UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

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

Report No.: 50-382/84-07

Docket No.: 50-382

Applicant: Louisiana Power and Light Company

Facility Name: Waterford 3

Inspection At: Waterford 3, Taft, Louisiana

Inspection Conducted: February 13-24 and March 13-23

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## I. INSPECTION SCOPE AND OBJECTIVES

The objective of this inspection was to evaluate the adequacy of construction at the Waterford SES Unit No. 3 Nuclear Plant. This objective was accomplished through review of the construction program and selected portions of the quality assurance program, with emphasis on the installed hardware in the field.

Within the areas examined, the inspection consisted of a detailed examination of selected hardware primarily in three safety systems 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 inspection, and various crafts.

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

- 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?
- The identification and scope of problems determined as a result of the inspection.

## 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, SAR commitments, and approved vendor and construction specifications and drawings. Additional objectives were to determine whether instructions and drawings, used to accomplish construction activities, were adequate and whether quality-related records accurately reflect the completed work.

### B. Discussion

Three plant systems were selected for examination of electrical construction activities. These were the Containment Spray (CS), Component Cooling Water (CCW), and High Pressure Safety Injection (HPSI) systems. Within these systems attention was given to several specific areas. These included electrical cable, raceways, electrical equipment, instrumentation cable, and instrumentation components. Additionally, a review of a select number of components from other plant systems was performed.

#### 1. Electrical Raceway Installation

##### a. Inspection Scope

Thirty segments of installed Class 1E cable trays, a total length of about 2,000 feet, were selected from various plant areas for detailed examination by the NRC Construction Appraisal Team (CAT). These segments, previously inspected and accepted by the applicant, were inspected for compliance to requirements relative to routing, location, separation, support spacing, identification, protection, and physical loading. Additionally, about 1,500 feet of installed Class 1E conduits were inspected for compliance to specific requirements; such as routing, location, separation, bend radii, support spacing and associated fittings.

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

For a listing of raceway, support, and concrete anchor samples, see Table II-1 of this section.

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

Specification EC-1 "Cable Trays, Cable Bus Ducts and Supports" for Waterford SES No. 3

Fischbach and Moore Quality Control Procedure (QCP) 304 Rev. 2, "Installation of Cable Tray"

Fischbach and Moore QCP-301 Rev. 3, "Installation of Conduit"

Fischbach and Moore QCI-101W3 Rev. 1, "Weld Inspection"

Specification EC-2 "Conduits, Ducts and Supports" for Waterford SES No. 3

b. Inspection Findings

In the area of raceway installations, the NRC CAT inspectors observed that the materials used were as specified, and attributes such as location and size were in accordance with requirements. However, several construction and inspection discrepancies were identified and are detailed in the following sections.

(1) Raceway Separation

The Waterford SES FSAR sections 8.3.1.2.13 and 8.3.1.2.19 contain commitments to Regulatory Guide 1.75-1975 and IEEE Standard 384-1974 for independence of Class 1E equipment and circuits. Section 8.3.1.2.19b states in part:

> Cables used in the plant are flame retardant and are installed in steel ladder or trough type trays or in steel conduit. Therefore, in areas from which missiles and other hazards are excluded, the minimum separation distances of sections 5.1.3 and 5.1.4 of the standard are generally maintained. Where one inch minimum separation cannot be maintained between redundant enclosed raceways and between barriers and raceways, a flame retardant material is used to provide as a minimum the equivalence to one inch separation in air.

Specific acceptance criteria for divisional separation of electrical raceways is further defined in Waterford SES 3 drawing LOU-1562, B-288 Sh. 8, 9, & 10 "Cable and Conduit List Installation Details, Separation Criteria for Raceway Systems."

During the inspection of the selected raceway samples, the NRC CAT inspectors observed cable tray and conduits, as listed in Table II-2, which did not maintain the required separation between divisions. In Table II-2, cable tray or conduits in the left columns do not meet the required minimum separation as installed relative to cable tray or conduits listed in the right columns.

The NRC CAT inspectors reviewed the inspection records for these installations. These were Quality Control Checklists issued by Fischbach and Moore. The records reviewed indicated an acceptable installation. Relative to the attribute of separation, the inspection checklist notes "(That this

item is not required prior to cable pull if a barrier is to be installed at a later date)." However, the NRC CAT inspectors noted that for a number of the records reviewed this item had been signed as acceptable, even though barriers had not as yet been installed and the installed configuration of the raceway was not in compliance with the requirements. An additional sample of some 1,000 inspection records revealed that only 40, or approximately 4%, had associated inspection reports (IRs) for separation deficiencies.

At the time of the CAT inspection, the electrical construction contractor (Fischbach & Moore) had left the site. Responsibility for additional construction activity had been given to Ebasco "Force Account." The NRC CAT inspectors reviewed five Ebasco QA surveillance reports initiated between July 1983 and present, to determine to what degree the attribute of electrical raceway separation had been examined. The review indicated that no deficiencies of separation criteria were found during these surveillances. The NRC CAT inspectors further observed that the surveillances had been performed in many of the same plant areas in which the previously discussed violations had been identified.

In summary, inadequate separation was observed between redundant safety trains and safety to nonsafety installations. Of particular concern were installations which exhibited less than one inch of free air spacing. Based upon the number of deficiencies identified and the associated inspection records reviewed, the NRC CAT inspectors concluded that, relative to raceway separation criteria, the applicant's inspection program had not been adequately implemented.

In connection with this issue, the applicant performed a walkdown of the Cable Vault and "B" Switchgear rooms. The walkdown identified 795 potential separation violations. These were documented on Nonconformance Report (NCR) W3-7621 initiated on February 25, 1984, and subsequently evaluated and reported under the guidelines of 10 CFR 50.55(e) as a "Breakdown of the QA Program" and "Deficiency in Construction."

The NRC CAT inspectors identified an additional concern with regard to a conflict in design document criteria for application of barriers. In general, design drawings indicate that where required separation cannot be maintained between cable trays and conduits, tray covers will be installed. However, NRC CAT inspectors observed that drawing LOU-1564, B-288 Sh. 10, Rev. 5 contains note 6 which states in part:

Solid tray covers have been excluded from areas where a water sprinkler system is provided (i.e., cable spreading area). The details shown on sheets 9 and 10 which utilize solid tray covers to meet separation requirements are still applicable in areas where water sprinkler systems are used, but in these areas the solid tray covers will not be installed.

The NRC CAT inspectors discussed this issue with members of the Ebasco design organization and expressed concern that the use of sprinkler systems as an alternative to tray covers was not in accordance with FSAR commitments. As a result of these conversations Design Change Notice (DCN) E-1441 was issued to further detail separation criteria and to clarify note 6 to read, "Solid tray covers (top or bottom) have been excluded from areas where a dedicated water sprinkler system is provided for the cable trays." In other areas, tray covers will be installed as shown on current drawings.

Further attention is required by the applicant to assure that safety-related raceway installations meet FSAR requirements for independence of equipment and circuits.

(2) Raceway, HVAC Supports

In connection with an issue previously identified by NRC Region IV involving loading of raceways and HVAC supports, the inspection of seismic cable tray and HVAC supports (refer to Section III.B.3) revealed that 18 of 28 supports examined exhibited loads not shown on design documents. The following cable tray supports exhibited this condition:

| | | |
|---|---|---|
| C-459 | C-1406 | C-1435 |
| C-512 | C-1407 | C-1989 |
| C-517 | C-1418 | C-2031 |
| C-574 | C-1420 | C-2318 |
| C-744 | C-1429 | 33E538 |

In accordance with procedure ASP-IV-58, Rev. E, "Attachment to Seismic Supports," added loads are to be reported to engineering for inclusion into the "Seismic Allowable Load Chart." The NRC CAT inspectors observed that none of the additional loads identified had been reported to engineering.

Additionally, NRC CAT inspectors observed that six of the 15 supports listed above contained loads in excess of the stated allowable and should have been individually analyzed by engineering. These supports are:

| | |
|---|---|
| C-1407 | 317% of Allowable |
| C-1418 | 161% of Allowable |
| C-1420 | 249% of Allowable |
| C-1429 | 162% of Allowable |
| C-1435 | 164% of Allowable |
| C-2031 | 151% of Allowable |

As indicated, these procedural violations have been identified by NRC Region IV, which issued a Notice of Violation in inspection report 50-382/83-13 dated April 13, 1983, and by Ebasco QA in their surveillance report EC-MECH-TK-1 dated November 3, 1983. In the applicant's response to the Notice of Violation, dated May 17, 1983, a commitment was made to analyze any additional loads in accordance with procedural requirements and that such action would be completed by August 30, 1983. However, the NRC CAT inspectors found no evidence that this action had been taken, and in fact, the review of Ebasco engineering responses to the referenced QA surveillance report indicate that such action has not been initiated to date.

Additional concerns were identified by the NRC CAT inspectors involving the adequacy of engineering review of added loads. The following concerns were identified:

(a) Field sketches, for six of 15 supports containing unreported loads, inaccurately depicted the as-installed configuration for tabulation of added loads.

(b) Loads added to seismic supports by Ebasco engineering in New York are not being reported on the "Seismic Allowable Load Chart." As such, field engineering may not be aware of all assigned loads when computing additional field-run loads.

(c) In cases where a conduit is directly attached to a cable tray (utilizing the tray as its seismic support), these loads are not being considered when determining allowable additional loading on the hangers which support these trays.

(d) In cases where two or more supports utilize a common vertical member for attachment to the main building structure, the cumulative effect of loads added to both supports does not appear to be considered when determining the maximum allowable loading for the common vertical member.

The procedural deficiencies in this area may have an impact upon the acceptability of seismic support installations. The existing seismic supports are considered indeterminate with regard to conformance to design criteria. Further analysis will be needed to determine the acceptability of present support installations.

(3) Concrete Anchors

Review of Mercury Procedure SP-666 Rev. 8, "Drilled-In Expansion Type Anchors in Concrete for Category 1 Structures", found that the inspection criteria did not include all the significant installation characteristics, such as center to center spacing, anchor to embedded plate spacing, and angularity. No deficiencies were found in the sample of 57 Mercury installed anchors examined by the NRC CAT inspectors. (Spacing deficiencies were revealed by a subsequent NRC inspection team in an expanded sample.)

The NRC CAT inspectors observed that one 1/2-inch anchor supporting isolation panel IP-3MA-S would not achieve minimum torque value of 90 ft-lbs. As a result of this observation the applicant issued Discrepancy Notice (DN) SQ-2878 to document this condition.

One 3/4-inch anchor supporting battery disconnect panel 3A-DC-S would not achieve its minimum torque value of 185 ft-lbs. Subsequently, the applicant issued DN SQ-2879 to document this condition.

The deficiencies noted in this area are considered isolated, and concrete anchors in general conform to specification requirements.

c. Conclusions

Many electrical raceway installations do not meet FSAR commitments for independence of Class 1E equipment and circuits. It was also concluded that the Quality Assurance program had not been effective in the identification of deficiencies is this area.

Seismic support installations are considered indeterminate with regard to conformance to design criteria. Many additional loads were observed that had not been properly considered by the responsible design organization.

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 QC inspectors. The sample included high voltage, power, control, and instrument cables. For each of these cable runs, physical inspection was made to ascertain compliance with applicable design criteria relative to size, type, location, routing, bend radius, protection, separation, identification, and support.

Additionally, the NRC CAT inspectors selected 84 cable ends for examination of terminations. These were inspected relative to the applicable design and installation documents for such items 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. For a detailed listing of cable terminations see Table II-3.

The following high voltage and power cables totaling approximately 2,500 feet were selected from Containment Spray, Component Cooling Water, and High Pressure Safety Injection systems and consist of different electrical trains, locations, and sizes:

| Cable | System | Type |
|---|---|---|
| 30502A-SA | HPSI | 3 1/C #8 |
| 30517A-SA | HPSI | 3 1/C #8 |
| 30612A-SA | CS | 1 2/C #10 |
| 30618G-SB | CS | 1 2/C #10 |
| 30609C-SB | CS | 1 2/C #10 |
| 30610A-SB | CS | 3 1/C 250MCM |
| 30500A-SA | HPSI | 3 1/C 250MCM |
| 30516A-SA | HPSI | 1 3/C #8 |
| 30504A-SA | HPSI | 3 1C #8 |
| 30784B-SB | CCW | 1 3/C #4 |
| 30788A-SB | CCW | 1 3/C #4 |

The following control cables totaling approximately 2,000 feet were selected from various systems, electrical trains, locations, and sizes:

| Cable | System | Type |
|---|---|---|
| 30516F-XA | HPSI | 1 2/C #18 ST. |
| 30516D-SA | HPSI | 1 12/C #14 |
| 30517D-SA | HPSI | 1 12/C #14 |
| 30517B-SA | HPSI | 1 9/C #14 |
| 30611M-XB | CS | 1 2/C #18 ST. |
| 30612E-XB | CS | 1 2/C #18 ST. |
| 30516B-SA | HPSI | 1 9/C #14 |
| 30611N-XB | CS | 1 2/C #18 ST. |
| 30516G-XA | HPSI | 1 2/C #18 ST. |

The following instrument cables totaling approximately 2,300 feet were selected from various systems, electrical trains, locations, and sizes:

| Cable | System | Type |
|---|---|---|
| 30613D-SB | CS | 1 2/C #14 ST. |
| 30534H-SA | HPSI | 1 2/C #14 ST. |
| 30624T-SB | CS | 1 2/C #14 ST. |
| 30612B-SB | CS | 1 5/C #14 |
| 30609D-SB | CS | 1 5/C #14 |
| 30609G-SB | CS | 1 2/C #14 |
| 30613A-SB | CS | 1 2/C #14 ST. |
| 30534G-SA | HPSI | 1 2/C #14 ST. |
| 30624U-SB | HPSI | 1 2/C #14 ST. |

The following documents provided basic acceptance criteria for the inspections:

Specification EC-4 "Cable Installation" for Waterford SES No. 3

Fischbach & Moore QCP-306 "Installation of Electrical Cable"

b. Inspection Findings

(1) Routing

In general, the routing of Class 1E cables through design designated raceway systems was found to be in accordance with specified criteria. However, the routing of several cables, representing approximately 16% of the sample examined, were not as indicated on the applicable pull slip. Examples of deviations include items such as cable tray identifications which did not match those shown on the pull slip, and the use of additional conduits not shown in the routing. The NRC CAT inspectors observed that none of the examples identified exhibited a significant deficiency in construction, but rather that minor construction deviations had not been identified by QC personnel.

(2) Separation

With the exception of raceway separation violations discussed previously, the NRC CAT inspectors observed that cable separation had generally been maintained throughout the facility. The examination of main control boards, auxiliary panels, motor control centers, and other electrical panels revealed only one cable separation deficiency. During the examination of several DC system panels a limited number of deficiencies were identified. In these panels, installations were such that cables of one division were within the six inches required separation envelope or physically ty-rapped to cables of another division. The following panels exhibited these separation deficiencies:

125V DC Pnl #3B-DC-S
125V DC Pnl #3AB-DC-S
125V DC Pnl #3A-DC-S
Battery Charger #3A2-S
Battery Charger #3A1-S

The applicant was informed of this condition and has issued a Potential Problem Report to evaluate installations. The condition listed above is considered to be an isolated case.

NRC CAT inspectors observed cable 30279S-SMC in panel LCP-62 physically bundled with SB cables, in violation of the six inches internal panel separation requirements. The applicant provided previously issued NCR W3-6608 dated July 26, 1983, and DCN E-7231R1 which state that physical separation within this panel is not required. However, this is not in compliance with FSAR Figure 8.3.34 which specifically states that this circuit will be "Electrically isolated and physically separated." As a result of this observation the applicant has reopened the referenced NCR.

(3) Cable Damage

The NRC CAT inspectors observed the following cable installations which exhibited damage to the cable jacket or insulation.

