and nine NDE personnel qualification records were reviewed in order to verify compliance with the governing codes and specifications. Eight NDE technicians were observed while performing in-process inspections and were evaluated for their ability to follow the applicable inspection procedures.

b. Inspection Findings

(1) Welding Activities

No weld defects or irregularities concerning QC documentation were found in the area of pipe welding. However, several minor discrepancies were identified in the area of pipe support/restraint welding.

Six of 1050 structural welds inspected, involving 97 pipe support/restraints, were found to be deficient with respect to the specified acceptance criteria. Three of the welds were undersized, one had poor weld profile, another weld did not have sufficient wrap around and one cracked weld was found in a support fabricated by Bergen Paterson. See Tables IV-1 and IV-2 for details. As a result of this finding, the applicant issued Nonconformance and Disposition Reports (N&Ds) and Unsatisfactory Inspection Reports. The welds will be evaluated and repaired as required by S&W engineering.

With respect to the cracked weld the NRC CAT requested that the applicant expand the sample and reinspect additional supports which had the same weld configuration. Nineteen additional supports were reinspected by the applicant, and the inspection found no weld defects or cracks to be present in these supports. The NRC CAT also inspected 14 additional supports and found no defects or cracks in these inspected supports. See Table IV-2 for the additional supports inspected.

(2) Nondestructive Examination Activities

No problems were identified in the areas of field, main steam, Reactor Recirculation system and reactor internals welding. All inspected welds met the acceptance criteria of the ASME Code. However, during the review of radiographic film supplied by B. F. Shaw Company, several irregularities were identified which involved three welds. The three welds and their associated deficiencies are as follows:

- Weld 1-CSL-1-2-009 FW1

  The original film of this weld exhibited an unacceptable indication and was rejected by the S&W radiographers. A subsequent reshot intended to show the repair of the area was also included in the package. This radiograph showed an acceptable weld condition. The NRC CAT inspectors were not able to verify that this repair shot was taken from the rejected area and requested a second reshot. When the weld was reradiographed the original indication reappeared which indicated that the weld was never repaired and the first reshot was taken from a wrong area. As a result of this finding, S&W issued N&D 7079 and rejected the weld.

- Weld 1-RHS-15-2-043 W3

  During the review of film for this weld the welded area appeared to be thinner than the thinnest joining member. The NRC CAT inspectors requested an ultrasonic examination (UT) of the weld in order to verify the minimum weld thickness. The UT examination confirmed that the weld is thinner between the 1 o'clock and 4 o'clock positions with the lowest reading of .235 in. The minimum wall requirement is .320 inches. As a result of this finding S&W issued N&D 7219 and the weld will be reviewed by engineering for disposition.

- Weld 1-CSL-1-2-003 W1

  The original radiograph for this weld contained a rejectable indication. The first repair film (R-1) covering the same weld area also showed the same rejectable indication. The second repair film (R-2), which was crossed out, showed an acceptable indication which did not have the same appearance as the indication found on the R-1 film. The accompanying Radiographic Test (RT) reports did not contain any explanation as to why the R-2 film was crossed out but showed that no repair was accomplished prior to taking the R-1 shot. This irregularity raised the possibility that the R-2 shot was taken at a favorable shooting angle which will tend to reduce the indication to an acceptable length. In order to verify these assumptions tne NRC CAT inspectors requested that the weld be radiographed using the correct angle of shooting. The weld was not radiographed during the time

the NRC CAT was at the site because the pipes were full of water and a significant amount of time will be needed to drain the water from the system. The licensee has agreed to resolve this issue.

c. Conclusions

(1) Welding Activities

No significant problems were identified in the area of inspected welding activities. With exception of the deficiencies discussed above, the inspected welds were found to comply with requirements of the applicable construction codes and specifications.

(2) Nondestructive Examination Activities

No problems were identified in the areas of field, main steam, and Reactor Recirculation systems welding. However, several irregularities were identified concerning film supplied by B. F. Shaw Company. The applicant has reported similar problems which were reported to the NRC in accordance with the provisions of 10 CFR 50.55(e). The NRC CAT believes that the applicant should expand the sample and review additional radiographic packages in order to assure that the discrepancies identified above constitute an isolated case and do not present a generic problem.

2. Control Rod Drive Mechanism Pipes

a. Inspection Scope

The installation of the control drive mechanism pipes and associated supports was completed by RCI. The NRC CAT inspectors reviewed both shop and field fabricated welds in order to assure compliance with the applicable code and specification requirements. The review of radiographic film, NDE procedures and personnel qualification records were also included in this inspection.

(1) Welding Activities

Approximately 50 structural welds and 30 pipe welds were visually inspected to determine if attributes such as mismatch, weld contour and appearance were in accordance with the ASME code. Ten welding procedures and ten welder qualification test records were reviewed. In addition the documentation packages for two welds on the reactor scram header were also reviewed for adequacy.

(2) Nondestructive Examination Activities

A total of 21 welds involving 188 films were inspected. Three NDE technicians were observed and evaluated for their ability to perform visual and liquid penetrant inspections

in accordance with the applicable procedure. In addition, two NDE procedures and the qualification test records for three NDE technicians were reviewed to determine compliance with the ASME Code.

b. Inspection Findings

No problems were identified in the areas of inspected pipe welding and nondestructive examinations. However, during the inspection of piping supports the NRC CAT inspectors found tack welds which were left on two completed supports. The ASME Code requires that the tack welds are removed or consumed in the finished weld. As a result of this finding RCI issued nonconformance report #RB-171 and the tack welds will be reworked to meet the requirements of the ASME Code.

c. Conclusions

No problems were identified in the area of inspected welding and NDE activities. With the exception of the minor discrepancy concerning the tack welds previously discussed, all inspected welds were found to be meet the quality standards required by the applicable construction codes and specifications.

3. Electrical Installation and Electrical Supports

a. Inspection Scope

The NRC CAT inspected approximately 140 welds comprising 60 field and 80 shop welds in the area of electrical installation. One welding procedure and the qualification test records for 17 welders were reviewed. In addition, two NDE personnel qualification test records were also reviewed and 4 NDE inspectors were observed and evaluated for their ability to follow the visual inspection procedures.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

4. Instrumentation Tubing Installation and Supports

a. Inspection Scope

Approximately 200 welds comprising 80 field and 120 shop fabricated welds were visually inspected in order to ascertain compliance with the specified acceptance criteria. Two welding procedures and the qualification test records for 15 welders were reviewed. In addition, four studs were torque tested to verify the adequacy of the stud welding procedures. NDE procedures and qualification records for three NDE inspectors were also reviewed. Three NDE

inspectors were observed and evaluated for their ability to follow the visual inspection procedures.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

5. Heating, Ventilating and Air Conditioning Installation and Supports

a. Inspection Scope

Approximately 120 welds comprising 60 field and 60 shop fabricated welds were inspected for compliance with the specified acceptance criteria. Two welding procedures and the qualification test records for 22 welders were reviewed. In addition, two NDE personnel qualification test records were also reviewed and two NDE inspectors were observed and evaluated for their ability to follow the visual inspection procedures. The vendor welds on two tornado dampers, two oil filters and three air blowers were also included in this inspection.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

6. Structural Steel Fabrication and Erection

a. Inspection Scope

Approximately 240 Category 1 welds comprising 80 field and 160 shop welds were visually inspected in order to ascertain compliance with the specified acceptance criteria. The NRC CAT inspectors also inspected approximately 100 Category 2 welds in order to evaluate the workmanship of these welds since only ten percent of those welds are inspected on a surveillance basis by the QC inspectors.

Three welding procedures and the qualification test records for 23 welders were reviewed. In addition five studs were torque tested to verify adequacy of stud welding procedures. NDE procedures and the qualification test records for three NDE inspectors were also reviewed. Two NDE inspectors were observed and evaluated for their ability to follow the visual inspection procedures.

b. Inspection Findings

No problems were identified in the area of inspected Category 1 welding and NDE activities. However, two shop welds from the 100 Category 2 welds were found to be deficient with respect to the

specified acceptance criteria. As a result of this finding the applicant issued N&Ds 7136 and 7148 and the two welds were evaluated by S&W Engineering. The welds were accepted "as is" and determined to be adequate for the intended application.

c. Conclusions

No problems were identified in the area of inspected Category 1 welding and NDE welding activities. Activities were found to comply with the applicable construction codes and specifications. The two deficient welds found in Category 2 structures were determined to be adequate for the intended application and indicated that ten percent QC surveillance for Category 2 structures constitutes an acceptable approach to achieve an adequate workmanship levels in Category 2 structures.

7. Fuel Storage Pool and Refueling Cavity Liner Fabrication

a. Inspection Scope

The NRC CAT inspected approximately 100 feet of welded seam on the fuel storage pool and the refueling pool liner. Eight welder qualification test records and two welding procedures were reviewed for compliance with the applicable codes and specifications. In addition, five pipe welds and 40 structural welds located inside the pools were also visually inspected.

b. Inspection Findings and Conclusions

No problems were identified in the areas of inspected welding and NDE activities. Activities were found to comply with the applicable construction codes and specifications.

8. Mechanical Equipment Installation

a. Inspection Scope

The NRC CAT inspectors inspected ten pipe to mechanical equipment connection welds which involved the installation of various equipment such as heat exchangers, chillers, tanks, steam turbines and pumps. In addition, eight welding procedures representing eight mechanical equipment vendors were also reviewed for compliance with the governing codes and specifications.

b. Inspection Findings

No problems were identified in the area of visual inspection of welds. However, during the review of QC documentation pertaining to welding performed on the nozzle of the fuel pool cooling heat exchanger 1-SFC-033A, the NRC CAT inspectors found that no documentation existed to show that the surface examination of the cavity required by the ASME Code was performed prior to final welding. As a result of this finding the applicant issued N&D 6973 and the QC documentation will be reviewed and corrected as needed. The NRC CAT inspectors

also reviewed the final radiographs for this weld which indicated that the completed weld is acceptable.

c. Conclusions

No problems were identified in the area of inspected welding and NDE activities. With the exception of the documentation discrepancy previously discussed, welds met the quality standards of the applicable code and specifications.

9. Fire Protection System Fabrication and Installation

a. Inspection Scope

The NRC CAT inspected 15 pipe supports which involved approximately 35 welds. One welding procedure and the qualification test records for seven welders were also reviewed for adequacy. The fire protection system is classified as a non-safety system but is required to meet Appendix R of Title 10 Code of Federal Regulations. The system was fabricated and installed by Automatic Sprinklers Corporation of America.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities inspected were found to comply with the governing construction codes and specifications.

10. Biological Shield Wall Fabrication and Installation

a. Inspection Scope

Approximately 40 feet of welded seams and the attachment welds for two penetrations were inspected in order to verify compliance with the applicable codes and specifications. In addition, two welding procedures, one heat treatment procedure and two magnetic particle inspection procedures were reviewed for adequacy. The sacrificial wall was fabricated and installed by CB&I.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities inspected were found to comply with the governing construction codes and specifications.

11. Containment Liner and Containment Penetration Fabrication and Installation

a. Inspection Scope

The NRC CAT inspected approximately 50 feet of liner seam, the welds on four beam seats, the attachment weld for one air lock, four plate attachments and the attachment welds for two pipe penetrations. In addition, seven welding procedures were also reviewed for adequacy.

The containment liner was fabricated by Graver. In the area of NDE, the NRC CAT reviewed 492 feet of liner seam which involved 522 films. The review of 63 feet of equipment and personnel hatch welded seam, involving 66 film, was also reviewed as a part of this inspection. The hatches were supplied by the W. J. Woolley Corporation.

b. Inspection Firdings and Conclusions

No problems were identified in the area of inspected welding and NDE activities. Activities inspected were found to meet the applicable codes and specifications.

12. Turbine and Turbine Generator Installation

a. Inspection Scope

Approximately 35 welds were visually inspected for compliance with the specified acceptance criteria. One welding specification was also reviewed for adequacy.

b. Inspection Findings and Conclusions

No problems were identified in the area of inspected welding activities. Activities inspected were found to meet the specified acceptance criteria.

13. Vendors and Shop Fabricators Other Than Those Previously Addressed

a. Inspection Scope

The NRC CAT visually inspected 15 vendor supplied tanks, filters and heat exchangers. See Table IV-5 for inspected vendor supplied equipment. Twenty miscellaneous vendor welding procedures were also reviewed as a part of this inspection. In addition to the welds inspected and listed in Table IV-5, the NRC CAT inspectors reviewed radiographs related to work performed by 12 vendors which have supplied various equipment and hardware to the River Bend project. A total of 381 feet of welded seam involving 532 radiographic film was reviewed. The radiographs for 11 valves involving 539 film, and the radiographs for 40 bellows and 16 expansion joints involving 214 film were also reviewed for compliance with the governing codes and specifications. See Table IV-6 for detailed listing of vendors reviewed.

b. Inspection Findings

During the inspection of tanks supplied by RECO the NRC CAT found that the size of the nozzle weld reinforcement did not meet the requirements stated on the vendor drawings. Specifically, the drawing required 3/8-inch weld reinforcement while the actual measured reinforcement on some of the tanks measured 1/4 inch. The ASME Code requires minimum 1/4-inch weld reinforcement; therefore all of the inspected tanks meet the Code requirements but were deficient with respect to the vendor drawings. Welds on a total

of eight tanks were found to deviate from the required drawing sizes. As a result of this finding the applicant issued N&D 7241 and this item will be reviewed and resolved by S&W Engineering.