(a) Cable 311886-SB has a damaged jacket where it enters conduit 37858-SB, near penetration 119 in the Reactor Auxiliary Building (RAB) at elevation +21 feet. As a result of this observation the applicant has issued Engineering Discrepancy Notice EDN-EC-1778 for repair or replacement.

(b) Cable 30182Q-NA has been damaged in cable tray P108-NA. As a result of this observation the applicant has issued Potential Problem Report 0018, which recommends replacement of both conductors of the cable.

The conditions listed above are considered isolated and are most likely the result of construction activity which occurred after the installation of electrical cables.

(4) Cable Identification

The NRC CAT inspectors observed that the Waterford SES FSAR takes exception to IEEE Standard 384 for identification of safety cables. This exception allows the use of permanent identification at cable ends alone. Although this method of identification is acceptable, it does hinder prompt verification of cables which may be damaged, or for other reasons must be identified, in areas other than at termination points.

The NRC CAT inspectors observed that, in general, cables had been identified in accordance with the criteria. However, two instances of improper identification were observed as listed below:

(a) Cables 32561J-SAB and 32561K-SAB are not identified at the battery disconnect panel or the station batteries. The applicant stated that these cables were in the process of rework in accordance with DCN-E-654 and would be properly identified at the time of Ebasco rework number 2-17-4-84.

(b) Cable 30517D-SA has no identification tag at Control Panel 8. As a result of this observation Potential Problem Report 0022 was issued recommending fabrication and installation of a new tag.

The instances of improper identification listed above are considered isolated cases.

(5) Terminations

An examination of 84 cable ends revealed that, in general, termination activities had been performed in accordance with procedures and design documents. A detailed listing of terminations examined can be found in Table II-3 of this report.

During the inspection of cable terminations the NRC CAT inspectors identified the following construction deficiencies:

(a) In 4.16kv switchgear 3B3-S, the black conductor of cable 30610B-SB does not meet minimum bend radius required by procedure and design drawings. As a result of this observation the applicant has issued Potential Problem Report 0015, which recommends retraining the cable.

(b) In motor control center (MCC) 3A-313 compartment 9M, cable 31513A-PA does not meet minimum bend radius requirements. As a result of this observation the applicant has issued Potential Problem Report 0024.

(c) At valve 2SI-V1556 the internal wiring to the Limitorque compartment space heater has stranded conductors which are not properly terminated under the lug. The applicant has issued Potential Problem Report 0019 to document this condition.

(d) The termination worksheet for MCC termination of cable 32312D-SA is marked "N/A" for wire stripper, in violation of Construction Procedure (CP) 307, which requires the use of calibrated strippers.

c. Conclusions

In general, cable installations were observed to be in accordance with design documents. With the exception of isolated separation deficiencies, no major hardware deficiencies were identified in the cable runs and terminations inspected.

3. Electrical Equipment Installation

a. Inspection Scope

Over 40 pieces of installed electrical equipment and associated hardware items were inspected. Samples were selected based on system function and safety classification.

The following specific electrical components were inspected in detail:

(1) Motors

The installation of seven motors and associated hardware was inspected for such items as location, anchoring, grounding, identification, and protection. The motors inspected were:

Containment Spray Pump Motor 3B5S
High Pressure Safety Injection Pump Motor 3A4AS
Component Cooling Water Pump Motor 3A2S
Component Cooling Water Pump Motor 3B81S
Aux. Component Cooling Water Pump Motor 3B6S
Component Cooling Water Makeup Pump Motor 311A4MS
Component Cooling Water Makeup Pump Motor 311B4MS

(2) Electrical Penetration Assemblies

The following containment penetration assemblies were inspected:

| | | | |
|---|---|---|---|
| P-119 | P-123 | P-139 | P-148 |
| P-121 | P-135 | P-142 | |

The location, type, mounting, and identification were compared with installation drawings.

(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:

| | |
|---|---|
| HPSI 4160V Breaker | 3A3-S4 |
| CS 4160V Breaker | 3B3-S5 |

The use of circuit breakers with integral undervoltage trip attachments at Waterford SES was investigated.

(4) Switchgear and Motor Control Centers

The following switchgear and motor control centers were inspected:

| | |
|---|---|
| Motor Control Center | 3A313-S |
| 4160V Switchgear | 3A3-S |
| 4160V Switchgear | 3B3-S |
| 4160V Switchgear | 3AB3-S |

These were inspected for items such as mounting configuration, location, weld detail, concrete anchors, and bolting.

(5) Station Batteries and Racks

The 125V battery rooms were inspected including the installed batteries, battery racks, and associated equipment. The location, mounting, installation, maintenance, and environmental controls 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, and proper configuration:

| | |
|---|---|
| Battery Charger | 3A1-S |
| Battery Charger | 3B2-S |
| Static Inverter | 3MB-S |
| Static Inverter | 3MA-S |
| Power Distribution Panel | 3B1-DC-S |

(7) Electrical Panels

The following electrical system panels were examined in detail:

| | |
|---|---|
| Remote Shutdown Panel | LCP-43 |
| Diesel Generator Control Panel | 3B-S |
| Annunicator Control Panel 19 | Bay 6 |
| Control Panel 8 | |
| Auxilary Panel 19 (AD) | |

(8) Motor Operated Valves

Motor operators for the following five valves were examined in detail:

| | |
|---|---|
| Valve 2SI-V1547 | Valve 2SI-V1545B |
| Valve 2SI-V1556 | Valve 2CS-F306B |
| Valve 2SI-V1557 | |

(9) Miscellaneous Equipment

Several additional pieces of electrical equipment were examined. These perform functions within the Component Cooling Water System.

| | |
|---|---|
| Chiller | 3A-SA |
| Chiller | 3B-SB |
| Containment Fan Cooler Unit | 3C-SA |
| Containment Fan Cooler Unit | 3C-SB |

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

Specification EC-7 "Distribution Equipment and Metal Enclosed Bus Installation" for Waterford SES No. 3

Specification EC-12 "Installation of Storage Batteries" for Waterford SES No. 3

Specification EC-18 "Installation of Electrical Penetrations" for Waterford SES No. 3

Fischbach and Moore QCP-311 Rev. 3 "Connecting and Maintaining Safety-Related and Nonsafety-Related Batteries"

Fischbach and Moore QCP-312 Rev. 3 "Installation of Electrical Equipment"

Fischbach and Moore QCP-314 Rev. 0 "Installation of Electrical Penetration"

Ebasco Specification LOU 1564.258 "Containment Electrical Penetrations"

LP&L Maintenance Procedure ME-4-702 Rev. 2 "Routine Electrical Maintenance During Construction Phases"

LP&L Maintenance Procedure ME-4-703 Rev. 1 "Routine Electrical Equipment Inspection and Maintenance"

b. Inspection Findings

(1) Motors

The inspection of Class 1E motors revealed no major hardware deficiencies. Motors examined were of the size, type and configuration shown on design documents. However, the

installation of one motor did exhibit an improper use of fastening materials. Auxiliary component cooling water pump motor 3B5S had been installed using hold down bolts which were of indeterminate material. Deficiencies with regard to the use of fasteners in seismic applications is more thoroughly detailed in Section VI of this report.

In addition to the physical examination of motor installations, the NRC CAT inspectors reviewed maintenance activities for the following safety-related pump motors:

| | |
|---|---|
| High Pressure Safety Injection Pump Motor | 3B3AS |
| Emergency Feedwater Pump Motor | 3A1010A |
| Containment Spray Pump Motor | 3A6S |
| Component Cooling Water Pump Motor | 3A2S |
| Component Cooling Water Pump Motor | 3AB4S |
| Aux. Component Cooling Water Pump Motor | 3B6S |

The inspectors observed that the motors had not been maintained in accordance with procedures. Specifically, the maintenance records indicated that insulation resistance checks (meggers) had not been performed at intervals required. The CCW pump motor 3AB4S received its last megger in October 1982, the auxiliary CCW pump motor 3B6S had been meggered only once (December 1982) between September 1982 and February 1984, and none of the six motors had been meggered later than April 1983.

Although the current revision of Maintenance Procedure ME-4-702 dated October 1982, does not specify a frequency for the insulation resistance test, the NRC CAT inspectors were shown concurrent memorandums with frequencies ranging from monthly to quarterly to once every 18 months. None of these test frequencies, however, are consistent with the maintenance records or with procedure ME-4-703 which replaced ME-4-702 in January 1984. ME-4-703 requires a megger to be performed on motors out of service longer than one month. It also states that the service status of the motors is to be verified with the control room "Out of Service" log, which the NRC CAT inspectors were verbally informed does not exist.

In connection with this issue, electrical maintenance records covering a four month period from September through December 1983, could not be located by the applicant. These records document the electrical maintenance activities for three plant areas and involve over 200 components.

Discussions with the applicant concerning this matter revealed that electrical maintenance activities had not been performed during reorganization of their maintenance group. However, mechanical maintenance records during the period were available for the six pumps listed above.

While inconsistent meggering is not considered by the NRC CAT inspectors to be a major hardware deficiency a similar problem was identified by NRC Region IV which issued a Notice of Violation in Inspection Report 50-382/82-05 dated April 7, 1982. As the violation involved equipment being released by contractors to the applicant, the applicant's corrective action was that after release the equipment would be under their Preventive Maintenance Program. The NRC CAT inspectors found the problem now affects equipment transferred to plant operations.

(2) Electrical Penetrations

Penetrations examined were found to be in accordance with design documents. During the review of penetration documentation, NRC CAT inspectors noted that the review signature of an Ebasco Vendor QA representative on a Conax test data sheet was dated two weeks before they were signed by the Conax technician and the QA supervisor. The Ebasco inspection report for this activity indicates that the tests were performed on the date of his review. Further clarification of this issue will be required by the applicant.

(3) Circuit Breakers

The NRC CAT inspectors observed two 4160V breakers which appeared to have been installed in the wrong cubicles of switchgear 3B3-S. Cubicle 4S contained a circuit breaker labeled as the isolation breaker for CS pump motor B while the switchgear identification for cubicle 4S was low pressure safety injection breaker. Additionally, the breaker in cubicle 5S was not labeled. Upon investigation, the applicant stated that the serial numbers indicate that the breakers had been correctly installed, but mislabeled. LP&L personnel stated that they will correct this condition.

Discussions with the applicant and a review of the response to NRC IE Information Notice 83-18 indicate that no circuit breakers with integral undervoltage trip attachments will be used at the Waterford SES.

(4) Switchgear and Motor Control Centers

The examination of Class 1E switchgear installations revealed several weld detail discrepancies. However, investigation produced a Notice of Violation previously issued by NRC Region IV on this subject.

(5) Station Batteries and Racks

The condition of the battery rooms was found to be in good order. Ventilation systems were installed and in operation. Access to these areas was controlled by keyed entry, and the appropriate danger signs had been posted to prohibit smoking or open flames.

The batteries were examined in detail and found to be in good condition. Maintenance activities had been performed in accordance with requirements.

The inspection of the 125V DC battery racks disclosed that indeterminate bolting material had been used in the assembly process. This issue is discussed in Section VI of this report.

(6) 125V DC System

The inspection of components comprising the 125V DC System revealed no significant deficiencies relative to the installed configuration of the equipment.

(7) Electrical Panels

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

(8) Motor Operated Valves

During the examination of flow control valve 2SI-V1547B-3 NRC CAT inspectors noted approximately 1/4 inch of water in the Limitorque compartment of the valve. At the time of inspection this compartment was sealed and dry on the outside. As a result of this observation, the applicant has issued Potential Problem Report 0019 to evaluate and correct this condition.

The examination of valve 2SI-V1556 revealed vendor wiring problems previously discussed in the Terminations section of this report.

No further construction deficiencies were identified in this area.

(9) Miscellaneous Equipment

The inspection of chillers and containment fan cooler units from the Component Cooling Water system indicated that these items had been installed in accordance with applicable design documents.

c. Conclusions

Certain attributes of electrical maintenance for several Class 1E motors were not performed in accordance with procedural requirements.

The use of indeterminate fastening materials was observed in several seismic bolting applications.

With the exception of the deficiencies listed above, the installation of electrical equipment examined by NRC CAT inspectors was determined to be in accordance with design documents.

4. Instrumentation

a. Inspection Scope

The NRC CAT inspectors selected a sample of instrument components and tubing from the Containment Spray, High Pressure Safety Injection, and Component Cooling Water systems. These were examined relative to the applicable design documents and procedural requirements. A detailed listing of the instrumentation samples examined are given below and in Table II-4 of this section.

Approximately 20 instruments were inspected in detail to ensure proper installation. Attributes inspected included type, nameplate data, mounting, and location.

Ten instrument racks were examined for conformance with requirements, such as installed configuration, concrete anchors, material conformance, identification, and location. The following racks were inspected:

| Rack Number | System | Rack Number | System |
|---|---|---|---|
| C-1A | HPSI | C-2B | CS |
| C-1B | HPSI | C-2C | CS |
| C-1C | HPSI | C-2D | CS |
| C-1D | CS | C-37A | CCW |
| C-2A | CS | C-37B | CCW |

Approximately 1,000 feet of installed instrument tubing and supports were inspected. Conformance to attributes, such as routing, slope, support intervals, and installed configuration were examined.

Additionally, three document packages were selected for review by the NRC CAT inspectors. These had been previously reviewed by LP&L QA in accordance with procedure QP 17.5 "Quality Records Status Review." The Operations Control Report (OCR) document packages reviewed were OCR 289, OCR 1855, and OCR 1880.

b. Inspection Findings

(1) Instruments

Instruments examined by the NRC CAT inspectors were installed in accordance with the design documents.

(2) Instrument Racks

The NRC CAT inspectors observed that rack C-1D contained one Nelson type mounting bolt which was found to be bent 7 degrees out of plumb. As a result of this observation, the applicant has issued Discrepancy Notice SQ-1955 to document this condition.

No other hardware deficiencies were observed in this area.

(3) Instrument Tubing

Tubing from root valve 2RC-V2579 to pressure transmitter PT-102A was observed to have an area of reverse slope, possibly caused by construction traffic. As a result of this observation, the applicant has issued Potential Problem Report 0010 and Condition Identification Work Authorization (CIWA) 006332 to correct this condition.

NRC CAT inspectors observed that tubing support 1647-7 was unbolted from the wall and hanging from the tube track. A review of applicable records indicated that the support had been disassembled without proper authorization. As a result of this observation, the applicant has issued DN SQ-1990 to document this condition.

Tube coupling welds in lines from flow transmitter CC-5570AS are not staggered per requirements. The applicant has issued Potential Problem Report 0091 to document this condition.

Tubing lines PT-SI-0311 and PT-SI-0313 were found to have coupling welds which were not staggered in accordance with requirements and tubing clamps missing in the Reactor Containment Building (RCB) between elevations +46 feet and +80 feet near the Safety Injection Tank. The applicant had previously issued DN SQ-1617 to document missing clamps but had failed to identify the unstaggered coupling welds. As a result of this observation, Potential Problem Report 0023 was issued to document these welds.

An abandoned concrete anchor hole was observed too close to a tubing support at RCB +47 feet, in violation of concrete anchor spacing criteria. The applicant has issued DN SQ-2059 to document this condition.

(4) Document Packages

The review of instrumentation document packages revealed no significant errors in documented information and no obviously missing required documentation. Included in the packages were the following documents:

Weld history records
Material traceability information
Visual weld inspection
Liquid penetrant inspection
ANI review
Code data sheets
As-built red-lined drawings
Applicable design change documents
Applicable nonconformance/deficiency reports.

c. Conclusions

The identified deficiencies do not appear to be individually significant or overly repetitive. The overall examination of instrumentation components indicated that installations generally conform to design documents.

TABLE II-1

RACEWAY AND SUPPORT INSTALLATION

Conduit Supports

| | | |
|---|---|---|
| 33E534 | 33E538 | F1053 |

Plus 30 non-engineered supports for general conditions. These supports do not have individual identification.

Tray Supports

| | | |
|---|---|---|
| C-449 | C-574 | C-1429 |
| C-459 | C-744 | C-1435 |
| C-482 | C-1406 | C-1989 |
| C-512 | C-1407 | C-2031 |
| C-514 | C-1418 | C-2318 |
| C-517 | C-1420 | |

Raceway

| | | |
|---|---|---|
| L101C-SA | C201B-SA | C205B-NA |
| P101C-SA | P201B-SA | C205E-NA |
| C102-SA | L201D-NA | C205M-NA |
| C102-SB | C202-SA | C205S-NA |
| P104-SB | C202-SB | C206K-NB |
| C105M-NA | C202B-SB | C206M-NB |
| C106-SA | C203-SB | 31551H-SA |
| C106D-NB | L203B-NA | 31551T-SB |
| C114-NB | L204-NA | 35261-SB |
| L201-SA | L204B-NA | |
| C201A-SA | P204B-NA | |

Concrete Anchors

| Number | Size (Inches) | Contractor |
|---|---|---|
| 34 | 3/8 | Mercury |
| 15 | 1/2 | Mercury |
| 8 | 3/4 | Mercury |
| 35 | 3/4 | Fischbach and Moore |
| 26 | 1/2 | Fischbach and Moore |
| 19 | 3/4 | Fischbach and Moore |

TABLE II-2

SEPARATION VIOLATIONS

| This Raceway | Violates Separation | With This Raceway | This Raceway | Violates Separation | With This Raceway |
|---|---|---|---|---|---|
| C205B-NA | | C202-SA | 35073B-NB | | C202-SB |
| C206K-NA | | L202-SB | 30001D-PA | | 34324-NA |
| C106-SA | | C114-NB | 3H051BA-SB | | 3H051AA-SA |
| L202B-SA | | C206M-NB | 3H051AB-SA | | 39148-NA |
| L201B-SA | | C205B-NA | 37855-SMB | | 36231-NB |
| 31551H-SA | | 31551T-SB | 37666-SMB | | 36379-SMA |
| P104-SB | | 30285E-NA | 32596B9-SA | | 3112981-SB |
| P104-SB | | 30285C-NA | 31246A-SB | | 31243A-SA |
| P104-SB | | 32087E-NA | 31246B-SB | | L208-NB |
| P104-SB | | 30287C-NA | 31243B-SA | | 31246A-SB |
| C106D-NB | | C102-SB | 31243B-SA | | 35223-NB |
| L201B-SA | | C205M-NA | 31246A-SB | | 35D51A2-NA |
| C205M-NA | | C201B-SA | 32661D-SB | | 37709-NB |
| C205M-NA | | P201B-SA | 39956-SB | | 36225-NB |
| L203B-NA | | C201B-SA | 39956-SB | | 36226-NB |
| C205L-NA | | L201-SA | L201D-SA | | 30203L-NB |
| C201A-SA | | C205E-NA | L201D-SA | | 35210H-NA |
| C201A-SA | | P204B-NA | 39559-SA | | 34004-NAB |
| C201A-SA | | L204-NA | 39787-SA | | 398228-NB |
| C201A-SA | | 37798-NA | C202E-SB | | 3100X-NB |
| C201A-SA | | 31172K-NB | C202D-SB | | 311004-NB |
| C202-SA | | P204B-NA | C202D-SB | | C201C-SAB |
| 35261-SB | | C102-SA | 39578-SA | | 39821-SB |
| C102-SA | | C103-SB | 38743-SMC | | L203-NB |
| C102-SA | | 32807R-NA | 38743-SMC | | L203D-NA |
| C102-SA | | 32807S-NA | 35369-SB | | L203D-NA |
| C102-SA | | 32810X-NA | 37963-NA | | C201-SAB |
| C102-SA | | 32810Y-NA | 39851-SAB | | 3CPR005-NA |
| C102-SA | | 32810H-NA | 3952L-SMA | | 39516A-SMD |
| C102-SA | | 32810S-NA | 37243-SMD | | 37691-NB |
| C102-SA | | 32812N-NA | 37172-SMA | | 30199M-NA |
| C105M-NA | | C101C-SA | C204A-SA | | 36941-NA |
| C205-NA | | C202-SA | C204A-SA | | 36942-NA |
| C203-SB | | C202-SA | 37666-SMB | | 37091-NA |
| 32847F-NA | | C202-SB | 37666-SMB | | 36786-NB |
| 3FD30A-NA | | 31509K-SB | | | |

TABLE II-3

CABLE TERMINATIONS

| Cable Number | Number of Conductors | Cable Number | Number of Conductors |
|---|---|---|---|
| 30275E | 3 | 30788F | 9 |
| 30500A | 1 | 30789F | 9 |
| 30502A | 1 | 30790F | 9 |
| 30516A | 3 | 30791F | 9 |
| 30516B | 9 | 30792F | 9 |
| 30516D | 12 | 30793F | 9 |
| 30516F | 2 | 30794F | 9 |
| 30516G | 2 | 30795F | 9 |
| 30517A | 1 | 30802E | 8 |
| 30517B | 9 | 30811E | 6 |
| 30517D | 12 | 30815E | 6 |
| 30534G | 2 | 30848E | 9 |
| 30534H | 2 | 30852D | 6 |
| 30609C | 2 | 31135G | 11 |
| 30609D | 5 | 31136G | 11 |
| 30609G | 2 | 31525K | 3 |
| 30610A | 1 | 32315H | * |
| 30611M | 2 | 32316F | * |
| 30611N | 2 | 32316N | * |
| 30612A | 2 | 32318A | * |
| 30612B | 5 | 32319J | * |
| 30612E | 2 | 32320G | * |
| 30613A | 2 | 32323M | * |
| 30613D | 2 | 32324M | * |
| 30618G | 2 | 32327F | * |
| 30624T | 2 | 32366F | * |
| 30624U | 2 | 32366N | * |
| 30731F | 9 | 32368H | * |
| 30732F | 9 | 32368R | * |
| 30733F | 9 | 32370G | * |
| 30734F | 9 | 32373E | * |
| 30735F | 9 | 32373G | * |
| 30736F | 9 | 32387F | * |
| 30737F | 9 | 32716C | 5 |
| 30738F | 9 | 32716D | 8 |
| 30739F | 9 | 32716E | 6 |
| 30740F | 9 | 32717C | 5 |
| 30741F | 9 | 32717D | 8 |
| 30742F | 9 | 32717E | 6 |
| 30743F | 9 | 32719C | 5 |
| 30744F | 9 | 32719D | 8 |
| 30788A | 3 | 32719E | 6 |

* Emergency Diesel Generator Control/Relay Panels

TABLE II-4

INSTRUMENTATION

Instrument Tubing

| Instrument/Location | Tubing Length (Feet) |
|---|---|
| FT-CC-5070BS/C101B | 120 |
| FT-CC-5570AS/C27A | 110 |
| FT-CC-5570BS/C27B | 110 |
| FT-CC-6950BS/C90B | 50 |
| FT-CC-7070AS/C37A | 136 |
| PT-CC-7072AS/C37A | 100 |
| PT-CC-7072BS/C37B | 40 |
| FT-CC-7074AS/C37A | 90 |
| PT-RC-0102A/C-1A | 60 |
| PT-RC-0102B/C-1B | 60 |
| PT-RC-0102C/C-1C | 84 |
| PT-RC-0102D/C-1D | 100 |

Instruments

| Instrument Number | Type |
|---|---|
| PT-RC-0102A | Pressure Transmitter |
| PT-RC-0102B | " |
| PT-RC-0102C | " |
| PT-RC-0102D | " |
| PT-CA-6701SMA | " |
| PT-CA-6701SMB | " |
| PT-CA-6701SMC | " |
| PT-CA-6701SMD | " |
| PT-CA-6702SMA | " |
| PT-CA-6702SMB | " |
| PT-CA-6702SMC | " |
| PT-CA-6702SMD | " |
| FT-CC-5570AS | Flow Transmitter |
| FT-CC-7070AS | " |
| FT-CC-7074AS | " |
| LS-CC-7011AS | Level Switch |
| LT-CC-7010AS | Level Transmitter |
| RE-CC-7050AS | Radiation Element |
| RE-CC-7050BS | " |
| TE-CC-7560A2S | Temperature Element |
| TE-CC-7570A2S | " |

# III. MECHANICAL CONSTRUCTION

## A. Objective

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

## B. Discussion

The specific areas of mechanical construction evaluated were piping, pipe supports and restraints, mechanical equipment, and heating, ventilating, and air conditioning (HVAC) systems. To accomplish the objective, a detailed 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

Twelve piping isometric drawings for approximately 1000 feet of Class 2 and 3 piping were selected, and the installed piping inspected for conformance to design requirements. The piping was examined for proper configuration with respect to piping and stress isometrics, valve identification, valve and valve operator orientation, clearances between piping and structures, and support and restraint function and location. See Table III-1 for a listing of the piping inspection sample.

Thirty-four hydrostatic/pneumatic test record packages were reviewed for completeness, accuracy and proper disposition of identified problems. In addition, one pipe bend record package was reviewed.

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

- Ebasco Specification LOU 1564.100, "Station Piping, Hangers and Supports"
- General Specification PC-1, Rev. 4, "Instructions for Erection of Process Piping and Supports"
- Ebasco Procedure ASP-IV-82, "Design Review of Safety-Related As-Built Pipe Support Installation Drawings Submitted to ESSE"
- Ebasco Procedure ESSE-SA-PR-4, "Methodology for the Search and Evaluation of Seismically Induced Interactions"

- Ebasco Procedure ESSE SA-PR-08, "Evaluation Criteria for Discrepancies Reported During Final Walkdown for Piping Systems"

- Applicable as-built piping isometrics and current stress isometrics

- Tompkins-Beckwith (T-B) Procedure TBP-36, Rev. B and C, "Hydrostatic - Pneumatic Test Procedure"

b. Inspection Findings

In general, the inspected piping runs were found to conform to as-built drawings and current stress isometrics. See Table III-1 for a listing of the specific observations.

Discrepancies were noted where three valve weights specified on the stress isometric were less than actual weights. A review of the stress calculation for this problem revealed that the reviewer for the final as-built stress analysis calculation had noted the error and reran the calculations. However, the stress isometric had not been corrected to reflect actual weights. The NRC CAT inspectors noted that several instances of errors on stress isometrics were also identified during the "7400 Walkdown" of supports/restraints per Procedure ASP-IV-138 in late 1983. Approximately 100 of the total of 400 stress problems have been worked on-site (as opposed to the Ebasco New York office). Stress isometrics were not always updated for minor changes. The NRC CAT inspectors are concerned that discrepancies in stress isometrics and the possible accumulation of unincorporated minor changes could significantly affect stress analysis or design decisions. These findings indicate that the applicant, Louisiana Power and Light (LP&L), should verify the accuracy and adequacy of information on Ebasco stress isometrics, and the interface between site and home office stress analysis organizations.

Drawing peculiarities were also noted on several stress isometric drawings. Stress isometrics showed dead weight supports such as rod hangers and box guides with no top member (which cannot be used to restrain upward loads) as vertical restraints. However, a check of approximately ten of these supports verified that, because of the low seismic loadings at Waterford, the net loading at these supports was downward. Seismic uplift loads were approximately one-third of dead weight loads.

Several instances were noted during the piping walkdown and support/restraint inspections where the clearance between piping and adjacent structures did not meet the criteria specified in Design Change Notice (DCN) NY-MP-804. Most of these instances had been previously identified by various walkdown activities and resolved by engineering. Region IV inspectors had issued a Notice of Violation in April 1983, citing the lack of acceptance criteria for potential clearance problems. The applicant, in the response

to the violation, stated in May 1983 that DCNs had been issued to preclude occurrence of clearance problems in future installations. These DCNs required that contractors notify and obtain approval from Ebasco engineering prior to installing anything that violated specific clearance criteria. However, when requested by the NRC CAT inspectors, no evidence could be provided of any occurrence where prior approval had been requested or obtained since the issuance of the DCNs in early May 1983. A review of walkdown documentation which identified clearance concerns revealed that the concerns had been dispositioned in a reasonable engineering manner. However, it did not appear that contractors were following procedures for prior identification and approval of interferences, nor were commitments to the NRC met to assure that all post-walkdown interferences were properly identified and evaluated.

Regarding the hydrostatic/pneumatic test packages which were reviewed, each record package contained a documentation deficiency report (Form 9.2) which contained numerous concerns and open items regarding the acceptability of each package. The deficiency reports which were initiated by Ebasco Quality Assurance Installation Records Group (QAIRG) personnel were dated in the time frame between January, 1982 and January, 1984. The deficiencies included overpressurization of piping segments, missing records or forms, underpressurization of piping segments, welds completed after hydrostatic testing, actual test pressures which did not agree with the test pressure stated on the drawing, improper temperature of the testing fluid, date discrepancies in records, and inadequate number of pressure gauges used during the test.

Each of the deficiency reports had been closed out, and the test packages found acceptable and complete based upon the referencing of Ebasco Memorandum W3-QAIRG-1191. This internal Ebasco memorandum was actually a summary of unresolved deficiencies identified in the deficiency reports of various test packages. This memorandum also contained brief, handwritten nondescript closures for some deficiencies. Other unresolved deficiencies were not addressed. Further, many deficiencies and even hydrostatic/pneumatic test packages which were not identified in Ebasco QAIRG-1191 were nonetheless closed out by referencing the memorandum. Thus, it could not be assumed that the memorandum was inclusive of all deficiencies of all test packages. A number of identified deficiencies referred to Ebasco Site Services Engineering (ESSE) memorandums for additional information. These ESSE memorandums, in actuality, were speed letters (non QA documents) which contained requests for information and responses that required engineering dispositions or changes to QA documents.

Overall, the dispositioning of deficiencies was in a manner which resulted in a fragmented documentation trail.

Clarification regarding the technical adequacy and aspects of the tests, appropriate documentation, and test pressure discrepancies were provided during a meeting between NRC CAT inspectors and applicant representatives. Due to the quantity of these discrep-

ancies, a documentation trail was reconstructed which verified that engineering evaluations regarding overpressurization and test pressure discrepancies had been performed for the sample which the NRC CAT inspectors had selected. However, the NRC CAT inspectors are concerned about the apparent inattentiveness by Ebasco and T-B regarding the continual misapplication of test pressures. It is evident that adequate attention had not been directed toward the formal documentation, justification, resolution, and trending of this problem, nor toward the dissemination of information to QC and engineering test personnel. Weld number FW3RW3R1, which was identified to have been completed after the date of the hydrostatic test of package TB-59-3-RO Retest 1 (BHTN-11-0015), was determined to have been a weld repair which entailed the deposition of weld filler metal on top of an existing pressure boundary weld. The addition of filler metal was required as directed by the disposition of NCR-W3-5760, "Undersized Schedule 80 Sockets Welds." This NCR was of generic concern. The applicant took the position that a rehydro of the system in this case was not required based on the provisions of ASME Section III 1974, Subsections NB, NC and ND, Paragraph 4436 (Summer Addendum, 1976). The NRC CAT inspectors did not determine the status of other welds that were identified as having been completed after the date of the hydrostatic test. Some deficiencies such as not having the required number of pressure gauges, and the package not containing the required forms were confirmed to be deficiencies, thus the deficiencies were improperly resolved. These findings should be reviewed by the applicant and further verification of acceptability of the resolution of these deficiencies made.

One pipe bend record package regarding eight 1-inch diameter pipe segments was reviewed. The pipe bends on isometric drawing LW3-MS-4 were formed on a qualified machine and shoe. However, Ebasco QA discovered that adequate QC during the bending process had not been performed. NCR W3-5989 resulted, and acceptability of the bends per ASME Code requirements were subsequently verified.

c. Conclusions

No major deficiencies were identified in the inspected piping runs, the pipe bend records, or in the technical adequacy of the hydrostatic/pneumatic tests. However, the NRC CAT inspectors have an unresolved question concerning the accuracy and acceptability of stress isometrics, and consider that pipe to structure clearance problems were not handled as committed in a response to a Notice of Violation.