In the area of NDE the NRC CAT inspectors identified the following irregularities:

- Spent Fuel Chiller SIN 24201 Weld A

  A questionable indication was identified on film No. 917A (14-15). As a result of this finding the applicant issued N&D 7226 and this indication will be reviewed and resolved by S&W Engineering. The spent fuel chiller was supplied by Carrier Corporation.

- The radiographs supplied by Metal Bellows Corporation did not have station marks positioned on the welds. Station or location markers are required in order to ascertain a complete radiographic coverage of the welded area. As a result of this finding the applicant has issued N&D 7242 and this ite will be reviewed and addressed by the applicant.

c. Conclusions

With the exception of the findings previously discussed (insufficient weld reinforcement of tank nozzles, questionable film indication and missing station marks) reviewed vendor hardware met the requirements of the applicable construction codes and specifications.

—

TABLE IV-1

PIPE SUPPORTS/RESTRAINTS SUBJECTED TO DETAILED INSPECTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BZ-71RD | | BZ-71JY | | BZ-19ALD | | BZ-31QS | |
| BZ-31RH | (5) | BZ-19ACN | | BZ-31QR | | BZ-17GW | |
| BZ-31PJ | | BZ-78-AP | | BZ-31PG | | BZ-78AF | |
| BZ-71CT | | BZ-71VQ | | BZ-71EN | | BZ-71VR | |
| BZ-71BE | | BZ-31PL-1 | | BZ-71RN | | BZ-MSS-163-1 | |
| BZ-71CS | (1) | BZ-60BL | | BZ-71CJ | | BZ-74CL | (3) (6) |
| BZ-71HX | | BZ-74CG | | BZ-74CN | | BZ-2BZ | |
| BZ-74GQ | | BZ-2BK | | BZ-71DQ | (4) | BZ-71EU | (2) |

(1) Undersize fillet, 1/32 x 2", N&D 6982

(2) Undersize fillet, 1/16 x 4-1/2", N&D 6974

(3) Crack, 5" long, N&D 7029

(4) Undersize fillet, N&D 6982

(5) Insufficient Wrap, IR-W400555

(6) Poor weld profile, IR-P4200596

TABLE IV-2

PIPE SUPPORTS SUBJECTED TO VISUAL INSPECTION ONLY

| | | |
|---|---|---|
| BZ-71RN | BZ-71ZF | BZ-970CA |
| BZ-350JG | BZ-38E | BZ-71BE |
| BZ-31RH | BZ-71BD | BZ-31QS |
| BZ-71FD | BZ-314BK | BZ-71QF |
| BZ-MSS-165 002 | BZ-71-FE | BZ-MSS-165 005 |
| BZ-71BJ | BZ-MS1-58 005 | BZ-316BZ |
| BZ-71-JF | BZ-71KL | BZ-19VM |
| BZ-71HX | BZ-72CF | BZ-83P |
| BZ-19TU | BZ-83AD | BZ-19RX |
| BZ-17GW | BZ-31RG | BZ-83CD |
| BZ-31RC | BZ-83Z | BZ-31RE |
| BZ-71QF | BZ-31QT | BZ-72AJ |
| BZ-31QP | BZ-78HQ | BZ-31QQ |
| BZ-71BU | BZ-31-GQ | BZ-19ASK |
| BZ-74CK | BZ-60BN | BZ-970A/B |
| BZ-71JS | BZ-970F | BZ-71-JR |
| BZ-74BJ | BZ-71JG | BZ-76-L |

List of Additional Supports Inspected Similar to BZ-74CL

| | |
|---|---|
| BZ-71GB | BZ-76-AN-1 |
| BZ-71-EC | BZ-13W-1 |
| BZ-72-BC | MSS-PSST-2031-A2 |
| BZ-78H | MSS-PSST-2037-A2 |
| BZ-74CS | BZ-83AW |
| BZ-74BN | BZ-83BD |
| BZ-11W | BZ-74DF |

TABLE IV-3

PIPE WHICH WAS SUBJECTED TO VISUAL INSPECTION ONLY

| Piece Mark | Size (Inches) | Material |
|---|---|---|
| SVV-26-3-021 | 12 | CS |
| RHS-12-2-083 | 14 | CS |
| RHS-121-3-210 | 6 | CS |
| RHS-109-2-179 | 14 | CS |
| RHS-106-2-535 | 4 | CS |
| RHS-143-2-215 | 16 | CS |
| RHS-140-3-320 | 16 | CS |
| SWP-140-3-320 | 16 | CS |
| ICS-015-A | 6 | SS |
| CSL-2-2-007 | 16 | CS |
| RHS-014-50-2 | 14 | CS |
| ICS-006-15-2 | 6 | SS |
| ICS-006-7-1 | 6 | CS |
| DTM-002-096-1 | 2 | CS |
| DTM-002-98-1 | 2 | CS |
| DTM-0099A | 2 | CS |
| WCS-171-2-225 | 4 | CS |
| RHS-55-2-146 | 18 | CS |
| RHS-55-2-147 | 18 | CS |
| ICSPEN19-P-11-MS | 6 | CS |
| MSS-156-1B | 2 | SS |
| SFC-063-A | 12 | SS |
| RHS-48-2-246 | 4 | CS |
| RHS-107C | 14 | CS |
| MSS-V306 | 2 | SS |
| MSS-V305 | 2 | SS |
| MSS-V307 | 2 | CS |
| SWP-393-3-997 | 4 | CS |
| SWP-393-3-989 | 4 | CS |
| RHS-200A | 6 | CS |
| RHS-008-33-2 | 8 | CS |
| KJPZ21APENMSS-16-56-4 | 16 | CS |
| SFC-34-3-092 | 12 | SS |
| SFC-3-246 | 12 | SS |
| SFC-063-CDA | 12 | SS |
| SFC-15B | 6 | SS |
| SFC-012-063-3 | 12 | SS |
| SFC-34-3-093 | 12 | SS |
| SFC-34-3-092 | 12 | SS |
| SFC-34-3-246 | 12 | SS |
| SFC-32-3-244 | 10 | SS |
| SFC-39-3-252 | 10 | SS |
| RHS-107-2-072 | 14 | CS |
| RHS-116-4-258 | 6 | CS |
| KJB*253APEN | 12 | CS |

TABLE IV-3 (Continued)

PIPE WHICH WAS SUBJECTED TO VISUAL INSPECTION ONLY

| Piece Mark | Size (Inches) | Material |
|---|---|---|
| RHS-14-2-046 | 10 | CS |
| CNS-416-3-071 | 4 | CS |
| CBS-416A | 4 | CS |
| WCS-005-A9 | 6 | CS |
| ICS-006-15-2 | 6 | SS |
| CHS-003-015-2 | 3 | CS |
| RHS-6-2-144 | 20 | CS |
| SVV-026-3-022 | 12 | CS |
| RHS-018-55-2 | 18 | CS |
| RHS-048-2-083 | 4 | CS |

TABLE IV-4

PORTIONS OF PIPING SYSTEMS WHICH WERE SUBJECTED TO DETAILED INSPECTION

| Item | Pipe Size | Description |
|---|---|---|
| RCS-020-006A-1 | 20 | Piping Spool |
| RCS-020-807A-1 | 20 | Piping Spool |
| RCS-020-808A-1 | 20 | Piping Spool |
| B33-0001A | 20 | Valve |
| B33-F060A | 20 | Valve |
| FWS-063-2-099 | 20 | Piping Spool |
| FWS-063-2-100 | 20 | Piping Spool |
| FWS-063-2-101 | 20 | Piping Spool |
| MOV F065B | 20 | Valve |
| MOV 7BVGN | 20 | Valve |
| FWS-048-1-102 | 20 | Piping Spool |
| B21 VF063B | 20 | Valve |
| B21 VF010B | 20 | Valve |
| 1KJB Z3B | 20 | Penetration |
| FWS-067-1-104 | 20 | Piping Spool |
| VGW-090-E-1RSV | 20 | Valve |
| FWS-048-1-102 | 20 | Piping Spool |
| FWS-048-1-103 | 20 | Piping Spool |
| B21 AOVF 032B | 20 | Valve |
| B21 VF010 B | 20 | Valve |
| FWS-039-1-105 | 20 | Piping Spool |
| FWS-039-1-106 | 20 | Piping Spool |
| MSS-024-60S-1 | 24 | Piping Spool |
| RCS-020-026A-1 | 20 | Piping Spool |
| B33-F060A | 20 | Valve |
| RCS-020-807A-1 | 20 | Piping Spool |
| RCS-020-908A-1 | 20 | Piping Spool |
| B21 ADV-F022A | 24 | Valve |
| MSS-024-635-1 | 24 | Piping Spool |
| RCS-016-810A-1 | 16 | Piping Spool |
| RCS-010-812A-1-30 | 10 | Piping Spool |
| RCS-010-812-A-60 | 10 | Piping Spool |
| RCS-010-821-A-120 | 10 | Piping Spool |
| RCS-010-812-A-160 | 10 | Piping Spool |
| RCS-010-811-A-1 | 10 | Piping Spool |
| MSS-024-603-3 | 24 | Piping Spool |
| MSS-024-604-1 | 24 | Piping Spool |

TABLE IV-5

VENDOR SUPPLIED TANKS, FILTERS AND HEAT EXCHANGERS

SUBJECTED TO DETAILED INSPECTION

| | | |
|---|---|---|
| B21TKA-001 A | (1) | Main steam isolation accumulator tanks |
| B21TKA-001 B | (1) | Main steam isolation accumulator tanks |
| B21TKA-001 C | (1) | Main steam isolation accumulator tanks |
| B21TKA-001 D | (1) | Main steam isolation accumulator tanks |
| B21TKA-003 E | | Accumulator tanks |
| B21TKA-003 B | | Accumulator tanks |
| B21TKA-003 J | | Accumulator tanks |
| 1HVK TK1 A | | Control building chilled water tank |
| 1EAG TK 2C | | Compress air tanks |
| 1EAG TK 2A | | Compress air tanks |
| 1EAG TK 1A | | Compress air tanks |
| 1EAG TK 1C | | Compress air tanks |
| EGF STR 2A | | Emergency diesel generator fuel oil filters |
| EGF STR 2D | | Emergency diesel generator fuel oil filters |
| RHR Heat Exchangers A and B | | |

(1) Insufficient weld reinforcement, N&D 7241

TABLE IV-6

VENDOR RADIOGRAPHS REVIEWED

| Contractors | Number of Valves | Number of Bellows | Number of Expansion Joints | Feet of Weld | Number of Film | Comments |
|---|---|---|---|---|---|---|
| Metal Bellows | | 40 | | | 198 | Rejected (1) |
| Carrier Corp. | | | | 8 | 8 | Rejected (2) |
| RECO | | | | 150 | 151 | Rejected (3) |
| Templex | | | 16 | | 16 | Acceptable |
| Texas Pipe | | | | 60 | 180 | Acceptable |
| Lebanon Valve | 6 | | | | 198 | Acceptable |
| Whitting Corp. | | | | 18 | 18 | Acceptable |
| Velan Eng. | 2 | | | | 193 | Acceptable |
| Hahn & Clay | | | | 137 | 163 | Acceptable |
| Struthers Wells | | | | 8 | 12 | Acceptable |
| Atwood & Morrell | 1 | | | | 50 | Acceptable |
| Fisher Controls | 2 | | | | 98 | Acceptable |

Notes

(1) Film did not show station marks positioned on the weld.

(2) Questionable indication found in weld "A".

(3) Tanks did not have sufficient weld reinforcement on the tank nozzle.

## V. CIVIL AND STRUCTURAL CONSTRUCTION

### A. Objective

The objective of the appraisal of civil and structural construction was to determine by evaluation of completed work and by review of documentation whether work, inspection, and test activities relative to civil and structural construction areas were accomplished in accordance with regulatory requirements, Safety Analysis Report (SAR) commitments, and project specifications and procedures.

### B. Discussion

The specific areas of civil and structural construction evaluated were: concrete activities, structural steel installations, and bolting applications.

#### 1. Concrete Activities

##### a. Inspection Scope

The concreting activities reviewed by the NRC Construction Appraisal Team (CAT) inspectors included five concrete placement areas of Unit 1. These areas were reviewed for conformance of rebar placement to the Stone & Webster Engineering Corporation (S&W) design drawings. General concrete quality was examined from surrounding areas for conformance to site specification requirements. Since concrete activities are basically complete the five samples selected were limited to areas where the concrete had been chipped out. In addition, documentation supporting the chipping out of these areas was reviewed. Selected cadweld inspection records and cadwelder qualification records were reviewed by the NRC CAT inspectors for seven cadwelders. The records were reviewed for proper qualification and requalification (if necessary), Quality Control (QC) visual inspection and tensile test results. The specific concrete placements reviewed are listed in Table V-1.