A concern also exists regarding the documentation of the dispositions for identified deficiencies in the hydrostatic/pneumatic testing program. The NRC CAT inspectors are concerned that each deficiency may not have been evaluated upon its own merit as evidenced by the use of the "generic" internal memorandum, which was even referenced against deficiencies that were not discussed in the memorandum. Tompkins-Beckwith Procedure TBP-37 is not

entirely specific in that it allows for interpretation as to what documents (forms) are required to be in the test packages. Further, justification of the resolution for each of the identified deficiencies have not been adequately or properly documented. The NRC CAT inspectors also question the adequacy and effectiveness of T-B's and Ebasco's test program overview, and corrective action efforts in light of the numerous applications of incorrect test pressures and overpressurization.

2. Piping Supports/Restraints

a. Inspection Scope

Twenty-four ASME Class 1, 2, and 3 safety-related supports/restraints representing a variety of types, sizes, systems and locations were selected for inspection. These supports/restraints were inspected for configuration, clearances, member size, identification and damage. In addition, approximately 150 other supports/restraints were observed at random in the field for obvious deficiencies such as loose or missing fasteners, improper clearances, angularity, improper locking devices, disassembled items and damage. See Table III-3 for the pipe support/restraint inspection sample.

Five documentation packages that had been turned over to and accepted by LP&L Quality Assurance (QA) (CCRR-20, BMRR-3059, CHRR-471, CSRR-259 and CCRR-1175) were examined for completeness and accuracy.

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

- General Specification PC-1, "Instructions for Erection of Process Piping and Supports"
- FCR-MP-1625, Rev. 3 (Locking devices)
- FCR-MP-1553, Rev. 8 (Instructions for erection of process piping and supports)
- NCR-W3-3776 (Gaps for chart analyzed box restraints)
- NCR-W3-2644 (Gaps for box restraints)
- FCR-MP-1730 (Sway strut installation criteria)
- Bergen Patterson and Pacific Scientific catalogues
- Applicable redlined, as-built support/restraint detail drawings.

b. Inspection Findings

Three discrepancies were noted between installed hardware and as-built drawings for the primary sample of inspected supports/restraints. On one restraint, two tube steel members exhibited 3/8-inch wall thickness instead of 1/2-inch as shown on the drawing. One strut end bracket was of a different catalogue item than specified on the drawing. One weld connecting a support end bracket to an embedded plate was undersized by approximately half as specified on the redline drawing. The undersized tube steel was evaluated by site engineering and deemed acceptable. The undersized weld was a redlining inspection error, and conformed to the weld size specified on the previous revision of the drawing. Thus, none of these conditions were considered by the NRC CAT inspectors to be a structural problem.

For the supports/restraints inspected at random, numerous discrepancies were identified. These discrepancies included items that could reasonably be expected to occur to some extent as a result of ongoing construction and testing activities; loose locknuts, strut and snubber angularity exceeding tolerances, disassembled struts with no authorizing or rework documentation, and bent or broken items. However, many discrepancies which were noted should have been identified during a thorough construction inspection program. These included U-bolts cinched down tight that were specified as a sliding fit on the drawing, improper clearances on box guides, improperly installed or missing strut bearings and washers, some of the strut and snubber angularity problems, and unspread cotter pins. Table III-4 provides a listing of specific observations. Numerous discrepancies were noted on supports/restraints in the Component Cooling Water, Containment Spray, and Safety Injection Systems, which were not listed in this report due to prior identification by an LP&L QA special surveillance conducted just prior to the NRC CAT inspection.

Since 1980, a variety of problems with the conformance of installed pipe supports/restraints to design drawings and redlined as-builts have been identified by site personnel. Reinspection and corrective action programs have been implemented to resolve these concerns. Nonconformance Report (NCR) 2644 required documentation and evaluation of as-built gaps for box restraints (ca 1981). NCR 4010 first required an evaluation of as-built configurations. Later, NCR 4010 was revised to include a reinspection and evaluation of as-built features. The total reinspection effort involved approximately 4000 supports (ca 1982-1983). A sample walkdown of approximately 200 supports per QAI-20 was performed in mid 1983. A reinspection of all installed supports (approximately 7400) was performed in late 1983. An LP&L QA walkdown of three systems just prior to the NRC CAT inspection identified over 300 deficiencies or potential deficiencies on approximately 600 supports/restraints. In addition, several other walkdowns, inspections, and surveillances have been conducted by Ebasco and

LP&L QA, Ebasco engineers, and the LP&L Independent Safety Engineering Group. These inspections have produced changes to drawings, inspection criteria, and as-built procedures. A Comprehensive Area Walkdown Program per procedure ASP-IV-141 was implemented during the NRC CAT inspection during which numerous problems were identified and corrected. The types of problems being noted during the latest support/restraint inspections, while numerous, did not appear to have great technical significance. While a number of deficiencies are of the type that could have been expected as a result of ongoing construction and testing activities, there are many that should have been previously detected. The NRC CAT inspectors noted that most of the support/restraint reinspections were performed by engineering personnel rather than certified QC inspectors, and that the inspection criteria and scope of these reinspections varied greatly from detailed inspections of all features, to detailed inspections of some features, to a general check for obvious damage or defects.

The NRC CAT inspectors are concerned that, even with this long series of inspections, numerous problems requiring evaluation or rework are still being identified in QC accepted components.

The NRC CAT inspectors reviewed the Comprehensive Area Walkdown Program procedure ASP-IV-141, interviewed personnel involved in the walkdown and observed field activities. This procedure was intended to identify and resolve remaining work items for all disciplines in each area of the plant by a complete "hand over hand" inspection. The procedure contained inspection checklists for each discipline. A number of concerns were identified during the review of the program. Engineers performing inspections in the field did not have copies of the procedure for reference and were not knowledgeable of the procedural requirements or other acceptance criteria with respect to the inspection of U-bolt restraint installations. In addition, there did not appear to be adequate means to assure that all features within a specified inspection area were indeed examined (i.e., use of layout or isometric drawings, line lists). Snubber/strut inspections did appear to be thorough; a separate checklist was prepared for each restraint to assure 100% inspection coverage. As with most of the previous "inspection" programs, the inspection and hardware acceptance activity was being performed by engineering personnel. QA/QC involvement was limited to acceptance inspections after corrective actions were performed on punchlisted items. LP&L QA personnel had performed a surveillance at the very beginning of the area walkdown, identified problems and stopped all work to correct them. However, follow-up on corrective actions and overall QA involvement in the program was not sufficient to identify the problems noted by the NRC CAT inspectors.

Minor discrepancies were noted in three of the five documentation packages reviewed. On CSRR-259, there were no ESSE signatures for redlines, no final ESSE review signature, and redlines that were not initialed and dated (Section A-A, revised loads, "looking southeast"). Ebasco engineering personnel were aware that a

number of packages on containment spray restraints located on the containment dome required further review and ESSE signatures. However, these packages had been included in transmittals that had been forwarded to and approved by LP&L QA. On CCRR-1175, it was noted that a Tompkins-Beckwith engineer had apparently redlined the drawing to delete pipe side welds from a box restraint. This type of change, although apparently approved by ESSE review of the final as-built drawing, should have originally been formally authorized by design change documents. On CCRR-20, the redline for weld W1 had two weld segments reversed from the position shown on the ESSE disposition of NCR 4010.

The decision to place all redline and as-built information on one specific revision of a drawing without updating these changes into the latest drafting revision, combined with the number of reinspections and as-built redlines, resulted in many drawings that were very cluttered with changes. These marked up drawings made determination of actual as-built, designer approved configurations and timeliness and completeness of approval signatures very difficult. In many cases, existing drawings were redlined to reflect changes provided by design on subsequent revisions and these superceded, but redlined, drawings were used for construction and inspection rather than the latest issued drawing revision.

The Ebasco document review procedure and checklist appeared to be extremely thorough and exhaustive. The NRC CAT inspectors went through a typical package review with two Ebasco document reviewers who appeared to be familiar with procedural requirements. The NRC CAT inspectors also audited the LP&L QA review process. Although the LP&L QA sample review of these packages were not as formally detailed or proceduralized as those of Ebasco's, they appeared to be thorough.

At the time of the NRC CAT inspection, the Ebasco QAIRG review of support/restraint documentation packages was essentially complete. The LP&L QA review was continuing. Because an entire transmittal of packages (50-65 packages) would have been rejected by LP&L QA if one package reviewed (from a sample of six to 10 packages) was rejected for a potential hardware impacting reason, approximately 60% of the total packages transmitted to LP&L had been rejected back to Ebasco. LP&L QA has not reviewed the resubmittals of those rejected packages.

c. Conclusions

No extensive structural integrity problems were identified on installed and accepted support/restraints. However, inspection efforts have not been totally effective in assuring that hardware have been properly installed, and installed as shown on design approved as-built drawings. The NRC CAT inspectors' concerns about the level of confidence provided by these programs are based on the following points:

(1) The number and types of deficiencies identified in present field installations by both the NRC inspectors and site personnel (QA and engineering).

(2) The rather fragmented inspection program reacting to identified problems with changing scope and inspection criteria, and variable inspection results and conclusions.

(3) Dependence on engineering personnel to perform acceptance inspections for many of the "reinspection" activities without a continuing, consistent, and controlling QA involvement in the reinspection programs.

(4) Inadequacies identified in the current Comprehensive Area Walkdown Program.

(5) The condition of redlined as-built drawings and the unresolved items identified during the LP&L QA documentation review.

3. Heating, Ventilating and Air Conditioning (HVAC)

a. Inspection Scope

Eleven seismic restraints, nine fire dampers and approximately 200 feet of ducting were selected and field inspected by the NRC CAT inspectors. Features verified were location, configuration, member size, duct joint gasketing and bolting, and free operation of fire dampers. Inspection checklists and as-built drawings were reviewed for three HVAC restraints. See Table III-5 for a listing of inspected items.

Also reviewed were installation packages for six safety-related HVAC components, including duct work, representing three systems. The packages were reviewed for completeness, accuracy and clarity. This equipment also received field checks for condition, location and configuration.

The following documents provided the acceptance criteria for HVAC hardware installations:

° Ebasco Specifications LOU 1564.744 and 1564.744a "HVAC Plant Installation - Nuclear Safety and Non-Nuclear Safety"

° Ebasco and Waldinger Corporation Sheet Metal Standards

° Ebasco HVAC Design Drawings

° Waldinger Corporation Construction Drawings

° FCR-HVAC-247, Rev. 1

b. Inspection Findings

HVAC systems were designed by Ebasco. The Waldinger Corporation (TWC) prepared construction drawings based on Ebasco design drawings providing necessary details for fabrication and installation of hardware. Most HVAC supports were fabricated and installed by TWC. Prior to completion of the HVAC contract, work activities were assumed by Ebasco. In most cases duct erection and connection to restraints were performed and inspected by Ebasco.

In general, HVAC duct, restraints and fire dampers were found to be installed in accordance with design requirements. However, it was found that clip angles used to attach restraint members to embedded plates had, in many instances, been modified (shortened) from sizes specified on construction drawings because of the location of the attachment point near the edge of embedded plates. A similar problem was noted where the ends of angles were welded to plates on three sides (all that is specified on design drawing typical details), but are specified on TWC installation drawings as welded on four sides. These restraints had been inspected by TWC in accordance with TWC Field QC Procedure (FQCP) 10.2-3, which specified inspection only to "fabrication tickets." Inspection checklists completed by both TWC and Ebasco listed the TWC construction drawing as the document to which installation was inspected. The TWC construction checklist reviewed by the NRC CAT inspectors did not list any applicable change documents such as DCNs, Engineering Change Notice (ECNs), Field Change Request (FCRs) or redlines; nor was reference made to shortening of angle clips, or reducing weld length or configurations within tolerances allowed by Ebasco design details.

FCRs HVAC-136 and HVAC-247 were issued subsequent to many of the TWC installation and attachment inspections to provide acceptance criteria for "deviations from design documents due to discrepancies or field interferences." Neither FCR directly addressed the two types of discrepancies observed by the NRC CAT inspectors; but HVAC-247 did permit alteration of construction drawing specified clip angle sizes for "member to member" connections, and the shortening of specified weld lengths within the limits specified by the design drawings. Regardless, FCRs HVAC-136 and HVAC-247, and Ebasco Procedure ASP-IV-47 "Control of As-Built Information for HVAC Duct and Supports" require redlining of construction drawings and ESSE approval for the minor changes allowed by these FCRs. This redlining was not performed for five of 11 restraints inspected by the NRC CAT inspectors.

It should be noted that as-built drawings for HVAC restraints consisted only of a construction drawing with a reference listing of change documents and redlines, rather than a redlined or redrawn configuration.

In summary, although apparently within design tolerances, field conditions for HVAC restraints are not accurately reflected or even referenced on the as-built drawings.

Another condition noted by the NRC CAT inspectors during the HVAC restraint inspections was the attachment of piping, conduit and light fixtures that had not been included in the allowable load records for three restraints. In April 1983, the NRC Region IV Office issued a Notice of Violation for failure to follow Ebasco Procedure ASP-IV-58 "Attachment to Seismic Supports" in not identifying, recording, and evaluating additional loads attached to HVAC restraints prior to installation. In response to this Notice, LP&L committed to compile and analyze these existing loads to determine that allowable loads were not exceeded. This commitment was to have been completed August 1983. It does not appear that this commitment has been satisfied. This topic is discussed in greater detail in Section II of this report as it relates to electrical supports. It is noted that the lack of complete as-built drawings for HVAC supports/restraints as previously discussed could have an adverse impact on any calculations required to evaluate additional loads.

Nine individual fire damper assemblies representing six fire dampers were inspected for proper installation, operability and condition. Types of fire dampers included gravity curtain dampers, spring assisted curtain dampers in both the vertical and horizontal planes, and spring assisted single blade dampers. Details of the fire damper sample may be found in Table III-5.

Of the nine assemblies tested, two failed to function as designed. Fire Damper (FD) 143 was a gravity curtain damper, and failed to completely close due to binding along the vertical guide tracks. The binding was apparently caused by an inward bowing of the vertical tracks, possibly due to the injection of penetration sealant. This damper had been identified as being functionally deficient during a preoperational test of fire dampers. FD 14 contained six assemblies, three of which were tested, one of which failed to function as designed. All six assemblies were of the spring-assisted vertical curtain type. The one assembly failed to drop due to binding along the vertical track. The binding was apparently caused by insufficient clearance between the spring at the point of attachment to the curtain, and the vertical track. This damper had been found operational and acceptable during a previous preoperational test of fire dampers.

The seven other tested damper assemblies functioned as designed. It was noted however that the guide tracks for assemblies FD-66A and FD-66B appeared to be inverted. The damper assemblies could not be reopened from the side on which the manway was located. Though this configuration did not affect the operability of the damper assemblies, it is nonetheless an installation error.

The NRC CAT inspectors were informed that most of the safety-related fire dampers were not installed during the initial erection of the HVAC ducting. Rather, they were retrofitted as a result of a DCN in order to meet the provisions of Appendix R to 10 CFR 50.

Installation packages for six safety-related HVAC components exhibited proper QC verification and acceptance of the installation processes. The six components were Diesel Generator Exhaust fans (E-28), Fans 3A-SA and 3B-SB; Main Control Room Air Handling Units (AH-12), Components 3A-SA and 3B-SB and approximately 400 ft. of associated duct work; and the Emergency Safety Features Air Handling Units and Fans (S-8), Components 3A-SA and 3B-SB. The installation packages contained equipment installation checklists, ducting leak test inspection checklists (including a subsystem boundary listing), and filter train checklists (if applicable). A field check of the equipment revealed that the condition, configuration and location were acceptable.

c. Conclusions

Although overall HVAC hardware installations conform to design requirements, restraint as-built drawings and inspection documentation do not accurately reflect field installation configuration. LP&L has not met their commitment to the NRC in response to a Notice of Violation to identify and evaluate all loads added to HVAC seismic restraints.