Records associated with concrete material certification and surveillance testing were reviewed for conformance to construction specifications and regulatory commitments. The records reviewed included records for cement and aggregate testing. The certification and testing records were reviewed for conformance to the specified testing frequency and acceptance criteria.

The requirements and acceptance criteria for concrete activities and rebar placement are included in the following specifications and procedures:

> S&W Specification 210.370, "Placing Concrete and Reinforcing Steel", Rev. 8, dated February 8, 1983, Addendum 1, dated May 19, 1983 and Addendum 2, dated November 28, 1983

S&W Specification 210.361, "Concrete Testing Services", Rev. 4, dated October 6, 1982 and Addendum 1, dated September 27, 1983

S&W Specification 210.350, "Mixing and Delivery of Concrete", Rev. 5, dated June 21, 1983 and Addendum 1, dated May 14, 1984

S&W Quality Assurance Inspection Plan (QAIP) R1210370F0501, "Placing Concrete and Reinforcing Steel Cadweld Qualification General", Rev. H, dated March 31, 1983

S&W QAIP R1210370F0502, "Placing Concrete and Reinforcing Steel - Caldweld Tensile Testing", Rev. E, dated July 13, 1981

S&W QAIP R1210370F0503, "Placing Concrete and Reinforcing Steel - In Process Inspection", Rev. I, dated February 24, 1984 and Change Notice Nos. 1 through 3

S&W QAIP R1210370F0504, "Placing Concrete and Reinforcing Steel - Cadweld Final Inspection", Rev. I, dated March 28, 1983

S&W QAIP R1210370F0505, "Placing Concrete and Reinforcing Steel - Final Location", Rev. I, dated March 31, 1983

b. Inspection Findings

In the five concrete placement areas reviewed, the size and grade of rebar and the general concrete quality placed in the areas were acceptable. The five areas were found to have the rebar placed in accordance with S&W design drawings.

During the inspection two cracks were identified by the NRC CAT inspectors in the concrete structures. One was in the east wall of the Fuel Handling Building at approximately elevation 80'. This crack was apparently caused by concrete entering the 3 in. rattle space between the Fuel Handling Building and the Shield Building during the placing operation for the Fuel Handling Building wall. Differential expansion between the Fuel Handling Building and the Shield Building apparently caused the concrete to spall off the Fuel Handling Building wall. The other crack was identified in the soffit of the doorway leading to the control rod drive (CRD) work area at elevation 95'-9" of the Auxiliary Building. This crack was apparently caused by the installation of an expansion type concrete anchor bolt with insufficient edge distance.

With regard to the crack in the Fuel Handling Building wall, the presence of concrete in the rattle space between the two buildings was apparently being masked by the Roto Foam used to

form the 3 in. space. S&W advised the NRC CAT inspectors that the Roto Foam would be removed and the rattle space inspected. Four areas in the rattle spaces were identified by S&W as containing Roto Foam. A reinspection by S&W found three additional areas with debris and one where concrete had violated the 3 in. specified clearances.

The qualification, requalification, production visual inspection and tension testing records of a sample of seven of 162 cadwelders employed in the activity were reviewed. This sample represented approximately 2900 of 41600 cadwelds made to date.

As a result of the review and inspection, two cases were identified where the cadwelder had not been requalified at the time of his welding. The first case has been documented on Nonconformance Disposition Report (N&D) 7009 for welder I-80 and the second on N&D 7204 for welder I-113. S&W has as a result of the above findings reviewed all cadwelder records in order to establish the extent of this problem. One additional example of this same problem was identified as a result of the S&W review.

c. Conclusions

The concrete quality was found to be acceptable and rebar was placed in accordance with the design drawings for areas inspected. The concrete material certification and testing records reviewed indicated conformance to the construction specifications and regulatory commitments. Concrete chipping and rebar cutting inspected appeared to be performed in a controlled manner.

Although three instances were identified where cadwelders had made splices without being properly qualified, inspected cadwelding activities were generally found to be performed in an acceptable manner.

The failure to identify the two cracks in the concrete structures and concrete in the rattle space between various plant buildings is indicative of inadequate inspection in these areas.

2. Structural Steel Installations and Bolting Applications

a. Inspection Scope

Structural steel installation activities were reviewed by the NRC CAT inspectors. Installed and QC accepted structural steel was inspected for member size, configuration, and conformance of bolted connections to the design drawings and specification. Structural steel bolts were tested using a calibrated torque wrench to determine whether the bolts were properly tightened. The building structures inspected were the Reactor Building and the Auxiliary Building. The specific structural steel areas reviewed are listed in Table V-2.

Structural steel installations reviewed included 37 bolted connections for proper size and dimensions, and 346 bolts tested for minimum installation torque.

The requirements and acceptance criteria used in the review of structural steel installations are included in the following specifications and procedures:

S&W Specification 210.310, "Structural Steel", Rev. 4, dated March 4, 1983, Addendum 1 dated September 23, 1983, and Addendum 2 dated May 1, 1984

S&W QAIP R1210310F0502, "Structural Steel Erection", Rev. J, dated July 1, 1981 and Change Notices Nos. 1 through 3

S&W QAIP R1210310F0504, "Inspection of High Strength Bolting", Rev. J, dated August 24, 1983 and Change Notices No. 1 and No. 2

b. Inspection Findings

Thirty-seven structural steel members were found by the NRC CAT inspectors to be in conformance with design drawings for configuration and location.

Of the 37 bolted connections inspected 35 were found to be in conformance with the design drawings and specification. The other two connections have discrepancies which are being evaluated by S&W as a result of being identified by the NRC CAT inspectors. In one case, the shim plates for the beam to column connection for the Residual Heat Removal (RHR) Heat Exchanger supports were undersized thus leaving a 1/4 in. gap over 30 percent of the design contact area. In the other case, column P4 in the RHR Heat Exchanger area was not located in the center of the base plate as shown on the design drawings. The anchor bolt for this column was also loose.

During our initial inspection of the beam to column shim plates, the NRC CAT inspectors noticed a file wedged between the two connection plates. S&W site personnel were asked to review this condition. S&W personnel advised the NRC CAT inspectors that craft personnel had stuck the file in the gap between the two connection plates and that an unsatisfactory condition did not exist. On later review of the design drawing the NRC CAT inspectors noted that the shim plate installed was smaller than shown on the design drawing. This condition was then documented on N&D 7211.

In the bolted connections which were checked for minimum torque, a significant number of insufficiently torqued bolts were found in the Reactor Building steel. Forty-six of 244 bolts tested were found to be below the applied inspection torque.

These deficient bolts were found scattered in the various connections in the Reactor Building steel. In a few cases, the observed bolt torques were as low as 100 ft-lbs.

In review of the high strength bolting reports it was noted that three Inspection Reports had the incorrect revision of the Inspection Plans and three had the incorrect revision of the drawings identified on them although they had been reviewed for such errors. The time frame of these errors was 1981 and 1982.

c. Conclusions

In general the structural steel installation activities (member size, configuration, and connections) were found to be in conformance with the design drawings and specifications with the following exceptions:

The number of bolts found below minimum torque values in the Reactor Building structural steel connections indicate that these bolts have not been preloaded to the proper bolt tension specified by the American Institute of Steel Construction.

The undersized shim plate in the beam to column connection for the RHR Heat Exchanger support is an example of inadequate inspection by site personnel.

TABLE V-1

CONCRETE PLACEMENT REVIEW

| Location | Drawing No. |
|---|---|
| Diesel Generator Building<br>Miscellaneous Wall Elevation | EC29R-5 |
| Diesel Generator Building<br>Wall Elevation Line DA & DC<br>Embedments | EC29T-4 |
| Fuel Building<br>Stair #1<br>Wall Elevation & Detail | EC62AB-6 |
| Fuel Building<br>Interior Walls El. 70'-0" | EC62AC-4 |
| Fuel Building<br>General Notes and References | EC-3F-2 |
| Auxiliary Building<br>3 Line Wall Elevation | EC68E-7 |
| Auxiliary Building<br>West Wall Elevation | EC68B-8 |
| Auxiliary Building<br>West Wall Elevation<br>Embedments | EC68N-5 |
| Auxiliary Building<br>3 Line Wall Elevation<br>Embedments | EC68T-7 |

TABLE V-2

STRUCTURAL STEEL INSTALLATION

| Location | Drawing No. |
|---|---|
| Diesel Generator Building<br>Floor Framing El. 98'-0" | ES29A-9 |
| Control & Switchgear Building<br>Floor Framing Plan & Detail El. 98 | ES70B-7 |
| General Notes and References | ES1B-9 |
| Reactor Building<br>Drywell Framing El. 95'-9" | ES54B-6 |
| Auxiliary Building<br>Floor Framing Plan and Detail | ES66G-2 |
| Auxiliary Building<br>Supplemental Steel<br>RHR Heat Exchanger | ES66V-1 |
| Auxiliary Building<br>General Arrangement<br>Component Support Heat Exchanger | EV155A-6 |
| Auxiliary Building<br>RHR Heat Exchanger<br>Lower Support Details | EV155B-7 |
| Auxiliary Building<br>RHR Heat Exchanger<br>Lower Support Details | EV155E-4 |

## VI. MATERIAL TRACEABILITY AND CONTROL

### A. Objective

The objective of this portion of the inspection was to examine material traceability and control of safety-related material and equipment.

### B. Discussion

Samples were selected from installed and stored safety-related material and equipment. A total of 220 individual samples were examined to varying extents. Table VI-1, "Summary of Samples" lists the sample distribution.

The following section describes the results of the inspection in the area of material traceability and control.

#### 1. Material Traceability and Control

##### a. Inspection Scope

Ninety-five groups of samples involving 220 individual samples were examined for traceability to drawings, specifications, quality control records or procurement records as applicable. Inspection samples included pipe, tubing, structural steel, steel plate and sheet, hangers/supports, embedments, fasteners, electrical cable reels, weld filler metal, weld joints and various equipment.

##### b. Inspection Findings

(1) Deficiencies involving material traceability and control of fastener materials were noted by the NRC CAT inspector as follows:

- Some fasteners for the battery racks (1ENB* STANDBY 1A and 1ENB* STANDBY 1B) and motor control centers (1ENB*MCC-1, 1EHS*MCC-2F and 1EHS*MCC-15A) were made of indeterminate material.

- Installed flange fasteners for one-inch lines off regenerative heat exchangers (1G33* EB001B and 1G33* EB001C) were found not to agree with QC accepted and verified fasteners as shown on control drawings. This condition indicated that work or rework was being accomplished without QC or engineering knowledge or concurrence.

(2) Deficiencies involving material traceability and control of piping or piping components were noted by the NRC CAT inspector as follows:

- ASME Code Class 3 orifices were found to be installed in ASME Code Class 2 systems. This deficient condition affected approximately 30 flange joints.

- Low Pressure Core Spray flange assembly CSL-4-2-011, adjacent to pump 1E21PC001, had an installed spacer plate made from ASME III, subsection NF material, rather than from the required ASME III, subsection NC material.

(3) Deficiencies involving weld filler material environmental control were noted as follows:

- One weld rod storage oven at weld rod issue station #1 and one weld rod storage oven at weld rod issue station #3 were not controlled within required temperature ranges.

c. Conclusions

Material traceability and control documentation, in general, was easily obtainable, accurate and agreed with actual inspected hardware conditions except as follows:

(1) Review of safety-related hardware or equipment revealed some traceability and control deficiencies involving fastener materials. Work or rework of flange joints was being accomplished without QC or engineering concurrence or knowledge and resulted in a loss of material control.

(2) Piping flange joints had components installed which were not of the correct ASME Section III class materials.

(3) Environmental control for storage of weld filler material was not adequately monitored to ensure against damage or deterioration.

TABLE VI-1

SUMMARY OF SAMPLES

| | No. of Samples |
|---|---|
| Piping Including Associated Fittings | 26 (L)* |
| Embedments for Hangers & Supports | 3 |
| Hangers and Supports | 15 |
| Steel Plate and Sheet | 5 |
| Tubing Including Associated Fittings | 5 (L) |
| Field and Vendor Weld Joints | 59 |
| Weld Filler Material | 31 (L) |
| Electrical Cable (Reels) | 7 (L) |
| Equipment | 21 |
| Fasteners | 39 (L) |
| TOTAL | 220 |

*(L) = Lots

## VII. DESIGN CHANGE CONTROL

### A. Objective

The primary objectives of the appraisal of design change control were to determine whether design activities were conducted in compliance with regulatory requirements, Safety Analysis Report (SAR) commitments and approved applicant, engineer/constructor and vendor procedures. An additional objective was to determine that hardware modifications described in a sample of design change documents were accurately completed.

### B. Discussion

10 CFR 50, Appendix B, Criterion III "Design Control" and Criterion VI "Document Control" establish the overall regulatory requirements. These requirements are elaborated in Regulatory Guide 1.64 "Quality Assurance Requirements for the Design of Nuclear Power Plants" and American National Standards Institute (ANSI) Standard N45.2.11-1974 "Quality Assurance Requirements for the Design of Nuclear Power Plants". The applicant's intent to comply with these requirements is stated in Chapter 17 of the River Bend Station (RBS) Preliminary Safety Analysis Report (PSAR) for construction-related activities and Chapter 17 of the RBS Final Safety Analysis Report (FSAR) for operations-related activities.

The areas of design change control evaluated by the NRC Construction Appraisal Team (CAT) inspectors were control of changes to design documents, control of onsite design activities and control of design changes. In each of these areas interviews were conducted with personnel responsible for the control of activities, procedures were reviewed, and a sample of the controlled documents were reviewed. In the relevant areas, a sample of the installed structures and hardware was inspected. These evaluations were performed on an interdisciplinary basis.

#### 1. Control of Design Documents

The specific aspects of the control of design documents inspected were the availability of the latest approved design documents to the users and the method of assuring that approved changes not yet incorporated into these documents are reviewed prior to work being performed.

##### a. Inspection Scope

(1) The following procedures related to control and distribution of design documents were reviewed:

Gulf States Utilities Company (GSU) Quality Assurance Procedure (QAP) 6, Revision 2, dated August 5, 1983, "Document Control".

Stone & Webster Engineering Corporation (S&W) Quality Standard (QS) 6.1, Revision D, dated June 10, 1983, "Document Control".

S&W Engineering Assurance Procedure (EAP) 6.1, Revision 1 dated February 8, 1980, "Document Control".

S&W EAP 6.5, Revision 0, dated June 1, 1981, "Preparation, Review, Approval, and Control of Engineering and Design Coordination Reports (E&DCRs) - Computerized Logging and Tracking System".

S&W River Bend Project Procedure (RBP) 12.0-12, dated January 14, 1983, "Engineering and Design Coordination Report (E&DCR) Procedure".

S&W Construction Methods Procedure (CMP) 11.1, Revision D dated August 9, 1982, "Jobsite Document Control".

GSU Administration Department Manual (ADM) 0005, Revision 0 dated March 7, 1984, "Station Document Control".

The procedure controlling the receipt, issue, reproduction and filing of design documents for use during construction is CMP 11.1. Under this procedure, design documents are distributed to satellite document stations. The latest issued revisions of the documents are listed in the Information Systems (IS)-256 (Drawing Systems Index) computer report, and all approved changes not incorporated in the latest revision of the design document are listed in the IS-217 (Answered Change Control Documents - Not Incorporated) computer report.

It is the responsibility of the user to review the IS-256 and IS-217 reports and identify the latest revision of the document and the unincorporated changes. If the latest design document and the change documents are not available at the satellite station, it is the user's responsibility to request and obtain them.

The latest revision of controlled design documents are issued black ink on green paper (black on green). Superceded revisions are voided by stamping or destroyed.

(2) Three S&W satellite document stations and one GSU satellite document station (Stations 11, 40, 51 and 62) were inspected. Approximately 30 controlled documents (black on green) were selected at random and reviewed for legibility and stamping. The revision number and date of each document was checked against those listed in the IS-256. The IS-217 report for

each document was reviewed to determine the unincorporated E&DCRs. A sample (approximately 70) of these E&DCRs were reviewed for appropriate signatures and dates, listing of the design document on the E&DCR as an affected document and to determine whether the E&DCRs had been incorporated in the controlled documents.

b. Inspection Findings

The IS-217 and IS-256 reports in the satellite stations were properly updated with current data. The controlled drawings and specifications reviewed were the latest revisions and dates listed in the IS-256 report, and were legible and properly stamped. The E&DCRs listed in the IS-217 report as unincorporated in the drawings and specifications were generally available for reference in the satellite stations. The E&DCRs were properly signed and dated, and the affected design documents were listed on the E&DCRs.

The following isolated (non-generic) discrepancies were observed:

(1) Two E&DCRs, P-31,054 and C-31,145 (one initiated by the Site Engineering Group (SEG) and one initiated by the Cherry Hill Operations Center (CHOC)) were written to effect the same drawing change.

(2) Three E&DCRs, P-12,549B, C-31,315 and C-31,331 were available for incorporation into Revision 5 of drawing BZ-350A, Sheet 37, but were not incorporated. This appears to be contrary to the requirements of Section 1.0 of Attachment E to RBP 12.0-12 which states "Whenever an addendum/revision to a specification ... or drawing is prepared, it shall incorporate or list as applicable all E&DCRs/N&Ds which are available for incorporation or listing."

(3) E&DCR C-31,275B was incorporated in drawing BZ-351CR Sheet 1, Revision 3 dated June 27, 1984. The drawing was incorrectly listed as Revision 1 dated July 24, 1983 in the IS-256 report dated July 2, 1984. In addition, the E&DCR was also incorrectly listed in the IS-217 report (latest page for BZ-351 CR Sheet 1 was dated June 8, 1984) as unincorporated. This is contrary to the requirements of Section 4.2.2 of RBP 12.0-12 for daily updating of the IS-217 report.

(4) E&DCR C-13,361 (February 29, 1984) deleted a number of double isolation valves 2-inches and smaller in size from the Feedwater System. The E&DCR did not indicate that a licensing document was affected by this change (i.e., "B" in Block No. 18 per EAP 6.5), although the FSAR presently shows a number of those isolation valves on Figure 10.4-7, the Feedwater System Piping and Instrumentation Drawing (P&ID). This appears to be contrary to the requirements of Section 7.0 of RBP 12.0-12.

The E&DCR does list the affected flow diagrams (FSKs), which are the bases for the P&IDs, and S&W provided documents to the NRC CAT inspector showing that the licensing aspects of the change in isolation valving had been considered. However, noting that the change does affect the FSAR would provide additional assurance that the change is eventually incorporated in the FSAR.

(5) E&DCR C-31,278 was signed by the Project Engineers's designated representative on December 16, 1983, and by the applicant's representative on December 17, 1983. This is contrary to the requirements of Section 4.1.1 of RBP 12.0-12 that "GSU must approve E&DCRs ... prior to the Project Engineer signing the E&DCR...".

(6) E&DCR C-6726 was modified after it had been signed by the S&W Project Engineer, a violation of Paragraph 4.1.3 of RBP 12.0. The modification was minor; the responsible engineer has been advised of his error. S&W Inspection Report (IR) S4620080 (August 1, 1984) was issued to document the discrepancy. S&W Site Engineering Assurance (EA) performed surveillance of E&DCRs and determined this was an isolated case.

(7) Interoffice Correspondence (IOC) C-2272 dated August 17, 1982 was issued to change the requirements of Specification 210.371 concerning witnessing/testing anchor bolt torque. This is a violation of EAP 6.5, Section 1.4, which states that E&DCRs are the only approved method for changing specifications, except for normal revisions or addenda.

c. Conclusions

Except for the isolated E&DCR discrepancies noted, the control of changes to design documents is satisfactory.

2. Control of Onsite Design

A limited amount of design work has been done by the S&W SEG which was not part of the changes to previously developed designs handled through E&DCRs and related change documents. This "onsite design" effort was mainly for small bore piping and supports and electrical conduit and supports in physically congested areas such as the drywell. The scope of these efforts is defined in Project Management Memorandum (PMM)-119, dated November 19, 1982 "Drywell and Unmodeled Fuel Building Small Bore Effort" and subsequent revisions to PMM-119.

a. Inspection Scope

Interviews were conducted with the supervisors of the SEG personnel performing the onsite design. The onsite design was performed to the same standards and procedures as similar work done in CHOC, except for administrative changes due to local

requirements. Standard design guidelines (i.e., "cookbook" rules) were used to run the small bore pipe and conduit and determine support location and configuration, with design of unique supports and computer analyses as required. The design effort in both these areas is essentially complete.

b. Inspection Findings

Routing of both pipe and conduit was generally preceeded by field walkdown. Changes to routing were made during installation, subject to later verification. Changes involving deviations from specification requirements required review and approval by E&DCR.

The onsite design drawings are subject to the same design verification processes as design drawings for similar commodities prepared offsite. Where required for the verification process and Field Quality Control (FQC) inspection, as-built drawings are developed.

c. Conclusions

Control of onsite design is satisfactory.

3. Control of Design Changes

Changes are made to the RBS design through a variety of change control mechanisms, some of which are specific to the design being changed. Under this system, a change can be made which affects only some technical disciplines through a change control mechanism requiring review only by the affected disciplines.

a. Inspection Scope

(1) The following procedures relating to the control of design changes were reviewed:

GSU QAP-3, Revision 3, dated November 30, 1983, "Design Control".

S&W EAP 6.5, Revision 0, dated June 1, 1981, "Preparation, Review, Approval, and Control of Engineering and Design Coordination Reports (E&DCRs) - Computerized Logging and Tracking System".

GSU River Bend Station Project Procedure (RBPP) 6.3, Revision 4, dated October 24, 1983, "Review and Approval of Technical Documents".

GSU RBPP 6.8, Revision 2, dated March 21, 1983, "Handling of E&DCRs and N&Ds by GSU".

S&W RBPP 6.9-0, dated April 30, 1979, "Procedures for Obtaining GSU Approval of Engineering-Related Documents".

S&W EAP 5.3, Revision, 3 dated June 14, 1984, "Preparation and Control of Manual and Computerized Calculations (Nuclear Projects)"

S&W Construction Site Instruction (CSI) 1.0.6, Revision 6, dated June 15, 1984, "Control of Requests for Changes/Deviations from GE Requirements and Control of FDDR/FDI".

S&W RBP 12.0-12, dated January 14, 1983, "Engineering and Design Coordination Report (E&DCR) Procedure".

S&W CSI 1.0.12, Revision 2, dated June 8, 1982, "Work Completion and Exception Tracking Report".

S&W RBP 18.10-2, dated November 28, 1983, "Handling Changes to QA Category I (ASME III) Pipe Supports and Piping, and Documentation/Approval of QA Category I Instrumentation Tubing Installations Onsite".

S&W Site Engineering Procedure (SEP) 118.5B, dated February 21, 1984, "Procedures for Design Verification of Piping and Pipe Supports for ASME III Small Bore Systems".

S&W SEP 118.3D, dated June 6, 1984, "Preparation and Handling of Changes to Category I Instrument Installations".

(2) Interviews were conducted with the S&W Superintendent of Engineering, the S&W American Society of Mechanical Engineers (ASME) Coordinator, the S&W Senior Instrumentation Engineer, the GSU Site Engineering Supervisor, the General Electric Company (GE) Site Manager, the GE Site Engineering Manager, the S&W Nuclear Steam Supply System (NSSS) Modifications Coordinator and other personnel as appropriate.

(3) The ASME control drawing system and the design verification system for ASME small bore piping were reviewed and sample drawings and calculations were inspected. Physical installation was inspected for conformance to the following ASME control drawings (the asterisk denotes a safety related support):

1-CCP-061, Rev. 2
1-BZ-CCP-061*014, Rev. 1
1BZ-CCP-064*006, Rev. 2

(4) The Instrument Change Revision Notice (ICRN) process was reviewed and sample ICRNs were inspected. Physical installation was inspected for conformance to the following ICRNs:

305D-05C
305D-02E
312F-04

(5) The S&W/GE interface for changes to GE designed or supplied items was reviewed. The following Field Deviation Disposition Requests (FDDRs) were reviewed and the initiating/resulting S&W IRs and E&DCRs were reviewed:

LD1-1892, Rev. 0
LD1-1760, Rev. 0
LD1-1931, Rev. 1

(6) The system for GSU Site Engineering independent review of selected E&DCRs and all N&Ds was inspected. A sample of 17 E&DCRs designated by S&W as requiring GSU approval was inspected to verify that GSU Review and Approval Route Sheets had been completed. A GSU engineer who had reviewed E&DCRs was interviewed concerning how he performed the reviews.

(7) SEG structural calculations for changes to electrical raceway supports were reviewed for conformance to requirements for checking and independent review.

(8) Approximately 500 E&DCRs were selected at random and reviewed for need for the change, clarity of problem description and solution, reasonableness of the solution, and appropriate review and approval by S&W and GSU. The following E&DCRs for structural, electrical and mechanical commodities were verified against physical installation:

| | |
|---|---|
| C-6575 (5/1/84) | C-31,204 (10/21/83) |
| C-6609 (5/23/84) | C-31,251 +(11/19/83) |
| C-6705 (7/19/84) | C-31,265 (12/1/83) |
| C-24,927 (6/20/84) | C-31,299 (12/21/83) |
| C-25,019 +(7/25/84) | C-31,403 (2/15/84) |

+Advance Authorization Approved

b. Inspection Findings

(1) The following isolated (non-generic) discrepancies were identified:

(a) Small bore restraints 1-BZ-CCP-61*PSR-13B and -64*PSAR-006A were missing inspection tags. Inspection of the restraints was verified and the tags replaced.