The operational and installation adequacy of fire dampers needs to be reevaluated by the applicant as a result of the malfunctions noted by the NRC CAT inspectors.

Duct and equipment installation, installation packages and hardware examined by the NRC CAT inspectors were found to be acceptable.

4. Mechanical Equipment

a. Inspection Scope

Installation records of thirty-three pieces of equipment for eight safety-related systems (Chemical and Volume Control, Component Cooling Water, Emergency Feedwater, Containment Spray, Spent Fuel Cooling, Emergency Diesel Generators, Safety Injection and Hydrogen Recombiners) were reviewed for content, clarity, consistency and thoroughness. Of the thirty-three components, twenty-four received field checks for proper configuration, location, condition and bolt size. Equipment examined included the Emergency Diesel Generators (EDG), High Pressure Safety Injection (HPSI) pumps, Containment Spray (CS) pumps and the Shutdown Cooling Heat Exchangers (SDHX).

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

- Ebasco Specification MC-1, Rev. 1, "General Specifications Covering Installation of Mechanical Equipment"

- General Specification PC-1, Rev. 4, "Instructions for Erection Process Piping and Supports"

- NISCO Procedure ES 147, Rev. D, "Process Control"

- Applicable equipment foundation detail drawings.

b. Inspection Findings

Records indicated that periodic maintenance and inspection were generally completed on time. A few exceptions in this regard were noted for the HPSI "B" pump, the SDHX "A", and the SDHX "B".

Installation travelers generally exhibited proper chronological QC verification and acceptance of installation processes and sequences. However, discrepancies were noted for the following equipment:

- Auxiliary Component Cooling Water (ACCW) Pumps "A" - Holdpoints were bypassed.

- Auxiliary Component Cooling Water Pump "B" - Holdpoints were bypassed; dates regarding the machining of motor mounting pads, and the setting of the motor onto the pads appear to be in reverse sequence; dates which indicated that craft bypassed QC holdpoints and performed work prior to obtaining QC signatures were lined out and changed to the date when the QC holdpoint was signed off, thus resulting in the appearance of proper QC and craft documentation.

- Component Cooling Water (CCW) Pump "A" - QC verification for tightening of foundation anchor bolts was not performed. Yet, the applicant had accepted the traveler package from Gulf Engineering and Ebasco as being completed and acceptable.

- Spent Fuel Racks - In some instances, the dates of craft signature sign-off were one to three months after the date for which QC had accepted the work. The NRC CAT inspectors were informed that the date which appeared with the craft signature is the date that the craft foreman decided to sign off the traveler, and not necessarily the actual date when the work was completed.

The discrepancies regarding the bypassed holdpoints for the Auxiliary Component Cooling Water pumps "A" and "B", and the date discrepancies for the Spent Fuel Racks had been previously identified by Ebasco QA. Also identified by Ebasco in other traveler packages were anomalies such as unsigned maintenance and inspec-

tion records, open NCRs and Discrepancy Reports (DRs), unrecorded grout curing dates and time, unrecorded temperature conditions, and unrecorded alignment readings.

Mechanical equipment installed prior to October 4, 1979, were not subject to any specified minimum torque requirements, unless directed by manufacturer's or engineer's instructions. However, minimum torque requirements were specified for equipment whose installation was accepted after October 4, 1979. Equipment such as the CCW Heat Exchangers "A" and "B", CCW pumps "A" and "B", ACCW pumps "A" and "B", the CCW Surge Tank, the Regenerative Heat Exchanger, and the Chemical and Volume Control System (CVCS) pump "A" fall into this category.

The CCW Surge Tank, CVCS pump "A", and CCW pumps "A" and "B" appear not to have been properly installed to the required minimum torque specifications since the installation travelers for each respective component were observed not to have the test equipment identification number and calibration due date recorded, or engineering data regarding the proper application of the "turn of the nut" method.

The Regenerative Heat Exchanger was found to exhibit bolting configurations and conditions contrary to those which were specified, and QC accepted, in the installation traveler. The traveler stated that the bolts on the sliding feet should be backed off one-fourth of a turn from "hand tight." Rather, three bolts on the sliding feet were found to be tight and one was loose and free to turn. Provisions to ensure that the desired bolting fit would be maintained (i.e., through the use of locknuts or staking) were not evident. Further, it was noted that the heat exchanger hold-down bolts were double nutted, though this configuration was not specified by drawings. A Condition Identification Work Authorization was to be issued to correct this installation.

The CCW Heat Exchanger "A" was found to have two locknuts which did not possess the minimum one-half nut engagement as required by procedure.

Bolt sizes and configurations were verified as being correct with the exception of those identified in this section.

c. Conclusions

No major deficiencies were identified during the inspection of mechanical equipment records and hardware. However, the numerous discrepancies identified by Ebasco QA regarding the installation travelers of mechanical equipment indicate careless documentation practices. The date-related discrepancy regarding the Spent Fuel Racks installation traveler is considered by the NRC CAT inspectors either as an unacceptable documentation philosophy, or a nonconformance to the purposes of installation travelers. Though the traveler is "closed-out" and is considered complete, adequate

justification regarding the acceptability of each of the craft and QC date discrepancies has not been provided. The other equipment travelers identified by the NRC CAT inspectors as containing discrepancies, yet found acceptable and complete by Ebasco or LP&L QA, appear to be isolated instances of documentation review oversights.

Tightening of foundation bolting to unspecified maximum values can result in the unintentional overstressing of bolts. The NRC CAT inspectors are concerned that possible overstressing of bolts has not been adequately addressed.

TABLE III-1

PIPING INSPECTION SAMPLE AND OBSERVATIONS

| System | Piping Isometric | ASME Class | Pipe Diameter (Inches) | Observations |
|---|---|---|---|---|
| SI | LWS-SI-11, R7 | 2/3 | 2 | |
| CC | IC-1125, R6 | 3 | 4 & 6 | Conduit support in contact with pipe. |
| CC | IC-764, R 3/3 (Partial 3CC-B129B to El.-13'6") | 3 | 10 | |
| CC | IC-779, R 5/4 | 3 | 4 | 5/16 inch clearance between valve 3CC-V236B and CCRR-1175 |
| SI | IC-66, R 11/6 | 2 | 4 | |
| CS | IC-28, R 9/7 | 2 | 14 | |
| SI | IC-78, R 9/5 | 2 | 4 & 6 | |
| CC | IC-249, R 8/7 | 3 | 10 & 20 | |
| SI | IC-73, R 11/3 | 2 | 14 | Extraneous tube steel within ½ inch of pipe (previously identified on 79-14 walk-down) |
| CC | IC-812, R 5/5 | 3 | 20 | |
| CC | IC-810, R 4/5 | 3 | 6 | |
| CC | IC-745, R 5/5 (Partial up to IC-745 FW 6) | 3 | 1½ & 10 | Valve weights on stress iso CC-185-84 too low for valves: 3CC-B143B (48# vs 120# act.) 3CC-B128B (120# vs 155# act.) 3CC-F131B (48# vs 155# act.) |

CC - Component Cooling Water System

CS - Containment Spray System
SI - Safety Injection System (Includes both High Pressure and Low Pressure)

TABLE III-2

HYDROSTATIC/PNEUMATIC TEST PACKAGES SAMPLE

| Test Package I.D. | System |
|---|---|
| 25-1-8 RO | Nitrogen |
| 25-1-8 RO Retest 1 | " |
| 36-2-1 R2 | Component Cooling Water |
| 36-3-13 RO | " |
| 52A2-2 RO | Reactor Coolant |
| 52A2-2 RO Retest 1 | " |
| 52A2-9 RO | " |
| 52A2-13 RO | " |
| 53A-6 RO | Charging & Letdown |
| 53A-6 RO Retest 1 | " |
| 53A-6 RO Retest 2 | " |
| 53A-7 R1 | " |
| 53B-5 RO | Boric Acid Makeup |
| 53B-5 RO Retest 1 | " |
| 53B-5 RO Retest 2 | " |
| 53B-2 RO | " |
| 53B-2 RO Retest 1 | " |
| 58-1 RO Retest 1 | Refueling Water |
| 58-2 R1 | " |
| 59-2 RO Retest 1 | Containment Spray |
| 59-3 RO | " |
| 59-3 RO Retest 1 | " |
| 60A-2 RO | Safety Injection |
| 60A-2 RO Retest 1 | " |
| 60A-5 RO | " |
| 60B-2 RO | " |
| 60C-1 RO | " |
| 60C-3 RO | " |
| 60C-3 RO Retest 1 | " |
| 60C-6 RO | " |
| 71B2-6 RO | Condensate Transfer & Storage |
| 73-2 R1 Retest 4 | Emergency Feedwater |
| 76-3 R1 | Main Steam |
| 76-6 RO | " |

TABLE III-3

PIPE SUPPORT/RESTRAINT INSPECTION SAMPLE

| System/Support Number | Type | Class | Size (Inches) |
|---|---|---|---|
| RCSR-63 | Snubber | 1 | 2 |
| CHRH-146 | U-Bolt | 2 | 3 |
| CHRR-254 | Box | 2 | 4 |
| FSRR-43 | Box | 3 | 12 |
| CCRR-20 | Box | 3 | 16 |
| CHRR-164 | U-Bolt | 2 | 2 |
| RCRR-3 | Strut | 1 | 12 |
| CCRR-150 | Box/Lug | 3 | 2½ |
| FSRR-13 | Box/Lug | 3 | 3 |
| RCRR-33 | Box/Lug | 1 | 2 |
| RCSR-48 | Snubber | 1 | 2 |
| RCSH-153 | Spring | 1 | 3 |
| CHRR-241 | Strut | 3 | 3 |
| MSSR-364 | Snubber | 2 | 8 |
| MSRR-270 | Box | 3 | 6 |
| MSRR-264 | Box/Lug | 3 | 6 |
| MSRR-279 | Strut | 3 | 8 |
| CCRR-52 | Rod | 3 | 6 |
| MSRR-261 | Box | 3 | 6 |
| CCRR-71 | Rod | 3 | 10 |
| RCSR-9 | Snubber | 1 | 2 |
| CCSR-77 | Snubber | 3 | 10 |
| RCSR-321 | Snubber | 1 | 3 |
| RCRR-54 | Box/Lug | 1 | 2 |

TABLE III-4

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATION

| Support/Restraint | Observation |
|---|---|
| Sample: | |
| CCSR-77 | End bracket is B-P Catalogue Pc. 1001, not Pc. 2540 as per drawing. |
| RCRR-54 | Zero clearance between pipe clamp and top member of restraint. |
| RCRR-3 | Weld of top end bracket to embed is smaller than on redlined drawing (1/4" and 3/8" fillet versus 1/2" specified). |
| MSRR-270 | Pc. 9 and 11 are 3/8-inch wall tube steel, drawing specifies 1/2-inch wall. |
| Other: | |
| SIRR-312 | U-Bolt installed tight, sliding fit specified. |
| SIRR-279 | U-Bolt installed tight, sliding fit specified. |
| SIRR-277 | Box guide with zero gap vertically. |
| CCRR-487 | Box guide with zero gap, NCR 2644 information incomplete. |
| MSSH-3084 | Cage installed around EFW pump interferes with spring hanger assembly. |
| RCRR-57 | Strut angle to attachment clevis exceeds tolerance, and is bound. |
| RCSR-64 | Snubber attachment angle to pipe clamp exceeds tolerance. |
| RCRR-139 | Strut to clamp alignment exceeds tolerance. |
| CCRR-55 | Two each 1 inch diameter pipes suspended from support not shown on drawing. |
| CWRH-31 | No spacers on strut rod end, and paddle bearing partially out on one end. |

TABLE III-4 - Continued

PIPE SUPPORT/RESTRAINT INSPECTION OBSERVATION

| Support/Restraint | Observation |
|---|---|
| RCRR-105 | Strut disconnected with no proper documentation. |
| MSSR-3072 | Strut tagged as snubber (a snubber was previously installed at this location). |
| Other: | |
| Conduit Support two ft. from CCRR-55 | Conduit support in contact with line 3CC6-110B (evaluated previously as acceptable due to 1/16 inch clearance). |
| Line 2CH4-40A/B | Loose U-Bolt clamp on pipe above restraint CHRR-246. |
| SIRR-835, SIRR-946, EGRR-39, CCRR-904 | Loose strut locknut. |
| SISH-113 | Spring can setting off scale. |
| CCRR-908 | Excessive gap between bearing and washer. |
| CCRR-304, CCRR-302, CCRH-1195 | No locknuts/upset threads on clamp bolts |
| CCRR-1701 | Unspread cotter pin |
| RCRR-45 | No strut spacers at pipe clamp. |
| Misc. | Numerous cases of excessive paint on strut paddle end bearing. Also on U-Bolts, making inspection of gaps impossible. |

TABLE III-5

HVAC INSPECTION SAMPLE

| Item Inspected | Observation |
|---|---|
| Supports/Restraints: | |
| F 553 | *Pc. 4 and 7 welded three sides, dwg. specifies weld four sides. |
| F 1072 | *Pc. 3, 9, 12 welded three sides, dwg. specifies weld four sides. |
| F 1070 | None |
| F 1071 | None |
| F 1233 | *Clip angle legs for three Pcs. 15 & 11 are 3½ inches, 2½ inches, and 3½ inches vs. 4 inches specified on dwg. |
| F 1234 | *Clip angle legs for three Pcs. 24 and 33 are 3 inches, 3 inches and 2½ inches vs 4 inches specified on dwg. |
| F 1228 | *Clip angle legs for four Pcs. 49 are 3 inches, 2½ inches and 3½ inches vs. 4 inches specified on dwg. |
| F 687 | Undocumented loads: five 2-inch conduits, two 1-inch conduits, one 1½-inch conduit, one 4-inch conduit. |
| F 566 | Undocumented loads - 10-inch storm drain, one 1½-inch conduit. |
| F 545 (For additional loads only) | Undocumented loads - 10-inch storm drain, four 2-inch conduits, two 1-inch conduits, two 3/4-inch conduits, one 4-inch conduit, one 2½-inch conduit, one light fixture, one 2½-inch pipe. |
| F 770/772 | None |
| Duct: | |
| System S-3 from fans 3B-SA and 3B-SB to risers at Column Lines 7A and L2 | Dwg. SMG-803-501-1A shows fans in reversed positions than on design diagram and actual installation. |

*Per construction drawings, condition acceptable per design drawings.

TABLE III-5 - Continued

HVAC INSPECTION SAMPLE

| Fire Dampers | Type |
|---|---|
| FD 143 | Curtain, Gravity (Vertical) |
| FD 66A | Curtain, Spring Assist (Horizontal) |
| FD 66B | " " " " |
| FD 27 | Single Blade, Spring Assist |
| Unidentified Damper in Duct Piece E-47 | Curtain, Gravity (Vertical) |
| FD 78 | Curtain, Spring Assist (Horizontal) |
| FD 14 (3 assys) | Curtain, Spring Vertical |

## IV. WELDING AND NONDESTRUCTIVE EXAMINATION (NDE)

### A. Objective

The objective of the appraisal of welding and nondestructive examination was to determine if Quality Control (QC) accepted work related to welding and NDE activities was controlled and performed in accordance with design requirements, Final Safety Analysis Report (FSAR) 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, electrical supports, instrumentation and control tubing, and heating, ventilation and air conditioning (HVAC) installations 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.