(b) The silencers for the Transamerica Delaval Inc. (TDI) diesel generators were installed without any sliding connection for thermal expansion. Investigation by S&W showed that the manufacturer's installation drawing was incorrect. E&DCR C-6741, (August 8, 1984) was issued by the SEG to correct this deficiency.

(c) The RBP FSAR states that cables and cable bundles shall be installed in trays such that they do not protrude above the tray side rails. This requirement was not included in S&W Specification 248.000, and thus was not an FQC inspection requirement. E&DCR C-25075 (August 8, 1984) has been issued to correct Specification 248.000. See Section II, Electrical and Instrumentation Construction, of this report for additional details.

(d) Reactor Controls, Inc. (RCI) drawing RB-024, Sheet 4, Revision 2, did not include weld length requirements. RCI has determined that this detail was lost when the drawing was revised, due to a drafting error. The weld length requirement will be added to the next drawing revision (RCI Nonconformance Report RB-172, August 27, 1984). See Section IV, Welding and Nondestructive Examination, of this report for additional details.

(e) E&DCR C-12,157 concerning caulking for fire dampers was issued after a number of fire dampers had been installed, but did not state retroactive requirements. E&DCR 14,330 (August 30, 1984) has been issued stating that the requirements are retroactive. See Section III, Mechanical Construction, of this report for additional details.

(f) ASME Class 3 orifice plates were installed in an ASME Class 2 line. The orifice plates were purchased as Class 3 due to an engineering error. S&W has issued N&D 6983 (August 7, 1984) and E&DCR C-14,275 (August 10, 1984) to correct the nonconformance. See Section VI, Material Traceability, of this report for additional details.

(g) Electrical support seismic loading calculations were based on dimensions which did not accurately reflect as-built conditions. See Section II, Electrical and Instrumentation Construction, of this report for additional details.

(2) The following discrepancies which may have generic implications were identified.

(a) The following E&DCRs were identified which were incorrectly written to address nonconformances:

C-31,266 (December 7, 1983)
C-31,296 (December 20, 1983)
C-31,297 (December 20, 1984)
C-31,358 (February 1, 1984)
C-31,621 (July 28, 1984)
C-13,633 (May 16, 1984)
C-13,713 (May 9, 1984)

S&W was aware of this problem, and issued an Interoffice Memorandum (IOM) on April 3, 1984 clarifying policy on the use of N&Ds versus E&DCRs. Subsequent to identification by the NRC CAT inspector of the three E&DCRs issued after April 3, 1984, S&W discussed the problem in the August 28, 1984 SEG Staff Meeting and reissued the IOM on August 30, 1984.

(b) A review of SEG Calculation Number 12210-S-E107 (340) "E&DCR/N&D Calculations for Reactor Building Cable Tray Supports" revealed that a number of calculations had not been checked and independently reviewed, yet the E&DCRs associated with these calculations had been signed by the Project Engineer. This is a violation of S&W EAP 5.3 Paragraph 6.1.

After identification of this discrepancy, S&W checked and reviewed all the pages in this calculation, and found only one minor error with no impact on hardware. All other SEG structural calculations were reviewed to verify that they had been checked and reviewed. S&W Site EA has committed to future surveillance across disciplines to ensure conformance to EAP 5.3 Paragraph 6.1.

(c) The original structural calculation which was the basis for drawing ES66V, Rev. 1, May 5, 1980 did not contain a calculation for the coped column shown on the drawing. A structural calculation relating to the cope in the column was requested by an NRC CAT inspector and provided by S&W CHOC (S66.371L, January 9, 1984). The calculation was found to be unchecked, unreviewed, and to contain a mathematical error. S&W has stated that the calculation was a portion of an in-process calculation not yet subject to checking or review. Subsequent to completion of the onsite NRC CAT inspection, S&W provided a checked and reviewed (as of September 7, 1984) Revision 4 of S66.371.L.

c. Conclusions

For the sample inspected, the control of the design change process is satisfactory. A small number of isolated deficiencies were identified, and these are being corrected. Three deficiencies with possible generic implications were identified, and further attention by GSU and S&W is required to verify that these discrepancies are not generic and to preclude similar discrepancies in the future.

## VIII. CORRECTIVE ACTION SYSTEMS

### A. Objective

The objective of this portion of the NRC CAT inspection was to examine the River Bend Station site corrective action program with respect to nonconformances of safety-related hardware or equipment to determine whether conditions adverse to quality were promptly identified, evaluated and corrected.

### B. Discussion

#### 1. Corrective Action Systems

##### a. Inspection Scope

The following procedures and reports were reviewed to assess the adequacy of the corrective action programs.

Stone and Webster Engineering Corporation (S&W) Quality Standard QS-15.1, Nonconformance and Disposition Report

Field Quality Control Department Reports

Monthly N&D and Unsat Reports

S&W Information Systems IS-217, "04 Report" (E&DCR/N&D History and Addendum) and "23 Report" (Drawing History and Addendum)

A detailed review of approximately 150 Nonconformance and Disposition Reports (N&Ds) was made to determine if nonconformances were adequately reported, recorded, evaluated, dispositioned, reviewed and trended or tracked for generic identification of problems. Each inspection sample was randomly selected from various disciplines such as electrical, mechanical, civil and structural, and welding and nondestructive examination.

##### b. Inspection Findings

The following deficiencies were identified regarding the corrective action (N&D) program:

(1) The NRC CAT inspectors noted a few cases which indicated that engineering dispositions failed to adequately address the nonconformances. This condition either results in additional N&Ds being written to correct the nonconformance or the possibility that the nonconformance may never be corrected. For example:

- N&Ds 4694, 4920, 4931, 4956 and 5837; Low Megger Readings on MOV Motor (Valves)

Problem: This is a recurring problem at the River Bend site with no discussion/resolution as to the cause of the motor problems.

° N&Ds 5130, 6180 and 7359; Clearance Violation of Permanent Plant Equipment

Problem: Additional electromechanical clearance problems were noted by the NRC CAT inspector which were not addressed on the N&Ds (pipe to electrical support, insulation to electrical support and insulation schedule deviations).

° N&D 5482; Arc Strikes on Pump/Valve

Problem: Engineering disposition on the N&D listed a minimum allowable wall thickness for valve 1SFC*V33 as .038" while the existing wall thickness was reported as 1.48". The actual allowable minimum wall thickness per ANSI B16.34 is .380". Even though 12 different individuals reviewed the N&D, the wall thickness error was never noticed.

° N&Ds 4872, 5193, 5225, 5353, 5371 and 5551; Incorrect Schedule Pipe Installed

Problem: Pipe was accepted as-is without any apparent consideration of possible creation of crud traps (because of pipe I.D. variations) and subsequent additional radiation exposure.

(2) The NRC CAT inspectors noted repetitive nonconformances occurring in several areas for which corrective actions were not being taken to minimize or eliminate the recurrence of nonconforming conditions. Of the inspection samples taken, the following is a list of discovered repetitive nonconformances:

° Sheared off anchor bolts or studs

° Wrong schedules of pipe installed

° Electrical separation violations

° Burnout of Limitorque motors

° Inability of motor operated valves to meet test criteria for opening and closing times.

c. Conclusions

In general the corrective action program utilizing N&Ds to identify, evaluate and correct nonconforming conditions was adequate.

However, from the above noted inspection findings, it is evident that the program is deficient with regard to corrective actions as follows:

(1) Several repetitive nonconformances were identified where adequate corrective actions were not taken to preclude recurrence of the nonconforming conditions.

(2) Failure to correctly identify nonconformances on N&Ds and for engineering to adequately address and disposition the nonconforming condition.

## IX. PROJECT CONSTRUCTION CONTROLS

### A. Objective

The objective of the appraisal of the applicant's project construction controls was to determine if the Project Management Organization was properly controlling the total project, maintaining quality control of construction and test activities, controlling the measuring and test equipment (M&TE) used in construction and test activities, endeavoring to respond adequately to quality concerns, implementing an adequate audit program, and controlling test activities.

### B. Discussion

To accomplish the objectives approximately 40 members of River Bend Station (RBS) project management were interviewed, Quality Control (QC) personnel files and procedures were reviewed, laboratories were inspected, the audit organization and audits were reviewed, the handling of quality concerns was examined, and test control procedures were inspected to determine programmatic adequacy. In all the above areas where applicable, procedures were examined, reports analyzed, and audits reviewed, in addition to personnel interviews.

#### 1. Project Organization

##### a. Inspection Scope

The Project Management Organization and implementing procedures were reviewed and appraised to determine that they are effective in monitoring and controlling the engineering, construction, start-up and quality activities to assure a quality end product in conformance with regulatory requirements.

##### b. Inspection Findings

At the present state of construction of the unit, approximately 90 percent complete, there are three principal organizations on site. They are the Gulf States Utilities Company (GSU) Project Organization, the Stone and Webster Engineering Corporation (S&W) organization and the General Electric Company (GE) as the Nuclear Steam Supply System (NSSS) organization. There are a few other speciality contractors on site performing work but the overwhelming manpower and effort involves the three named organizations.

Gulf States Utilities has structured their RBS organization along essentially project lines. In effect, all the activities and personnel required to design, engineer, construct, test and operate the plant are under the direct organizational control of the Senior Vice President River Bend Nuclear Group.

The Gulf States Utilities Company, as the applicant, represented by the Chairman of the Board of Directors/Chief Executive Officer, the Senior Vice President River Bend Nuclear Group and officers of GSU acknowledge that they hold full responsibility for design

and construction of the project and the compliance with the applicable regulatory requirements. The Chairman of GSU has vested this responsibility in the Senior Vice President and given him the authority to complete the project. The Senior Vice President is physically located at the plant site and has directly reporting to him a Vice President and a GSU site organization so that he can effectively direct, control and monitor site activities. The site GSU organizations reporting to him are elements of the Project Managment Organization, Quality Assurance (QA) organization and Nuclear Operations. Those sections of the Project Managment Organization that directly monitor site activities are located on site. Additionally the Manager - Engineering, Nuclear Fuels and Licensing, while located in Beaumont, does directly report to the Senior Vice President. This GSU Project Organization is essentially responsible for the plant engineering, construction, start-up, operations, and quality assurance activities. To implement these responsibilities, S&W is under contract as the architect-engineer, construction manager and constructor for the plant. GE is under separate contract to GSU to supply and provide other services for the NSSS.

Overall, the Senior Vice President River Bend Nuclear Group has an organization of approximately [illegible] individuals directly engaged in the monitoring of engineering and site activities including a QA organization of approximately 57 individuals.

The S&W organization is under the direct supervision of the Resident Project Manager who is located on site. Reporting to him is the Resident Manager, Senior Project Engineer and the Project Manager for the Preliminary Test Organization (PTO). The basic engineering is performed at the Cherry Hill Operations Center (CHOC) of S&W. However, there is an engineering group of approximately 400 engineers located on site. The Senior Project Engineer at the present time is spending approximately half his time at the River Bend site to better coordinate engineering to support the construction systems turnover schedule. There are various support services to the River Bend Project under a Project Manager at the CHOC.

GE is under contract to GSU to supply the NSSS. GE has a Technical Director and approximately 50 engineers and technicians to support the installation of these systems. The crafts for performing installation work are supplied by S&W, the constructor, to GE. The QC inspections are also supplied by the Field QC (FQC) section of S&W. GE is working under its own QA program and a QA engineer is on site who reports independently to the GE QA Manager in San Jose, California.

The overall responsibility for QA is retained by GSU, who monitors and conducts surveillances and audits of the various site and off site activities to determine compliance with the 10 CFR 50 Appendix B criteria. In addition to the GSU QA program, GE and Reactor Controls, Incorporated (RCI) utilize their own QA programs and are audited by GSU and S&W respectively. The utilization of S&W

as the constructor has resulted in a simplified site QA structure as compared to many nuclear sites where there are multiple contractors with individual QA programs.

The Quality Control portion of the Quality Assurance Program is implemented by approximately 310 individuals in the FQC organization under the supervision of the Superintendent of Field Quality Control. He is assisted by a support organization consisting of Assistant Superintendents, QC Engineers, inspectors and technicians. The Superintendent of FQC reports directly to the S&W Manager of FQC in Boston and maintains liaison and communications with the Resident Project Manager. Essentially all the site construction work is inspected by S&W FQC, with the exception of RCI and ANCO (the insulation contractor) which provide their own QC inspections under their independent Quality Assurance programs.

The NRC CAT inspector interviewed approximately 40 individuals in the GSU, S&W and GE organizations to determine if each segment of the Project Management Organization was aware of their individual responsibilities to the project and the necessary interfaces that needed to be maintained to successfully complete the project. The interviews, review of documentation, and review of meeting minutes indicated there is a good working relationship between these principal groups and that the interfaces are functioning properly and the interviewed individuals are dedicated to a common goal.