During the inspection of welds completed under the rules of AWS D1.1 "Structural Welding Code," the NRC Construction Appraisal Team (CAT) observed that some welds contained various defects which did not meet the specified acceptance criteria. The applicant had previously addressed this problem by performing an engineering evaluation. This evaluation was documented in the L.M. Petrick's report dated September 7, 1983. In essence, the report's conclusions were that the observed defects are minor and their presence will not adversely effect the structural integrity of the affected structures and supports. In order to verify these conclusions, the NRC CAT inspectors selected the "worst" defects which were observed during this inspection and requested that an engineering evaluation be performed concerning structural integrity of selected supports. The NRC will review calculations and assumptions in order to assess the engineering basis for the applicant's conclusions on this subject. NDE activities were appraised through the review of radiographs for both field and vendor-fabricated welds, review of NDE procedures and personnel qualifications, inspecting the calibration status of NDE equipment, and witnessing of in-process NDE activities. The inspected welding and NDE activities were performed in order to ascertain compliance with the governing construction codes and involved the following contractors:

## Field Fabrication

1. Tompkins-Beckwith (T-B): piping, pipe supports/restraints
2. Nuclear Installation Services Co. (NISCO): reactor cooling system piping, supports/restraints
3. Ebasco Services Inc. (Ebasco): architect engineer; heating, ventilating and air conditioning installation, piping, pipe support/restraints
4. Combustion Engineering (CE): Nuclear System Steam Supplier (NSSS)
5. Gulf Engineering: mechanical equipment installation
6. Chicago Bridge and Iron Company (CB&I): containment liner, reactor supports steel, diesel oil storage tanks
7. Mercury Company: instrumentation piping and supports
8. Fischbach and Moore (F&M): Electrical installations and supports
9. Nooter Inc.: reactor vessel refueling pool and spent fuel liners
10. American Bridge: structural steel

## Shop Fabrication

1. Dravo Corporation: piping
2. Bergen Patterson: pipe supports/restraints
3. Harnischfeger Corporation: reactor building crane
4. Associated Piping & Engineering Corp.: containment piping penetrations
5. BIF, Division of General Signal Co.: flow elements
6. Hudson Products Corporation: dry cooling towers
7. Struthers Wells Corporation: CCW heat exchangers
8. Peden Steel: structural steel
9. Greer Hydraulics: charging pump pulsation dampers
10. Carrier Corporation: water chillers
11. American Air Filters: containment fan coolers
12. Industrial Engineering Works (IEW): reactor coolant pump supports and pipe restraint steel
13. Superpressure: traps and strainers
14. Magnetrol: level switches
15. Anchor Darling Valve: valves.

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

### 1. Tompkins-Beckwith (T-B)

#### a. Inspection Scope

The NRC CAT inspectors reviewed activities relating to the T-B 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 Bergen-Patterson (BP) on preassembled pipe supports/restraints and welding by Dravo Corporation on shop fabricated piping spools was also inspected as a part of the T-B inspection.

(1) Welding Activities

The NRC CAT inspected 46 pipe supports/restraints involving approximately 600 welds in order to verify conformance of welding to drawing requirements and confirm the visual acceptability of the welds. See Table IV-1 for listing of supports inspected. Additionally, another 95 supports/restraints involving 1300 welds were also visually inspected in order to verify the quality of the completed welds. Twenty-one of these supports were inspected against the drawing requirement, while the remaining 74 supports were inspected for visual appearance of the welds. See Table IV-2 for 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 82 piping spools involving 1500 ASME Class 1, 2 and 3 welds were inspected. See Table IV-3 for a listing of welds 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 were blended for inservice inspection.

Welder qualification records for 29 welders and seven welding procedures were reviewed for compliance with applicable specifications, procedures and the ASME Code requirements . In addition, the N-5 documentation package for the Volume Control System (CVC) was reviewed and isometric sections CH-IC-328 and CH-IC-679 were reviewed in detail. This documentation review involved 21 field butt welds and 23 socket welds.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities for T-B included the review of radiographic film for shop and field fabricated pipe welds. The shop welds were fabricated by Dravo Corporation. The review of NDE procedures and NDE personnel qualifications was also included in this inspection.

The NRC CAT inspectors reviewed radiographic film for 53 field and 49 shop welds involving 1170 film. This radiographic film was previously reviewed and accepted by Ebasco.

b. Inspection Findings

(1) Welding Activities

Seven of 1900 structural welds inspected, involving 141 pipe support/restraints, were found to be deficient with respect to the specified acceptance criteria. Some of the welds were

undersized, had poor weld profile, or were seal welded instead of the required fillet weld. See Table IV-1 and IV-2 for details.

As a result of this finding, the applicant issued NCRs and the seven welds were evaluated and accepted "as is" by Ebasco engineering. The welds were determined to be adequate for the intended application.

In the area of pipe welding, the CAT inspectors observed arc strikes near SIRR 867, HPSI suction line and one weld in BM-IC-850 had incomplete fill of the groove. As a result of this finding, the applicant issued EDN EC-1715.

During the review of documentation for pipe welds, the CAT found that some Post Weld Heat Treatment (PWHT) strip charts did not indicate the travel speed, therefore, the heatup and cooldown rate could not be calculated. As a result of this finding, the applicant has added appropriate notes to the recording documentation in order to facilitate future reviews of PWHT charts.

(2) Nondestructive Examination Activities

The reviewed 1170 radiographic film involving 53 field and 49 shop welds were found to meet the acceptance criteria for the ASME Code.

c. Conclusions

(1) Welding and NDE Activities

No significant problems were identified in the sample of T-B welding and NDE activities. Welds were found to meet the quality standards required by the applicable construction codes and specifications except for the minor deficiencies discussed above.

2. Nuclear Installation Services Co. (NISCO)

a. Inspection Scope

The NRC CAT welding inspection activities related to NISCO's contracts were in the area of primary loop piping and the reactor coolant pump supports. Both shop and field fabricated welds were inspected in order to assure compliance with the applicable code and specification requirements. The shop welding of reactor coolant pump supports was performed by Industrial Engineering Works (IEW). The review of NDE procedures and radiographic-film qualification of NDE personnel was also included in this inspection.

(1) Welding Activities

Three piping welds were visually inspected to determine if attributes such as mismatch, weld contours and appearance were in accordance with ASME Code.

The NRC CAT inspected approximately 60 structural welds on the reactor coolant pump supports. Ten welding procedures and 14 welder-qualification test records were reviewed. In addition, pertinent welding documentation for Reactor Coolant Pumps 2A and 2B was also reviewed for adequacy.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities included the review of NDE procedures and NDE personnel qualification records. In addition, seven radiographic films for three feet of weld fabricated by IEW were reviewed for compliance with the applicable code and specification requirements.

b. Inspection Findings

(1) Welding Activities

During the visual inspection of the structural welds on the reactor coolant pump supports, the CAT inspectors observed some undercut along several welds. As a result of this finding, the applicant issued DN-SQ-2881, and this item will be addressed and evaluated by Ebasco engineering.

The review of the welding documentation for pump supports 2A and 2B revealed that the PWHT chart for 1-A2A-P1-E7-E-1 was performed at 1050°F instead of the 1100°F minimum required by the Ebasco specification. In addition, the chart also did not indicate a time base, therefore, the PWHT time and heatup/cooldown rates could not be determined.

(2) Nondestructive Examination Activities

All inspected NDE activities met the requirements of the applicable codes and specification requirements.

c. Conclusions

No significant problems were identified in the area of inspected welding and NDE activities. With the exception of the findings previously discussed all welds were found to meet the quality standards required by the applicable construction codes and specifications.

3. Ebasco

a. Inspection Scope

The NRC CAT inspection activities related to Ebasco's contracts were in the area of piping welds and pipe supports pertaining to modifications and rerouting of existing piping sections and supports; review of welding activities pertaining to Ebasco's HVAC installation contract; review of welding procedures, welder qualification records and observation of ongoing welding and heat treatment operations. The review of NDE procedures, NDE personnel qualifications and the observation of NDE inspections were also included in this review.

(1) Welding Activities

Approximately 90 welds involving 11 hangers were visually inspected in Ebasco's modification and repair welding activities. In addition, 41 piping welds were inspected as a part of this effort, and this involved four piping and two valve records packages which were also reviewed for adequacy of documentation. Seventeen welding procedures and 21 welder-qualification test records were reviewed.

In the area of Ebasco's HVAC contract, the NRC CAT inspectors visually inspected approximately 200 welds comprising a sample of vendor welds, shop welds and field welds completed by Ebasco. Nine welding procedures and the qualification test records of eight welders were also reviewed. In addition, two NDE inspectors were observed and evaluated for their ability to perform the visual inspection in accordance with applicable procedures.

(2) Nondestructive Examination Activities

The NRC CAT inspection of NDE activities included the review of 11 NDE procedures and five NDE personnel qualification records. In addition, eight NDE technicians were observed while performing in-process NDE inspections.

b. Inspection Findings

(1) Welding Activities

No concerns were identified regarding Ebasco's piping and pipe support welding activities. However, during the inspection of piping inside the refueling pool the hand wheel on a valve was found to be carbon steel. Since the valve will be fully immersed in boric acid solution during refueling, this material was identified as inappropriate. As a result of this finding, the applicant issued a Condition Identification Work Authorization (CIWA), and the carbon steel valve handle will be replaced with a stainless steel handle.

During the inspection of structural welds in the area of HVAC welding, the NRC CAT inspectors observed weld defects which did not meet the specified acceptance criteria. Most of those welds were fabricated by Waldinger Corporation which was the HVAC contractor before Ebasco took over the contract. Two welds were selected for engineering evaluation and these welds represented the "worst" welds from the inspected weld sample. The selected welds had base metal damage, overlap, area of excessive undercut, craters and ridges. In addition, they were undersized and were welded using E6011 and E7018 filler metal electrodes. E7018 electrodes are certified to deposit weld metal having 70,000 psi minimum tensile strength while E6011 is certified to deposit weld metal having 60,000 psi minimum tensile strength. The inspected structural welds were required to be welded only with the higher strength low-hydrogen E7018 electrodes.

As a result of this finding, the applicant issued DN-SQ-1993 and NCR-W3-7294. The selected welds were evaluated by Ebasco engineering. The welds were accepted "as is" and were determined to be adequate for the intended application.

Three welding procedures were found to lack impact test values for the base material tested. These procedures contained impact testing values only for the weld metal and weld heat-affected zone. The procedures were identified as WP-5, WP-11 and WP-24. The NRC CAT inspector interviewed the Ebasco's site welding engineer who stated that those procedures were never used in applications requiring impact testing.

(2) Nondestructive Examination Activities

All of the inspected NDE activities met the applicable code and specification requirements.

c. Conclusions

No significant problems were identified in the areas of inspected welding/NDE activities. The NRC CAT inspectors found weld defects which did not meet the acceptance criteria specified by the architect engineer. However, the "worst" welds from the inspected weld sample were evaluated by Ebasco engineering and found to be adequate for the intended application.

4. Combustion Engineering (CE)

a. Inspection Scope

The NRC CAT reviewed eight welding procedures and two documentation packages related to the repair of reactor vessel hot & cold leg nozzles, and the repair of the core barrel keyway. In addition, 390 feet of weld involving 932 film were reviewed for compliance with the ASME Code requirements. One radiographic test

procedure was also reviewed for compliance with the ASME Code requirements.

b. Inspection Findings and Conclusions

Inspected welding and NDE activities were found to comply with the applicable construction code and specification requirements.

5. Gulf Engineering

a. Inspection Scope

The NRC CAT inspected welds fabricated by Gulf which involved piping and structural welds associated with the installation of mechanical equipment such as pumps, vessels and tanks. Approximately 50 piping welds and 45 structural welds were inspected for compliance with the applicable code and specification requirements. In addition, nine welding procedures and 10 welder qualification test records were reviewed for adequacy of documentation.

b. Inspection Findings and Conclusions

All inspected welding activities were found to comply with the applicable construction codes and specifications.

6. Chicago Bridge & Iron (CB&I)

a. Inspection Scope

A total of 21 welder qualifications and three welding procedures were reviewed for compliance with the requirements of the ASME code. In addition, 121 feet of weld involving 136 radiographs on the containment liner, diesel oil storage tank and the reactor support steel were also reviewed.

b. Inspection Findings and Conclusions

All of the inspected welding and NDE activities met the requirements of the applicable code and specifications.

7. Mercury Company

a Inspection Scope

Approximately 280 welds involving shop and field fabricated welds were inspected for compliance with the applicable code and specification requirements. Seven welding procedures and 45 welder qualification test records were also included in this inspection. In addition, NDE procedures and NDE personnel qualifications were reviewed for adequacy.

b. Inspection Findings

All inspected tubing welds were found to meet the requirements of the ASME Code. However, during the visual inspection of the structural welds, the NRC CAT identified two welds which were undersized and had undercut in excess of the specified acceptance criteria. As a result of this finding, the applicant issued DN-SQ-2104 and NCR-W3-7604. The welds were evaluated by Ebasco engineering, accepted "as is" and determined to be adequate for the intended application.

c. Conclusions

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

8. Fischbach & Moore (F&M)

a. Inspection Scope

Approximately 250 welds comprising 90 field and 160 shop fabricated welds were visually inspected in order to ascertain compliance with the specified acceptance criteria. Five welding procedures and the qualification test records for 15 welders were reviewed. In addition, five studs were torque tested to verify the adequacy of the stud welding procedures. NDE procedures and qualification records for NDE inspectors were also reviewed. Two NDE inspectors were observed and evaluated for their ability to follow the visual inspection procedures.

b. Inspection Findings

During the visual inspection of welds fabricated by F&M, the NRC CAT inspectors identified welds which did not meet the specified acceptance criteria. Two field and two shop fabricated welds were selected for engineering evaluation. Those four welds represented the "worst" welds from the inspected weld sample. The selected welds contained various defects such as undercut, cold roll and crater and were also undersized. As a result of this finding, the applicant issued nonconformance reports (NCRs) NCR-W3-7292 and NCR-W3-7293. The selected welds were evaluated by Ebasco engineering. The welds were found to be acceptable "as is" and were determined to be adequate for the intended application.

c. Conclusions

No significant problems were identified in the areas of inspected welding/NDE activities. The CAT found weld defects which did not meet the acceptance criteria specified by the architect engineer. However, the "worst" welds from the inspected weld sample were evaluated by Ebasco engineering and found to be adequate for the intended application.

9. Nooter

a. Inspection Scope

The NRC CAT inspected approximately 120 feet of welded seam on the refueling pool liner. Twelve welder qualification test records and 16 welding procedures were reviewed for compliance with the applicable codes and specifications. In addition, 30 feet of welded seams involving 40 radiographs were reviewed. Five NDE procedures and five NDE personnel qualification records were also reviewed.

The inspectors also inspected the ends of 28 telltale pipes of both spent fuel pool and refueling pool in order to ascertain that the pools had not leaked during the time they were tested for leakage. The inspection reports associated with these tests were also reviewed for adequacy of documentation.

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.

10. American Bridge

a. Inspection Scope

Approximately 380 welds consisting of 80 field and 300 shop fabricated welds were inspected for compliance with the specified acceptance criteria. The shop welds were fabricated by Peden Steel Company. Eighteen welder qualification test records and 15 welding procedures were reviewed for compliance with the applicable codes and specifications. In addition, 40 feet of weld involving 244 radiographs were reviewed. Four NDE procedures were also reviewed for adequacy.

b. Inspection Findings

No concerns were identified in the area of reviewed NDE activities and inspected field welding. However, during the inspection of shop welds fabricated by Peden steel, the NRC CAT inspectors identified welds which did not meet the specified acceptance criteria. Three welds were selected for engineering evaluation. Those three welds represented the "worst" welds from the inspected weld sample. Two of the selected welds contained various defects such as undercut, lack of fusion, crater and were undersized. The third weld was a seal weld whereas the drawing required a 1/4-inch fillet weld. Therefore, the required 1/4-inch fillet weld was missing altogether. As a result of this finding, the applicant issued DN-SQ-2167. The three welds were evaluated by Ebasco engineering, accepted "as is" and were determined to be adequate for the intended application.

c. Conclusions

No significant problems were identified in the area of inspected welding and NDE activities. With the exception of the findings previously discussed, welds met the quality standards of the applicable codes and specifications. The NRC CAT found weld defects which did not meet the acceptance criteria specified by the architect engineer. However, the "worst" welds from the inspected weld sample were evaluated by Ebasco engineering and found to be adequate for the intended application.