(1) Management Involvement - GSU

By interviews and review of documents and procedures the NRC CAT inspector was able to ascertain that GSU management at all levels was actively involved in the construction of the project and participating in the resolution of site problems. This was demonstrated by the following actions of GSU:

- GSU was instrumental in forming an owner's group to help resolve the industry-wide diesel generator problems of a particular manufacturer.
- The Chairman of the Board of Directors visits the site monthly and interviews the key managers to determine site construction progress and problems.
- The Vice President River Bend Nuclear Group presently chairs the Start-up and Test Program.
- The Senior Vice President meets daily with key GSU, S&W and GE site managers to keep abreast of problem areas and their resolution.
- The Senior Vice President monthly reports to the GSU Board of Directors in Beaumont on the status of the project and the progress of the test program.

- The Board of Directors of GSU has a Board Safety Committee which has access to a senior technical Board Advisory Committee that periodically meets with plant managers and discusses critical areas, makes recommendation and reports, and advises the GSU Board of Directors.

- GSU through its Quality Assurance organization, Project Engineer staff, Nuclear Engineering - Fuels - Licensing staff and Nuclear Operations staff is actively engaged in auditing, surveillance, appraisal of engineering changes, start-up and testing and monitoring the construction and preliminary testing of the plant.

- A number of corrective action meetings were called in 1983 and 1984 by GSU for discussion of unsatisfactory craft performance. Minutes of these meetings were reviewed by the NRC CAT inspectors.

(2) Project Management Nuclear Experience

Through interviews, review of resumes and observation, the Project Management Organization was evaluated as to their previous nuclear experience in the construction of similar type units. It was determined that each of the three critical project management organizations were experienced, qualified, and competent.

- The GSU organization's key members of management have had extensive prior nuclear experience, are experienced in the various stages of nuclear plant construction, test and start-up, and appear competent to satisfactorily complete the project.

- The S&W personnel assigned to the River Bend Project are experienced nuclear engineers and have on average over 10 years experience with a number of units in various stages of construction. They have on average over four years at the RBS site. The individuals interviewed appeared to be knowledgeable, competent and dedicated to the successful completion of the project.

- The GE NSSS site Technical Director is an experienced nuclear engineer having worked at a number of sites and has reporting to him and matrixed to General Electric, San Jose, a staff of start-up, control and instrumentation, installation engineers, and technicians.

The NRC CAT inspector in reviewing the working inter-relationships of the three project organizations reached the conclusion that it was a viable organization, that their individual efforts were directed towards a common goal and that they were sufficiently experienced and competent to bring the project to satisfactory completion.

(3) Management Reports and Intercommunications

The NRC CAT inspector through interviews, report reviews, procedure reviews, and observation endeavored to determine if construction reports of the three principal organizations comprising the River Bend Project Management Organization were sufficiently detailed to describe the status of problems and activities of the project. The reports listed below are those that are presented and distributed to various levels of management:

- A monthly oral report by the Senior Vice President River Bend Nuclear Group to the Board of Directors on critical aspects of the project.

- A monthly written status report by the GSU Senior Vice President to the GSU Chairman of the Board that includes among other items:

  - A progress summary section that describes activities in start-up and test, construction, Quality Assurance, Nuclear Plant Engineering, Nuclear Fuels & Licensing, Plant Staffing and Administration.

  - Percentage construction completed.

  - A cumulative graph index of 1984 construction planned vs. construction achieved.

  - A graph indicating percent complete for Test Program priorities necessary for fuel load and 5% power.

  - A graph indicating actual PTO equipment releases vs. those planned.

  - A graph indicating cumulative start-up and test turnovers for the PTO.

- A monthly QA Department Activity Report to the GSU Senior Vice President River Bend Nuclear Group tracks open items, tracks close-out of open items, and reports on the corrective action programs to River Bend Project Management.

- A S&W Monthly Project Report to GSU that encompasses the total construction effort. The report addresses the engineering effort, construction PTO effort, a Quality Assurance Report and numerous graphs. In addition, the report identifies and tracks problem conditions in all of the above areas.

- A report from the S&W Resident Construction Manager to the S&W Senior Construction Manager at Cherry Hill, New Jersey that describes the monthly construction activities.

- A monthly Field Quality Control Report generated by S&W that is distributed internally and externally to S&W management and copies of which are transmitted to GSU QA and Project Engineering. These reports are comprehensive resumes of QC activities during the month, including QC personnel changes, audits, reviews and visits of the QC Department, QC training, Nonconformance and Disposition Reports (N&Ds) opened and closed, inspection planning, documentation package turnover, and monthly summary graphs indicating a year's trend for each monitored discipline of acceptable and rejectable QC inspection attributes.

- S&W Construction Control and Completion Administration generates a monthly status report for N&Ds and Unsatisfactory Inspection Reports that charts and analyses reports for each construction discipline and transmits the report for institution of corrective action to site S&W management and the GSU QA organization.

- S&W Cherry Hill QC generates a Process Averages Field Inspection report that depicts and evaluates Calculated Percent Defective for those processes documented on an Inspection Report (IR) and displaying significant activity during the reporting period. In substance, this report analyzes the site FQC monthly input to the home office and provides an overview of the site construction activities. Where necessary, corrective action is recommended to the site. This report is distributed to site, Boston and Cherry Hill superintendents and also to other S&W nuclear power plant construction sites.

- A monthly GE report is generated at San Jose, California and at the site covering all NSSS activities and is distributed to both GSU and S&W management.

(4) Control of Site Contractors

Approximately 95 percent of direct site construction work is performed by the S&W construction organization. S&W has in effect at the RBS site a Nuclear Stabilization Agreement under which it directly hires craft labor and then directs and supervises their activities with their site Construction Management organization. The Nuclear Stabilization Agreement is essentially an understanding negotiated at the national level with all the individual craft disciplines to have a mechanism to resolve site labor grievances, wages, holidays, working conditions, and jurisdictional disputes during the life of the project's construction period. To date the agreement has reasonably functioned as intended according to the S&W Resident Project Manager.

Having S&W acting as constructor for the bulk of site activities has worked effectively, resulting in a minimum number of construction organizations and Quality Assurance programs at

the site. At the present time the only other organizations performing site construction work are RCI, ANCO, and GE as the NSSS supplier and installer. The crafts and QC personnel for the GE site organization are provided by the S&W organization. RCI and ANCO hire their crafts direct from the union halls and work under their own QA programs.

- The QA/QC organizations were essentially fully staffed in budgeted positions and further these staffings were periodically reviewed to determine adequacy as the construction phase changed.

- At the present time approximately 400 employees of GSU/S&W/GE are engaged in quality control and quality assurance activities.

- The QA/QC managers have direct access to upper management and freedom to express their concerns and implement corrective action if necessary.

- S&W construction management works closely and cooperatively with both FQC and GSU QA to identify and implement corrective action in problem areas by means of meetings, correspondence, and discussions.

- The site QA/QC organizations are essentially independent from pressures of construction cost and schedule. As a result of the construction work division, GSU and S&W are able to adequately monitor the site work activities. The GSU QA organization periodically audits the construction organization, conducts surveillances, and monitors the work activities of the subcontractors to assure compliance with design and regulatory requirements.

(5) Management and Supervisory Support of QA/QC

The NRC CAT inspector conducted discussions and interviews with QA/QC management, supervisory personnel, engineers, auditors and inspectors to determine if GSU and S&W were committed to support of the QA/QC program. The following observations were made:

- GSU/S&W/GE QA management personnel are actively involved in site construction activities and in the chain of pertinent communication channels for construction.

- The site QA/QC personnel are experienced personnel indicating management commitment to the overall QA program.

(6) Awareness of Industry Construction Problems

Through interviews, discussions, and review of documentation, the NRC CAT inspector attempted to determine if the Project

Management Organization was aware of nuclear industry construction type problems. The inspector determined that the following associations, reports and methods were utilized to stay abreast of industry wide problems:

- GSU is a participating member company of the Institute of Nuclear Power Operations (INPO) and through audits, reports and exchange of information maintains cognizance of problems.

- GSU, as a participating member of the Boiling Water Reactor Mark III owners group, stays informed of problems with the GE supplied NSSS.

- GSU is a participating member of a diesel generator owners' group that is attempting to resolve industry wide diesel generator deficiencies.

- The S&W FQC organization has reviewed the NRC CAT reports of previous nuclear site inspections and has prepared a document listing the problem areas and concerns. The document has been reviewed by the construction group disciplines and corrective action is being implemented.

- GSU is a participating member of the Edison Electric Institute and has management attend various Prime Mover Committee meetings in the areas of Nuclear Design and Quality Assurance.

- S&W receives construction reports from other S&W sites and reviews problem areas for applicability to the RBS project.

- S&W engineers visit non-S&W nuclear sites to discuss problem areas and construction methodology improvement.

- GSU receives, analyzes and institutes corrective action where required for NRC information notices, circulars and bulletins.

- GE issues to their site Technical Director, installation bulletins relative to the NSSS supplied by GE and corrective action is instituted when required.

c. Conclusions

The overall Project Management Organization is evaluated to be satisfactory to successfully complete the project. The senior management of the RBS project has integrated a qualified, competent team that intercommunicates satisfactorily and works in unison to reach a common objective. GSU management involvement at RBS is comprehensive and the generation of reports and intercommunications amongst the integrated organizations is adequate.

The limited number of site contractors assists the project management team to satisfactorily control and monitor their efforts.

Through all levels of project management interviewed there appeared to be full management support of and the recognition for the need of a strong Quality Assurance/Quality Control effort.

The Project Management Organization has made a determined effort to stay abreast of industry construction and equipment problems and in some instances they have acted as leaders in the attempt to resolve some of the problems.

While the overall Project Management Organization is evaluated to be satisfactory there needs to be improvement and continuous awareness of potential problems in some specific areas of project management:

- At a critical time of plant testing the Nuclear Plant Manager position was vacant for approximately four months. It is essential that critical management, construction, testing, and operating vacancies be filled more expeditiously.

- The present division of construction disciplines reporting to the Resident Site Manager and the Construction Field Superintendent is not a conventional construction organization structure. At the present time, in the NRC CAT inspector's opinion it is functioning satisfactorily with the present incumbents. However, in the event there is a change in personnel in either of these two positions the present organizational structure should be reviewed.

- The GSU Manager of Quality Assurance at the present time reports to the Senior Vice President River Bend Nuclear Group at the site, who is also charged with direct responsibility for the project's cost and schedule. While the existing reporting relationship is functioning satisfactorily at the present time, in the event of change in the senior management position at the RBS site, this reporting relationship should be reevaluated to assure QA independence from the pressures of cost and schedule.

- A significant S&W quality control report is not being directly transmitted to GSU management. This report, generated in Boston, "The Process Averages - Field Inspections Semi-Annual Report", is a useful analysis of project quality trends.

2. Quality Control

a. Inspection Scope

The Field Quality Control program, organization, procedures, and their implementation were reviewed and appraised to determine if

they are effective in monitoring and controlling the quality activities associated with construction and test activities.

b. Inspection Findings

(1) Organization

The FQC organization has the responsibility to assure that the erection, construction and testing is in conformance with procedures, specifications and drawings. The QC section is staffed by a Superintendent of FQC and supported principally by four discipline Assistant Superintendents and a Construction Training Coordinator. All S&W FQC personnel report to the Superintendent who maintains liasion and communication with the site Resident Project Manager and the site QA Program Administrator. The FQC organization reports independently off-site to the Manager of Field Quality Control in the Boston headquarters of Stone & Webster. A number of the superintendents were interviewed by the NRC CAT inspector and they were found to be adequately qualified and experienced to perform their duties.

The staffing of the FQC section numbered approximately 310 individuals and in the inspector's observation these numbers appeared adequate to perform the quality control functions assigned to the section.

(2) FQC Inspector Qualifications

Fifteen random selections of FQC inspector personnel files were made. The sample included four of the inspection craft disciplines. The files for each inspector were reviewed for education, work experience prior to certification, verification of work experience and education, certifications, eye examinations, training received, and other pertinent criteria. In all fifteen cases the qualification of the inspectors reviewed met the ANSI 45.2.6-1978 qualification standard.

It was further determined that the average inspector experience level was over 6 years which is most probably a result of the attention given to the selection process when hiring inspectors and the limited turnover of site FQC personnel.

(3) Inspection Plans

The NRC CAT inspector reviewed a number of QC Inspection Plans (QCIPs) to ascertain if they were sufficiently comprehensive, contained qualitative and quantitative acceptance criteria, encompassed the pertinent attributes of inspected items and included hold points so that critical in-process inspections could be made. The QCIPs reviewed were:

° Electrical Cable Tray Installation

° Mechanical Equipment Installation

° Conduit, Pull and Junction Box Installation

The QCIPs were evaluated to be sufficiently detailed to permit satisfactory QC inspections if properly implemented. Correlating to each QCIP is an inspection report that provides for detailed documentation results of the inspection with the provision for inspector's signature and date of inspection. Inspection results are in such form that they can be readily computer programmed for trending and other analyses.

(4) Trending and Quality Control Report

The NRC CAT inspector reviewed a number of quality related reports generated by the FQC, the S&W Boston Quality Assurance organization and the Construction Control and Completion Program Group (CCCP). These reports were:

° Field Quality Control Department Monthly Report #104

° S&W - Boston Process Averages - Field Inspections Semi-Annual Report - June 25, 1984

° CCCP Monthly N&D and Unsat Report - July 24, 1984

° CCCP Weekly Unsatisfactory Inspection Report - July 3, 1984

° CCCP Weekly N&D and Unsat Summary Report - August 2, 1984

A detailed study of these reports indicates that the Project Management Organization has at its disposal, comprehensive and useful information to permit early detection and correction of construction related quality problems.

The FQC Department Monthly Report includes information such as personnel changes, audits, activities, training, N&D status, inspection planning, document package turnovers, and monthly work discipline graphs of Quality Index Trend Charts for percent acceptance and rejects from inspection attributes contained in the FQC inspection reports. A perusal of these graphs can indicate at a glance the work performance of the various disciplines and where there are trouble or potential trouble areas. The NRC CAT inspector noted that for the last seven months there were zero rejects in the area of mechanical inspections. Interviews with the FQC Superintendent indicated that the data was incorrect and had slipped through the system because the field personnel did not understand the inspection data they were required to submit.

In response to inquiries by the NRC CAT inspector, further FQC review indicated that actual rejections were:

| Month | Accept | Reject |
|---|---|---|
| Jan. | 1095 | 46 |
| Feb. | 1427 | 68 |
| Mar. | 2192 | 167 |
| Apr. | 2067 | 53 |
| May | 2511 | 80 |
| June | 2516 | 107 |
| July | 2438 | 101 |

This report is distributed to various members of the Project Management Organization and to S&W Boston and it indicates that the report may not be getting proper review for project work quality trends. It was further observed that graphing is performed with an ordinate of percent acceptance vs. months rather than percent rejections. Plotting in this matter tends to mask variations in percent rejections and makes it more difficult for reviewers to detect adverse trends.

The S&W Boston Process Averages report is a semi-annual report that depicts with a series of graphs the Calculated Percent Defective for those processes documented on an Inspection Report and which have significant activity during the reporting period. The data for the period is compared to Long Term Calculated Percent Defective, in order to determine long term trends which may be adverse to quality. The report is an excellent device for project management to determine quality trends and institute corrective action. The NRC CAT inspector noted that this useful report is not directly transmitted to GSU management and is treated as an internal S&W document.

(5) Quality Accountability Meeting

The S&W site construction organization conducts a weekly quality accountability meeting to review and implement corrective action for recurring problems or isolated significant instances of unsatisfactory workmanship. The meetings are attended by the responsible construction discipline supervisors, the Resident Engineer or designee and FQC. As a result of such meetings, responsibility is fixed, timely corrective action is implemented and work quality is improved. Subsequent to such meetings a number of craftsmen have been terminated over the past few years because of recurring poor quality work performance.

The NRC CAT inspector attended one such meeting and it was determined that it was performed in a professional and competent manner, the resolutions of problems were technically adequate, and that it was a very useful method of instilling

the requirement for quality work, the first time work was performed, in supervisors and craftsmen.

c. Conclusions

The NRC CAT inspector determined that the overall QC program of the River Bend site is satisfactory to construct the plant in accordance with regulatory requirements.

However, in the area of trending and reporting QC activities, there is need for improvement. The following recommendations need to be implemented:

- Responsible project management need to be more diligent in their review of QC reports, especially the FQC Monthly Department Report.

- Graphing of the FQC Monthly Department Report should be on a reject percentage basis similar to the Process Averages Semi-Annual Report.

3. Control of Measuring and Test Equipment

a. Inspection Scope

The applicant's procedures, program, and their implementation for the control of measurement and test equipment (M&TE) were reviewed and appraised to assure that they satisfactorily meet quality standards and requirements.

b. Inspection Findings

The applicant has delegated the responsibility for executing the Quality Assurance Program for the control of M&TE during the construction phase of the RBS Project to S&W. GSU has retained the responsibility for control of M&TE during the start-up and test and operating phase.

The NRC CAT inspector reviewed the following pertinent procedures to evaluate the effectiveness of the S&W/GSU programs:

- S&W Calibration Program - Quality Standard - 12.1 Rev. C

- S&W Verification of Measured Data - Quality Assurance Directive 12.1 RB

- S&W M&TE Recall and Instrument Status - Metrology Standard 1.3 Rev. B

- S&W Calibration Identification Labels and M&TE Identification Numbers - Metrology Standard - 1.2 Rev. B

- S&W M&TE Procedural System - Metrology Standard - 1.1 Rev. B

- S&W Verification of Measured Data - QA Directive
- GSU Quality Assurance Procedure (QAP)-12 Rev. 2
- GSU Control of Measuring Test Equipment - ADM-0029 Rev. 1

A review of the S&W/GSU procedures, directives, and standards indicated that they were adequate and sufficiently detailed to control the measurement and test equipment if properly implemented. The unique identification numbering system for each M&TE, the associated records, the status cards, and the controls in place to assure proper and timely calibration were evaluated to be adequate.

Interviews with the individuals responsible for the overall S&W/GSU M&TE activities indicated them to be knowledgeable, experienced, qualified, and competent to perform their assigned responsibilities.

The NRC CAT inspector examined the S&W/GSU calibration and storage facilities to determine if they were adequate. Overall the calibration facilities were evaluated to be sufficiently adequate in size, environmental control, and adequately equipped to perform the necessary functions of a measurement and test equipment calibration laboratory. In the GSU calibration laboratory, it was observed that M&TE that had attached reject tags were located in open cabinets between incoming and outgoing serviceable M&TE.

A more desirable method of segregation would be provision for a closed and locked cabinet in a different room location for the storage of rejected or non-serviceable M&TE. In addition, it was observed that a rejected test standard was located in a cabinet with usable standards and while it had been identified with a reject tag, it was not adequately segregated.

A random sample of three working standards utilized to calibrate other M&TE was inspected and each standard had a certificate of calibration that was found to be current and traceable to the National Bureau of Standards. These standards were:

- M&TE No. 10972 - Pressure Gage
- M&TE No. 11140 - Density Strip
- M&TE No. 10089 - Gage Block Set

The utilization of S&W/GSU calibration labels was reviewed in detail to determine their adequacy for the control of the various statuses of M&TE. In the S&W calibration laboratory it was observed that laboratory personnel were using a sealing wax on the zero adjustment of a Simpson Model No. 260-7 multimeter instrument in lieu of a S&W procedural sticker stating - "Notice - Certification Void When Seal is Broken". While it is probable that seal wax is a satisfactory application to prevent tampering, it should not be

utilized except when properly reviewed and incorporated into approved procedures. The NRC CAT inspector was subsequently notified that the use of sealing wax for instrumentation would be reviewed and if satisfactory the S&W procedures would be modified to permit its utilization for specific purposes.

Four, randomly selected, Out of Tolerance (OT) reports for S&W M&TE were reviewed in detail to determine if they were handled in accordance with the proper control procedure. The reports identified the specific problem, documented the corrective action concerning previous use of the test equipment, and indicated a satisfactory disposition of the deficient test equipment. The disposition of the report was in agreement with the governing S&W Quality Assurance Directive - 12.1. The specific out of tolerance reports reviewed were:

- OT No. 4-198-3, M&TE No. 12840
- OT No. 4-221-2, M&TE No. 10441
- OT No. 4-131-1, M&TE No. 12452
- OT No. 4-117-3, M&TE No. 12676

To determine if control of M&TE was existent in the field during in-process work a random sample of four items of equipment were selected in the field and reviewed for adequacy. The M&TE were found to be properly identified, labeled, calibrated, and proper for its intended use. The M&TE were:

| M&TE No. | Item | Calibration Date | Due Date |
|---|---|---|---|
| 12877 | Torque Wrench | 8/15/84 | 10/15/84 |
| 11318 | Torque Wrench | 8/18/84 | 10/18/84 |
| 11316 | Torque Wrench | 8/15/84 | 10/15/84 |
| 12870 | Crimping Tool | 8/11/84 | 2/11/85 |

c. Conclusions

The inspector concluded that adequate measures are in place to assure that M&TE utilized in construction, test, and operating activities that affect quality are properly controlled, calibrated, and adjusted at specified intervals to maintain accuracy. However, there are areas that need to be improved. These are:

- Proper segregation facilities need to be provided for both the S&W and GSU calibration laboratories.

- M&TE should not be modified, or altered except as described in implementing procedures.

4. Audits

a. Inspection Scope

The objective of examination of the audit program was to determine if the Project Management Organization had a sufficiently comprehensive system of audits spanning all the applicable QA elements and contractors. Efforts were also made to determine if auditors were qualified, competent and if audit methodology was in conformance to applicable standards.

To accomplish the reviews, interviews were conducted with the auditing organization managers and auditors, and a sample of audits conducted by the GSU/S&W/GE organizations were reviewed to determine if they met quality standards.

b. Inspection Findings

GSU/S&W/GE have procedures in place and are implementing a comprehensive range of audits to encompass the engineering, construction, testing and vendors site and off site activities.

Four GSU auditors' qualification personnel folders were reviewed in detail and the auditors were found to be fully qualified to the applicable ANSI standards. The personnel folders were readily retrievable and contained all the necessary information to make a determination as to the qualification, certification, and training of each reviewed auditor. Further, interviews were held with a number of the auditors and they appeared to be knowledgeable, experienced and qualified.

The GSU audit schedule for calendar year 1984 was reviewed in detail and indicated all the pertinent information necessary to determine what audits were to be conducted. The audit planning and schedule was deemed to be satisfactory with the exception that site audits of GE were not scheduled for 1984 and while audits of engineering activities of S&W were to be conducted at S&W Boston and S&W CHOC none were scheduled at S&W Toronto where mechanical analysis activities were being conducted in the time frame under review.

The NRC CAT inspector reviewed a total of 13 audit reports by GSU/S&W/GE and determined that in general the audits conducted were well planned, scheduled, auditors oriented, reported and followed up and closed out in compliance with applicable standards. However, it was determined that contrary to GSU QAP-18, Nuclear Quality Assurance Project Directive NQAPD-103 and the PSAR, which require annual audits of the applicable elements of the S&W CHOC and GE (San Jose) activities, specific audits conducted in 1982 and 1983 overlooked specific elements of the S&W and GE Quality Assurance Programs. The criteria missed were:

| Audit Number | Criterion Missed |
|---|---|
| GSU - GES - 1/82 | X |
| GSU - GES - 7/82 | None |
| GSU - GES - 5/83 | VI |
| GSU - GES - 11/83 | None |
| GSU - SWC - 4/83 | VIII |
| GSU - SWC - 10/83 | None |

To determine if corrective action to audit findings were adequate and timely a number of Quality Assurance Finding Reports (QAFRS) were reviewed. Those that were reviewed were found to have timely responses and adequate corrective action. The NRC CAT inspector further reviewed the June 1984 QA Department Activity Report that is prepared and distributed monthly by the GSU QA Department. The report is utilized as a mechanism to track open items, to promote timely follow-up and close out of open items and to act as a report to River Bend Project Management as a status report for corrective action implementation. The report includes a matrix of open QAFRS that indicates that of 186 open audit findings over 87 percent have been open more than 60 days. A determined effort is required by the respective disciplines to close out the audit findings in a timely manner.

Auditor training was reviewed with the Manager and the Training Supervisor. While a review of training records indicated auditors were trained there was no documented training program procedure available nor was there a training schedule prepared.

c. Conclusions

The overall audit programs of GSU/S&W/GE were evaluated to be satisfactory. There are a number of areas that need to be improved:

- GSU needs to periodically review its audit program to be certain that all the elements of 10 CFR 50 Appendix B criteria are included in their audits.
- GSU should periodically audit those organizations that are tasked significant engineering work by the S&W CHOC.
- A specific documented training program and schedule should be instituted for GSU QA auditors.

- Audit findings need to be closed out more expeditiously than the current practice.

5. Quality Concerns

a. Inspection Scope

Three individuals responsible for investigating and making disposition of quality concerns were interviewed, policy statements were reviewed, ten specific concerns were reviewed and the present methodology for disposition was evaluated.

The subject of quality concerns has been previously discussed with the licensee by Region IV senior management.

b. Inspection Findings

The Senior Vice President River Bend Nuclear Group is the senior GSU officer directly responsible for the design, construction and operation of the River Bend Station. He has seen fit to issue, under his signature, a comprehensive Management Statement of Policy that encourages employees to report through either channels, or the Director of Quality Assurance, or him personally or the NRC any known or suspected defect or noncompliance associated with the design and construction of the River Bend Station. This statement of policy; 10 CFR 50, Appendix B, Quality Assurance Criteria; Significant Deficiency Reporting Criteria, 10 CFR 50.55(e); and Reporting of Defects and Noncompliance, 10 CFR Part 21 are printed in a pocket sized manual that is distributed to each GSU employee engaged in the RBS project.—

In addition to the manual, posters are located at site locations directing all employees to report any deficiency through normal channels and to two specific individuals if satisfaction is not obtained. Further, the poster states that a written response will be provided upon request.