11. Vendors and Shop Fabricators Other Than Those Previously Addressed

a. Inspection Scope

In addition to the welds previously discussed, the NRC CAT inspectors reviewed radiographs related to work performed by 11 vendors which have supplied various equipment and hardware to the Waterford project. A total of 98 welds involving 1150 radiographic film were reviewed. Another 325 feet of welded seam from the reactor building crane and dry cooling towers involving 444 film, and one valve body involving 50 film were also reviewed for compliance with the governing construction code and specifications. See Table IV-4 for detailed listing of vendors reviewed.

b. Inspection Findings

During the review of radiographic film covering welds completed by Associated Pipe and Engineering, the NRC CAT inspectors rejected one weld of the main steam line containment penetration #1. The weld was identified by radiographic number D22872W3. This weld displayed evidence of root conditions such as melt through and suck back in several locations. The internal surface condition of the finished weld was judged to be unsuitable for the proper interpretation of the required radiographic examination.

c. Conclusions

With the exception of the finding previously discussed (unsuitable main-steam line penetration weld), reviewed vendor radiographs met the requirements of the applicable construction codes and specifications.

TABLE IV-1

T-B SUPPORTS WHICH WERE SUBJECTED TO DETAILED WELD INSPECTION

Component Cooling Water

| | |
|---|---|
| CCRR 691 | CCRR 892 |
| CCRR 83 | CCRR 897 |
| CCRR 845 | CCRR 1379 (1) |
| CCRR 1828 | CCRR 1381 (1) |
| CCRR 314 | CCRR 1060 |
| CCRR 695 | CCRR 1701 |
| CCSH 1069 | CCRR 306 |
| CCA 966 | CCRR 561 (2) |
| | CCRR 419 |

Containment Spray System

| | |
|---|---|
| CSRR 314N | CSRR 419 |
| CSRR 314S | CSRR 316 |
| CSSR 352 | CSRR 315 |
| CSRR 403 | CSRR 441 |
| CSRR 333 | CSRR 438 |

Safety Injection System

| | |
|---|---|
| SISH 405 | SIRR 1106 |
| SIRR 1285 | SIRR 748 |
| SIRR 1261 | SIA 982 |
| SIRR 623 | SIA 748 |
| SIA 31 | SIRR 1017 |
| SISH 3060 | SIRR 812 |
| SIRR 3022 | SIA 1033 |
| SIRR 1113 | SIRR 1147 |

Miscellaneous Systems

| | | |
|---|---|---|
| NGRR 561 | RSI-11-R26 | BMRR 3063 |

NOTES: (1) Seal welded only - drawing required fillet weld.

(2) Weld undersized.

TABLE IV-2

T-B SUPPORTS SUBJECTED TO VISUAL INSPECTION

| | |
|---|---|
| SIRR 199 (1) | SIRR 307 |
| CSSH Pump A | SIRR 938 |
| CSRR 402 | SIRR 151 |
| SIRR 728 | SISH 308 |
| CCRR 272 | SIRR 1032 |
| CSRR 333 | CCRR 454 |
| SIRR 74C | CCRR 456 |
| CCSSH 353 | CCRR 457 |
| SIA 693 | CCRR 455 |
| SIRR 706* | CCRR 456 |
| SIRR 97 | SIRR 1015 |
| SIRR 93 | SIRR 975 |
| SISH 1030 | CWRH 26 |
| SISH 1026 | RIRR 448 |
| SISR 773 | CHA 83 |
| SISH 126 | CHRR 81 |
| SISR 961 | CCRR 49 |
| SISR 9392 | SIRR 417 |
| SISH 147 | SIRR 419 |
| MSRR 245 | CHRR 79 |
| SIA 1016 | SLRR 0089 |
| SIRR 867 | SLRR 0151 |
| CSRR 356 (1) | SLRR 0149 |
| CCRR 694 | CCRR 1507 |
| SISR 1125 | SIRR 1147 |
| SIRR 1265 | MSRR 229 |
| CCRR 1509 | MSRR 228 |
| CCSR 3112 | MSRR 231 |
| SISR 3062 | MSRR 359 |
| MSSH 234 | MSRR 488 |
| MSSH 235 | MSRR 487 |
| MSR 2A | MSRR 461 |
| MSR 1A | MSRR 251 |
| MSR 2B | FWRR 31 |
| CDRH 138 | FWRR 30 |
| CCRR 419 | FWRR 68 |
| CCRR 716 (2) | FWRR 69 |
| CCRR 95 | CCRR 696 |
| CCRR 694 | RCRR 292 |
| CSRR 356 | SIRR 1340 |
| SIRR 160 (1) | CCRR 3840 |
| CCRR 3841 | CCRR 3843 |
| CCRR 3842 | CCRR 3844 |
| CCRR 3845 | CCRR 1061 |
| CCRR 995 | CSRR 420 |
| SIRR 813 | CSA 362 |
| RCRR 4042 | SIRR 3022 |
| | CCRR 1506 |

NOTES: (1) Weld undersized.
(2) Poor weld profile.

TABLE IV-3

PIPING WELDS WHICH WERE VISUALLY EXAMINED (3)

| Identification | | Pipe Size (Inches) |
|---|---|---|
| 3CC V606-21 | | 1½ |
| 3CC V606-22 | | 1½ |
| 3CC V607-6 | | 2 |
| 3CC V607-7 | | 2 |
| 3CC V607-13 | | 2½ |
| 3CC V607-13 | | 2½ |
| SIRR 867 | (1) | 12 |
| 3SI-6-180B-2 | | 6 |
| 3CC V607-1 | | 1 |
| 3CC V607-8 | | 1 |
| 3CC V606-25 | | 1 |
| 3CC V602-17 | | 1½ |
| 3CC V602-16 | | 1½ |
| CS IC-27 | | 10 |
| 3CC V601-8 | | 1 |
| 3CC V601-12 | | 1 |
| 3CC V601-7 | | 1 |
| 3CC V601-10 | | 1 |
| BM-IC-850 | (2) | 3 and 1 |
| 3CC 603-7 | | 1 |
| 3 SI-6-180B-2 | | 6 |
| Q2-MX-LW3-MS-1 | | 1 |
| MS-IC-11-E | | 40 |
| MS-IC-10 | | 40 |
| MS-IC-10 | | 8 |
| CS-IC-24 | | 10 and 12 |
| SI-IC-25 | | 6 |
| SI-IC-78 | | 6 |
| CS-IC-25 | | 6 |
| 3SI V611-8 | | 1 |
| 3CC V286A | | 16 |
| 3CC V287B | | 16 |
| 3CC-16-202A-1 | | 16 and 3 |
| 3CC-16-202B-1 | | 16 and 3 |
| CC-IC-752 | | 2 |
| CC-IC-741 | | 1½ |
| 7CW-V601-13 | | 1 |
| SI-IC-22 | | 1 |
| SI-IC-886 | | 6 |
| SI-IC-15 | | 3/4 and 1 |
| 7FS-V173 | | 3 and 1 |
| 3SI-V629A | | 1 |
| 3CC V260A | | 20 |
| CS-IC-29 | | 8 |
| 2SI-V1594-4 | | 10 |
| 1CI-V9592-5 | | 1 |
| 2WM-F104 | | 1½ |

TABLE IV-3 - Continued

PIPING WELDS WHICH WERE VISUALLY EXAMINED (3)

| Identification | Pipe Size (Inches) |
|---|---|
| 3CD V398 | 4 |
| 1SI-V1592-6 | 1 |
| 2SI-V1594-4 | 4 |
| 1SI-V-1592-4 | 4 |
| 3CC V1504-B2 | 2 |
| 3CC V651-18 | ½ |
| 2SI V1593-1 | 4 |
| 1SI V1592-1 | 4 |
| 2SI V2511-1 | 4 |
| 7FS V612 | 6 |
| 3CC V650-3 | 1 |
| 3CC P15002B | 1½ |
| 7CA V643 | 1 |
| 7CA V645 | 1 |
| 2SI R339A | 10 |
| 1SI V15003A | 1½ |
| 6CD 5309 | 2 and 6 |
| 6CD V308-4 | 4 |
| and 8 7TC B102 | 16 |
| 7TC B109 | 16 |
| 7TC B157 | 16 |
| TE-TC-9276 | 16 |
| CS-IC-15 | 10 |
| SI-IC-25 | 6 |
| SI-IC-464 | 2 and 10 |
| SI-IC-885 | 6 |
| CS-IC-24 | 10 |
| SI-IC-59 | 10 |
| SI-LW3-CH2 | 2 |
| SI-LWS-CH43 | 2 |
| 3NG-V669-3 | 1 |
| 3NG-V672 | 1 |
| 3NG-V676 | 1 |
| 3NG-V678 | 1 |
| 3NG-V680 | 1 |
| BM-IC-241 | 3 and 1 |

NOTES: (1) Arc strikes found.
(2) Weld underfilled on the groove.
(3) All CC designations are Carbon Steel, all SI and CS designations are Stainless Steel and all Pipe 2½ inches and smaller was socket welded.

TABLE IV-4

VENDOR RADIOGRAPHS REVIEWED

| Contractor | Number of Welds or Feet of Weld | Number of Radiographs | Comments |
|---|---|---|---|
| Harnischfeger Corp. | 7 feet | 16 | Acceptable |
| Associated Piping & Engineering (APE) | 36 | 715 | One weld rejected |
| BIF | 7 | 56 | Acceptable |
| Hudson Product Corp. | 318 feet | 428 | " |
| Struthers Wells Corp. | 10 | 94 | " |
| Greer Hydraulics | 12 | 96 | " |
| Carrier Corp. | 7 | 7 | " |
| American Air Filter | 11 | 110 | " |
| Superpressure | 2 | 8 | " |
| Magnetrol | 13 | 64 | " |
| Anchor Darling Valve | One valve | 50 | " |

# 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 engineering 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: concreting activities, concrete materials certification and testing, cadwelding, clam shell filter blanket and soils backfill records, structural steel installation and bolting, and masonry walls.

### 1. Concrete Activities

#### a. Inspection Scope

The concreting activities reviewed by the NRC CAT inspectors included 22 concrete pour record packages, one block out repour package, two concrete areas which had been chipped out, and the witnessing of Windsor Probe testing to confirm the adequacy of several nonconformance report dispositions. The specific concrete placements reviewed are listed in Table V-1.

The requirements and acceptance criteria for concrete placement documentation are included in the following specification and procedures:

- ESI Specification LOU-1564.472, Rev. 7, Concrete Masonry
- J.A. Jones W-WP-7, Rev. 20, Concrete Placing, Curing, Finishing, and Repairs
- J.A. Jones W-SITP-7, Rev. 6, Inspection of Concrete Placing, Curing, Finishing, and Repair
- GEO QA12-6752, Rev. 4, Field and Laboratory Inspection and Testing of Concrete
- Ebasco QCIP-7, Rev. E, Inspection of Concrete Placement, Curing and Finishing

#### b. Inspection Findings

Twenty-two concrete pour record packages and one block out repour record package were found to generally meet construction specifications, procedures, and regulatory requirements, except as noted below. Records generally showed evidence of QC inspection, proper

frequency of in-process testing, satisfaction of acceptance criteria, and use of proper materials.

The following are instances in which discrepancies were identified by NRC CAT inspectors:

(1) In two common foundation basemat pour packages (499-S02-6 and 499-S03-13B) a portion of the in-process test records were not available. These test records contain test results for concrete slump, air content, unit weight, and concrete temperature. The missing records (approximately 5 pages) concern those samples taken at the concrete pump discharge. In-process concrete test records exist for testing done at the truck discharge point; however, the sampling point specified in ANSI N45.2.5-1974, paragraph 4.8, is "from the pump line discharge." Based on the NRC CAT review of placement records, it appears that testing was accomplished.

(2) In one common foundation basemat pour package (499-S02-3) one concrete cylinder test was taken slightly outside the required testing frequency. For concrete batches numbers 1700 through 1720 (representing 186 cubic yards of placed concrete) no concrete cylinders were taken for subsequent testing. The 186 cubic yards of concrete is slightly outside the 150 cubic yard frequency of the construction specification and procedures. As a whole, pour package 499-S02-3 had seven sets of cylinders cast during the placement of 861 cubic yards of concrete which exceeded specification requirements.

(3) In one component cooling water system structure (cooling tower) pour package (499-S04-1A3 and 1A4), test values slightly exceeding specification requirements were recorded but not identified as being nonconforming conditions. A high slump value of 5½ inches was recorded for batch ticket 14531 whereas the specification limit was 2-5 inches and for batch ticket 14616 a high air content value of 6.6% was recorded whereas the limit was 3.5-6.5%. Memos were provided to the NRC CAT inspectors which demonstrated that Ebasco engineering had approved an increase in the slump and air content limits (Ebasco memos - J.O. Booth to Peabody Testing Services dated July 7, 1977 and August 4, 1977). However, this approval was a few weeks after the placement of pour 499-S04-1A3 and 1A4. In addition, the change in specification limits was not incorporated into the specification via the required change mechanisms, Design Change Notice or Field Change Request.

(4) In one component cooling water system structure (cooling tower) pour package (499-S04-8A1), the top of the wall pour was identified not to be covered with water for one day during the curing period. Discrepancy Notice (DN) C-308 specified that the normal curing period be extended two extra days. The NRC CAT review of the curing records, Nonconfor-

mance Report (NCR) W3-236, and DN C-307 showed that for wall pour 499-S04-8A1 curing information exists for only one extra day. It appears that for the final day specified to be added, no curing temperatures or conditions were taken.

In two areas, concrete had been chipped out exposing the reinforcing steel. The reinforcing steel and concrete were reviewed for conformance to design drawings, proper size, grade, and location of reinforcing steel and ties, adequate concrete cover, and general concrete quality. Reinforcing steel and concrete were found to be acceptable.

During the inspection of a lateral restraint for reactor coolant pump 1A, it was identified by NRC CAT inspectors that concrete adjacent to the restraint was cracked around the base plate which was embedded in concrete. Based on the inspectors' comments and additional review by Ebasco engineering, Engineering Discrepancy Notice (EDN) EC-1780 was issued to remove the damaged concrete, repair the concrete, and to inspect the concrete around other reactor coolant pump lateral restraints for similar conditions. The cracked condition of the concrete had not been previously identified by construction, engineering, or inspection personnel.

NRC CAT inspector review of NCR W3-7355 disposition revealed that seven concrete pour placements were tested using the Windsor Probe Test System (which measures concrete resistance to penetration). Windsor Probe tests were done for those placements for which a portion of the curing records could not be found. Based on discussions with Ebasco engineering personnel, it was noted that other generic NCRs regarding the lack of curing records were also dispositioned on the basis of acceptable Windsor Probe test results. Windsor Probe test results were correlated to compressive strength values using the manufacturer's generic table. However, it was pointed out by the NRC CAT inspectors that a report by the American Concrete Institute (ACI), ACI Monograph No. 9, Testing of Hardened Concrete: Nondestructive Methods, by V.M. Malhotra, 1976, stated that "the manufacturer's [Windsor Probe Test System] tables cannot be used with satisfactory results... It is, therefore, imperative for each user of the probe to calibrate his probe test results with the type of aggregate being used" (pg. 33). Without this calibration, compressive strength values obtained using the Windsor Probe Test could be erroneous and should only be used as a relative measure. Only placements which had questions concerning the curing record were tested using the Windsor Probe at this facility.