The subject matter of the poster has also been incorporated into a 3-inch by 8-inch "flyer" which is periodically inserted into all pay statements of both GSU and S&W employees at the site. The poster and flyer both bear the name of the Senior Vice President River Bend Nuclear Group.

The President of S&W has issued an interoffice memorandum, dated May 4, 1984 to all S&W nuclear projects that any engineer, designer, support group member, construction supervisor, or craftsman who observes a practice or event that may violate a quality assurance measure is expected to communicate this observation to the appropriate supervisor. The memorandum further directs the supervisor to conduct an appropriate investigation, resolve the issue and explain the resolution to the individual who reported the concern in the first place. Also provided is a telephone number where an individual can be contacted on a confidential basis for resolution of employee concerns.

Both GSU and S&W also endeavor to determine employee concerns at times of exit interview. When quality assurance employees leave the project they are individually interviewed to determine whether they have any concerns about work quality. Such interviews have elicited concerns and both GSU and S&W have attempted to resolve such concerns. A record of the interviews and a copy of the resolution report is maintained by the S&W Superintendent of Quality Control and by the GSU Supervisor of Quality Systems. The NRC CAT inspector reviewed samples of allegations maintained by both S&W and GSU to determine if there was programmatic resolution of allegations and if suitable corrective action was implemented and if records were properly maintained. The samples reviewed were found to have been properly dispositioned.

c. Conclusions

The manner in which quality concerns are addressed needs to be improved, made more effective and centralized. At the present time there is no procedure in place to direct GSU, S&W or GE in the handling of concerns. It is recommended that GSU, as the applicant, develop a quality concern resolution procedure to be implemented by all organizations at the River Bend site and that a single point of contact be established and maintained for all documentation relative to concerns. Also that GSU require that specific responses be provided to all individuals raising quality concerns.

6. Test Controls

a. Inspection Scope

The test control program was reviewed to assure that testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and documented, and that the testing is performed in accordance with written test procedures.

b. Inspection Findings

To determine the adequacy of the test control program, both the Preliminary Test Organization and the Start-up and Test Organization implementing procedures and directives were reviewed. The specific items reviewed were:

- S&W Project Test Program Manual
- GSU Start-Up Manual - Test Instruction Numbers 8 and 14
- FSAR Chapter 14
- GSU Quality Surveillance Report - No. SUT 84 - 217 S
- GSU Operations Quality Assurance Manual

- GSU Quality Assurance Instruction - 2.13

- GSU Low Pressure Core Spray System Test Procedure

The S&W PTO is the initial test organization that performs certain functional tests immediately after a system or subsystem identified in a Boundary Identification Package (BIP) is released from construction. The NRC CAT inspector interviewed the PTO Engineer and others in the organization to determine that they were qualified and competent to perform their duties. The size and structure of the organization, the procedures and Quality Assurance/Quality Control oversight appeared to be adequate to accomplish their task. After the S&W PTO has completed its tests, the system or subsystem is transferred to the GSU Start-up and Test Organization. The Assistant Plant Manager responsible for the activities of this organization and other personnel under his supervision were interviewed and found to be qualified and competent to perform their responsibilities.

The test procedure for the Low Pressure Core Spray System (LPCS) was reviewed in detail with the Assigned System Engineer and it was determined that he was knowledgeable in details of the procedure and its implementation requirements. It was also apparent to the inspector that he was experienced in performing test activities and that he had a working knowledge of the characteristics of the system under test. At the time of the NRC CAT inspection the LPCS was in the process of testing by the Start-up and Test Organization. Valve alignment and switching were reviewed in detail with the Assigned System Engineer and were found to be in accordance with the test procedure. It was further determined that the procedure included the requirements of QAP-11, such as:

- Outline scope and condition of test
- Description of component
- System to be tested
- Prerequisites for test
- Test conditions
- Acceptance criteria
- Detailed test method
- Qualifications of test personnel
- Instrumentation required
- Quality Control check lists

As the specific tests are implemented, surveillances are conducted by the Quality Test Group personnel to be assured that the tests are performed in accordance with procedures. A number of Quality Surveillance Reports were reviewed to determine that Quality Assurance was properly monitoring the activities performed during the test.

Subsequent to the completion of each test the results are reviewed and evaluated by the Joint Test Group, a five member oversight group consisting of the Plant Manager, S&W Site Advisory Manager,

the GE Operations Manager, Supervisor Preoperational Test and the GSU Superintendent of Start-Up and Test.

While the test control at River Bend is divided between the construction organization (S&W) for the preoperational test phase and the licensee (GSU) for the start-up and test phase, it appears that the separation is functioning adequately to permit an orderly completion of the test program.

c. Conclusion

Based on the inspection sample, it appears that the overall test control organizations are competently manned, have adequate procedures in place, and are receiving surveillances and audits by Quality Assurance/Quality Control, and that the program should result in a satisfactory conclusion if the procedures and controls are properly implemented.

## A. PERSONS CONTACTED

The following list identifies applicant's representatives and NRC personnel present at the exit meeting, applicant's discipline coordinators for each area, and individuals contacted during the inspection.

### 1. Exit Meeting

#### Applicant and Contractors

C. Ballard
Gen. R. Barrow
D. Barry
V. Barton
T. Bates
R. Beaudet
W. Benkert
R. Birke
J. Booker
R. Breaux
G. Byrnes
W. Cahill, Jr.
D. Castleberry
W. Clifford
D. Collins
D. Cowart
T. Crouse
W. Curtis
J. Davis
J. Deddens
V. Deavers
W. Eifert
R. Fay
R. Ferguson
J. Ford
P. Freehill
C. Goody
P. Graham
T. Gray
J. Green
B. Hall
L. Handy
P. Hanks
R. Helmick
K. Hodges
P. Holden
R. Kelly
J. Lord
R. Lykens
V. Normand
J. Ogea
R. Otis
T. Plunkett
Dr. M. Rathbone
W. Reagles
W. Reed
S. Salowitz
T. Shea
R. Spence
E. Stubbs
K. Suhrke
E. Tomlinson
W. Tucker
R. Turner
D. Whitlock
W. Whittey
L. Young
J. Zullo

#### NRC and Consultants

D. Chamberlain
J. Collins
R. Compton
R. Farrell
D. Ford
G. Georgiev
N. Grace
R. Heishman
K. Hooks
J. Jaudon
P. Keshishian
R. Lloyd
O. Mallon
J. McCormack
T. McLellan
W. McNeil
E. Martindale
W. Sperko
S. Stein
E. Weinkam, III

2. Applicant's Coordinators

a. Overall NRC CAT Coordinators

C. Ballard
R. Birke
R. Spence

b. Electrical and Instrumentation

D. Castleberry
R. Fay
R. Johnson
N. Morohan
R. Otis
T. Shea
A. Stepanovich

c. Mechanical

V. Barton
T. Chitester
D. Cowart
R. Frazier
J. Green
S. Kincer
R. Ludwig
T. Olsen
J. Strickland
M. Turner

d. Welding and NDE

R. Beaudet
P. Gross
D. Scheele
E. Stubbs
L. Stubbs

e. Civil and Structural

V. Deavers
S. Lenox
T. Vears

f. Material Traceability

R. Phebus
D. Whitlock

g. Design Change Controls

W. Curtis
W. Tucker

3. River Bend Personnel Interviewed

W. Anders
J. Balcken
C. Ballard
D. Barry
W. Cahill, Jr.
W. Clifford
J. Curless
W. Curtis
T. Crouse
J. Davis
J. Deddens
F. Finger
R. Fisher
P. Freehill
C. Goody
J. Hamilton
D. Hanks
R. Helmick
K. Hodges
R. Kelly
J. Kirkebo
J. Lord
J. Lozes
R. Lykens
M. Malik
P. Murrill
V. Normand
J. Paueiglo
D. Plant
T. Plunkett
S. Radbaugher
D. Smith, Jr.
W. Smith
R. Spence
W. Sutor
J. Zullo

In addition to the above personnel, numerous other inspectors, engineers, and supervisory personnel were also contacted.

B. DOCUMENTS REVIEWED

The types of documents listed below were reviewed by the inspection team members to the extent necessary to satisfy the inspection objectives stated in Section I of this report. References to specific procedures, specifications, and drawings are contained within the body of the report.

1. Final Safety Analysis Report
2. Quality assurance manuals
3. Quality assurance procedures
4. Quality control inspection procedures
5. Administrative procedures
6. General electrical construction installation procedures
7. General electrical installation specifications
8. General piping installation procedures
9. General piping specifications
10. General mechanical installation specifications
11. General concrete specifications
12. As-built drawings
13. NDE procedures
14. Personnel qualification records
15. Material traceability procedures
16. Procedures for processing design changes
17. Procedures for processing field change requests
18. Procedures for controlling as-built drawings
19. Procedures for processing nonconformances

ATTACHMENT B

## GLOSSARY OF ABBREVIATIONS

| | |
|---|---|
| ADM | Administrative Department Manual |
| AISC | American Institute of Steel Construction |
| ANSI | American National Standards Institute |
| ASC | Automatic Sprinklers Corporation of America |
| ASME | American Society of Mechanical Engineers |
| BBC | Brown Boveri Corporation |
| BIP | Boundary Identification Package |
| BP | Bergen-Paterson |
| CAT | Construction Appraisal Team |
| CB&I | Chicago Bridge and Iron Company |
| CCCP | Construction Control and Completion Program |
| CCRN | Conditional Construction Revision Notice |
| CHOC | Cherry Hill Operations Center |
| CMP | Construction Methods Procedure |
| CPD | Calculated Percent Defective |
| CRD | Control Rod Drive |
| CRN | Construction Revision Notice |
| CSI | Construction Site Instruction |
| EA | Engineering Assurance |
| EAP | Engineering Assurance Procedure |
| E&DCR | Engineering & Design Coordination Report |
| EPA | Electrical Protection Assembly |
| ERT | Equipment Removal Tag |
| ESHC | Equipment Storage History Card |
| FABCD | Final As-Built Control Drawing |
| FDDR | Field Deviation Disposition Request |
| FQC | Field Quality Control |
| FSAR | Final Safety Analysis Report |
| GE | General Electric Company |
| GES | General Electric San Jose |
| GSU | Gulf States Utility Company |
| HCU | Hydraulic Control Units |
| HVAC | Heating, Ventilation and Air Conditioning |
| ICRN | Instrument Change Revision Notice |
| IE | Inspection and Enforcement |
| IEEE | Institute of Electrical and Electronics Engineers |
| IOC | Interoffice Correspondence |
| IOM | Interoffice Memorandum |
| IPCEA | Insulated Power Cables Engineers Association |
| IR | Inspection Report |
| IS | Information Systems |
| LOCA | Loss of Coolant Accident |
| LPCS | Low Pressure Core Spray System |
| MCC | Motor Control Center |
| M&TE | Measurement & Test Equipment |
| MOV | Motor Operated Valve |
| MS | Meteorology Standard |

| | |
|---|---|
| N&D | Nonconformance and Disposition Report |
| NDE | Nondestructive Examination |
| NQAM | Nuclear Quality Assurance Manual |
| NRC | Nuclear Regulatory Commission |
| NRR | Office of Nuclear Reactor Regulation |
| NSSS | Nuclear Steam Supply System |
| OT | Out of Tolerance Report |
| PGCC | Power Generation Control Complex |
| PMM | Project Management Memorandum |
| PSAR | Preliminary Safety Analysis Report |
| PSB | Power Systems Branch, Office of Nuclear Reactor Regulation |
| PTO | Preliminary Test Organization |
| QA | Quality Assurance |
| QAD | Quality Assurance Directive |
| QAFRS | Quality Assurance Finding Report |
| QAIP | Quality Assurance Inspection Plan |
| QAP | Quality Assurance Procedure |
| QC | Quality Control |
| QCI | Quality Control Instruction |
| QCIP | Quality Control Inspection Plan |
| QS | Quality Standard |
| RBP | River Bend Project Procedure |
| RBPP | River Bend Station Project Procedure |
| RBS | River Bend Station |
| RCF | Rework Control Form |
| RCI | Reactor Controls, Incorporated |
| RCIC | Reactor Core Isolation Cooling System |
| RG | Regulatory Guide |
| RHR | Residual Heat Removal |
| RPS | Reactor Protection System |
| RT | Radiographic Test |
| SAR | Safety Analysis Report |
| SEG | Site Engineering Group |
| SEP | Site Engineering Procedure |
| S&W | Stone & Webster Engineering Corporation |
| TDI | Transamerica Delaval Inc. |
| UNSAT | Unsatisfactory |
| UT | Ultrasonic Test |