To establish additional confidence in the compressive strength values obtained from the previous Windsor Probe test results, two placements were selected for additional testing. The first placement (499-S05-15A1) had been previously tested using the Windsor Probe. The second placement (570-S01-J6A) had an acceptable cure record, similar concrete mix design, similar age of concrete, and for which concrete cylinder strengths were available. Placement 570-S01-J6A was tested with two sets of Windsor

Probes with three probes for each set. Placement 499-S05-15A1 was tested with one set of probes. The difference between the two placements was small (0.0" and 0.075") showing similar compressive strengths. Thus, this testing shows that the manufacturer's table as used at Waterford may conservatively indicate a compressive strength lower than actually in place.

c. Conclusions

Except as noted above, the review of concreting activities demonstrated that construction specification and regulatory requirements have been met for inspection, testing frequency, acceptance criteria, and use of proper materials. The NRC CAT inspectors noted that:

(1) Concrete in-process test records were missing for two placements. However, there is indirect evidence which indicates that testing was in fact performed although actual records do not exist.

(2) The two instances in which concrete testing exceeded specification requirements, which were not identified by QC inspection personnel, appear to be isolated cases in the civil/structural area. The inappropriate use of a memo, instead of a Design Change Notice (DCN) or Field Change Request (FCR), for making a permanent specification change also appears to be an isolated case.

(3) The instance in which the last added cure day information is not recorded for placement 499-S04-8A1 is an example of inadequate corrective actions. This appears to be an isolated case.

(4) The two concrete chipped areas were found to be acceptable.

(5) Concrete cracks were identified by the NRC CAT inspectors adjacent to reactor coolant pump lateral restraints. EDN EC-1780 was issued to resolve the situation.

(6) Windsor Probe Testing during the NRC CAT inspection period onsite correlated previous test results to concrete of known compressive strength.

2. Concrete Material Certification Testing

a. Inspection Scope

Records associated with concrete material certification and surveillance testing were reviewed for conformance to construction specifications and regulatory commitments. Seventy-three concrete material certification records were reviewed which included records for cement, reinforcing steel, aggregate, and admixture (see Table V-2). Over 700 surveillance test records were reviewed

for testing of aggregate and water (daily, weekly, monthly, and semi-annually) and mixer uniformity (see Tables V-3 and V-4). The certification and testing records were reviewed for conformance to the specified testing frequency and appropriate acceptance criteria.

b. Inspection Findings

Concrete material certification and testing records were found to meet construction specifications and regulatory commitments. It was noted that three certifications for sand were found to be slightly outside of specification requirements (Tickets B-32797, 33428, 34100). The requirements are specified in ASTM C-33, "Standard Specification for Concrete Aggregates", which stipulates 2 to 10% by weight passing the No. 100 sieve, whereas the sand supplied had 0.8, 1.6, and 1.4% passing the No. 100 sieve. Since aggregate gradation testing was to be performed on each day of concrete production, any significant deviation in the gradation of the sand supplied could be identified prior to concrete batching. NRC CAT review of daily gradation testing showed that gradation requirements were being met.

During the review of coarse aggregate (one inch and ½ inch) certification and daily gradation testing records, NRC CAT inspectors noted that the acceptance criteria specified on the certification and test sheets did not match the construction specification. However, it was shown that the coarse aggregates were ordered and batched in two groups (one inch and ½ inch), as was done in the trial mix design process. In addition, when the two coarse aggregate gradation requirements are merged together, the combination did meet the construction specification gradation requirements.

It was noted by NRC CAT inspectors that certain water quality test records (monthly tests) were not available for review. The missing test records had been identified by notations on the records folder in previous reviews by site personnel.

c. Conclusions

Review of concrete materials certification and surveillance testing demonstrated that the construction specification and regulatory requirements were essentially met for testing frequency, acceptance criteria, and proper certification of materials.

3. Cadwelding

a. Inspection Scope

Cadweld inspection records and cadwelder qualification records were reviewed by NRC CAT inspectors for 12 cadwelders, including associated NCRs. A portion of 12 cadwelders' splices were selected for review which represented approximately 200 to 300 cadwelds for

each cadwelder (see Table V-5). The records were reviewed for proper qualification and requalification if neccessary, QC inspection, and meeting tensile test frequencies and acceptance criteria. In addition, 27 cadwelds made while NRC CAT inspectors were onsite were inspected for workmanship and inspection quality.

Requirements and acceptance criteria for cadwelding activities are provided in the following documents:

- ESI Specification LOU-1564.479, Rev. 2, Mechanical Splicing of Concrete Reinforcing Steel, Seismic Class I
- Regulatory Guide 1.1C, Rev. 1 (January 2, 1973), Mechanical (Cadweld) Splices in Reinforcing Bars of Category 1 Concrete Structures
- ANSI N45.2.5-1974, Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants

b. Inspection Findings

The review of the records, including NCRs associated with the 12 cadwelders, showed that cadwelders were qualified by testing for the given review period. In addition, cadwelders were found for the most part to be requalified as required by the construction specification based on visual or tensile test failures. There was evidence of QC inspection of the cadwelds as recorded on daily cadweld inspection reports for each cadwelder.

Cadweld tensile testing is to be performed for each cadwelder. Testing requirements are based on a testing schedule for each cadweld position, bar size, and grade of bar. The testing frequency is specific in selection of the production or sister splices to be tensile tested. For four of the 12 cadwelders reviewed, cadwelds were not tested at the proper frequency for certain bar sizes and positions (seven bar sizes and positions for the four cadwelders). In one instance, for cadwelder 5W, it appears that although the specifications called for a production test splice to be taken, a sister test splice was used. There appeared to be sufficient rebar length to cut out the production cadweld and install a replacement cadweld. The testing discrepancies are shown in Table V-6.

In review of the production summary for cadwelder J59, NRC CAT inspectors noted that the requirement of specification LOU-1564.479, Section 13.03 was not met in that when two visual rejects occurred (cadwelds #13 and 14), cadwelder J59 should have been requalified in all positions. The two visual rejects were on #8 rebar in the vertical position. After the visual rejects, cadwelder J59 was not requalified in all positions, but instead switched to the horizontal position without additional qualification testing. Cadwelder J59, however, was requalified in the vertical position

prior to resuming cadwelding in the vertical position. It was noted that cadwelder J59 had a fairly low cadweld rejection rate (eight rejects of a total of approximately 400 cadwelds or approximately two percent).

Results of the NRC CAT inspectors' review of cadweld records were compared to the production and testing summary provided as Attachment V to NCR 6234. It was noted that the production and testing summary is partially inaccurate in that the summary does not take into account the requirement to restart the splice sampling plan based on the occurrence of visual rejects. For example, cadwelder 6W had visual rejects on cadwelds #68 and 235, however, Attachment V to NCR 6234 does not reflect restarted test schedules. The concern is that Ebasco engineering dispositioned this item of the NCR based partially on the aggregate number of cadwelds made and tested. However, a more accurate view of the cadwelding operation would be reflected in the number of tests required and the number actually performed. Based on the above, and discussions with Ebasco and LP&L personnel, the production and test summary of Attachment V to NCR 6234 is being reviewed to accurately reflect visual rejects and the restart of the testing schedule.

NRC CAT inspectors also reviewed 27 cadwelds made during the inspection period and witnessed the setup and actual firing of one cadweld. These cadwelds were located in the two temporary sumps for the Reactor Auxiliary Building at Elevation -35.00 and made by cadwelders E14 and E15. The cadwelds inspected were acceptable with evidence of proper centering of the cadweld sleeve, no excessive voids, no slag at the tap hole, proper setup, and proper identification of the cadwelder and sleeve.

c. Conclusions

Review of cadwelding records indicated that: cadwelders were qualified and generally were requalified when required based on visual or tensile test failures; there was evidence of QC inspection of the cadwelds; and tensile testing met the specified acceptance criteria. It appears that the tensile test frequency was not met for four of the 12 cadwelders reviewed. Cadwelds were tested slightly outside of the required schedule. The production and test summary of Attachment V to NCR 6234 is being reviewed and revised to reflect proper testing schedules and to determine whether the testing done met schedules or not, the significance of which cannot be determined at this time.

The one case of a cadwelder not requalifying in all positions on the occurrence of two visual rejects appears to be an isolated case for one cadwelder in one position only. In addition, the cadwelder did requalify in the position in which the two visual rejects occurred prior to the resumption of cadwelding in that position.

4. Clam Shell Filter Blanket and Soils Backfill Records

a. Inspection Scope

Records for the six clam shell filter blanket strips placed and a selected portion of soils backfill placements were reviewed for conformance to construction specifications and procedures. Records were reviewed for evidence of QC inspection, test frequencies and acceptance criteria, and proper construction practices as defined by specifications and procedures. The acceptance criteria used in review of these records were:

- ESI Specification LOU-1564.482, Rev. 6, Filter and Backfill Seismic Class I
- ESI Procedure QCIP-2, Rev. H, Soils Control

b. Inspection Findings

Records for clam shell filter blanket strips (#1-6) placed were reviewed and found to be either acceptable or that deficiencies were already identified in NCR W3-5997. It was noted by NRC CAT inspectors that in the test records for strip #5 a discrepancy existed in the in-place density test locations for a reworked section of the strip. Test records for February 20, 1976, test numbers 797, 798, 799, and 800, indicate grid locations not in strip #5, but in strip #4. However, the comments portion of the test records indicate the testing to be in strip #5. In a memorandum to file dated March 14, 1984, B. Dickson, Ebasco QC, states that the grid location seems to be in error (D3 written vs. D6). Recollection of the event by M. Temchin, Senior Site Soils Engineer at the time of the clam shell placement, confirmed that the reworked area had been compacted, tested, and accepted.

Selected records for five of the seven soils backfill placements were reviewed as follows: Fill #1, Vol. 8; Fill #3, Vol. 1; Fill #4, Vol. 14; Fill #6, Vol. 2; Fill #7, Vol. 10. The records reviewed represent 41 days of backfill operations and approximately 170 test/inspection records (see Table V-7). The records showed evidence of J.A. Jones or Ebasco QC inspection and testing and met the required testing frequency. It was not possible to reconstruct a chronological sequence of placements to determine whether multipoint Proctor density tests were performed at required frequencies. However, there was ample evidence that multipoint Proctor tests were being performed.

As part of the backfill quality control process, fill material acceptance (defined in FSAR Section 2.5.4.5.3.3) was to be performed using inspections of the backfill prior to placement to determine its acceptability. The FSAR requirement was incorporated into the construction specification (LOU 1564.482, Section 8.3.b) and the QC inspection procedure (QCIP-2, Section 6.2.3). The fill material acceptance inspection/testing was recorded on

form QCIP-2-1 entitled; "Borrow Material Inspection Report". Review of the Borrow Material Inspection Reports and the associated test records indicated that tests performed for material acceptance (moisture content and gradation) were performed after placement and compaction rather than before placement as required. In practice, material acceptance tests were performed as part of the in-place density tests routinely run to ensure adequate compaction of backfill. Although in most cases the backfill material placed and compacted did meet material acceptance criteria, quality control requirements were not met in that the backfill was actually placed prior to material acceptance.

Review of backfill test records indicated that some moisture contents reported were above the specification limit of "no greater than 3% above the optimum moisture content". This requirement is stated in Ebasco specification LOU 1564.482, Section 8.3.1.b and is in fact highlighted on the Peabody Testing form (PBO 8-09-6752) for the in-place density test rubber balloon method. The in-place density tests which involved high moisture contents were:#939 (Fill #3, Vol. 1) and #BO182ARR, #BO181AR, #BO216ARR, and #BO222A (Fill #6, Vol. 2) (see also Table V-7). In at least one case, test #BO181AR, the QC inspector had flagged the greater than allowable moisture content. However, the density test was accepted based on meeting density requirements. There was no evidence of engineering approval of this condition nor that the specification limit on moisture content was not a quality attribute. The concern is that although soils with moisture contents greater than optimum can be compacted to the required degree using more compactive effort, there is a point at which the soil strength decreases (overcompaction).

c. Conclusions

In general, review of clam shell filter blanket records showed that testing and inspection were performed as required or that deficiencies had been identified in an NCR.

Review of soils backfill records showed two deficiencies: (1) tests for material acceptance were performed after the soils backfill were placed and compacted, and (2) there is no evidence that Ebasco engineering had determined that moisture content was not a quality attribute and that higher than allowable moisture contents were acceptable. The issue of material acceptance after-the-fact is important from a quality assurance perspective. However, materials placed were tested and found to be acceptable. Occurrences of moisture contents greater than allowed by specifications should be reviewed by Ebasco engineering to determine the effects of overcompaction.

5. Structural Steel Installation

a. Inspection Scope

Structural steel installation activities were reviewed by NRC CAT inspectors. Installed and QC accepted structural steel was inspected for member size, configuration, conformance of bolted and welded connections to design drawings, proper use of washers, and minimum radius cuts on re-entrant corners. Structural steel bolts were tested using a calibrated torque wrench to determine whether the bolts were properly tightened. Building structures inspected were: reactor containment building, steam generator upper structure, reactor coolant pump support, polar crane support steel, and dry cooling tower steel.

Structural steel installations reviewed included: 40 members for proper size and dimensions, 19 bolted and welded connections, and 339 bolts tested for minimum installation torque. The majority of connections reviewed by NRC CAT inspectors had been previously reviewed under Ebasco Services, Inc. (ESI) procedure ASP-IV-129 for reinspection of American Bridge installed structural steel bolted connections (see Table V-8).

The acceptance criteria used in the review of structural steel installations are specified in the following:

- ESI Specification LOU 1564.723, Rev. 11, Structural Steel
- Ebasco Procedure ASP-IV-129, Rev. C, Reinspection and Rework of American Bridge Bolted Connections
- ESI Specification 501-76, High-Strength Bolted Field Connections for Structural Steel

b. Inspection Findings

Forty structural steel members and 19 bolted and welded connections were found by NRC CAT inspectors to be in conformance with design drawings. All but four of 339 high strength bolts met the minimum torque requirements specified in ASP-IV-129.

Bolts tested included 7/8-inch, 1-inch, and 1-1/8-inches diameter A325 and A490 bolts. Calibration of torque wrenches before and after torque testing provided assurance of torque values actually applied to bolts. Of the four bolts with low torque values, none were lower than 600 ft-lbs, whereas the required torque is 790 ft-lbs.

c. Conclusions

In general, structural steel installation activities (member size and configuration, connections, and bolt torque) were found to be in conformance with design drawings. The turning of four

out of 339 bolts prior to reaching minimum torque is considered an isolated case and not a generic issue.

6. Masonry Walls

a. Inspection Scope

The design basis for masonry walls (both hollow core and solid block) at Waterford were discussed with Ebasco engineering personnel onsite. Based on these discussions and two design documents, Ebasco Civil Engineering Department Technical Directive No. 7 (Analysis and Design of Concrete Block for Nuclear Power Plants) and design calculation OFS No. 1564, Dept. No. 65 dated January 2, 1973, it was identified that the design of masonry walls utilized the Uniform Building Code (1973 and 1979) allowable stresses associated with "special inspection". It was indicated that the only inspections performed of the masonry work were by an Ebasco engineering inspector (not part of QA or QC) following Procedure IP-9, Masonry Work. Four masonry walls were selected by NRC CAT inspectors and the inspection documentation requested. For only one of the four masonry walls could an inspection record be provided. Based on the lack of inspection documentation, the NRC CAT inspectors requested a design review be performed. Since no mortar was placed between the masonry wythes for solid block walls (collar joints), the solid block walls were analyzed to act independently and not monolithically. Eleven multi-wythe, solid block masonry walls were inspected by NRC CAT inspectors to determine their conformance to design drawings and design assumptions (see Table V-9).

b. Inspection Findings

Ebasco engineering provided three sets of calculations (OFS No. 4294.385, Dept. No. 653 dated March 15, 1984, Concrete Block Wall-Review; Block Wall-Frequency Analysis, dated March 16, 1984; and Concrete Block Wall Dur-O-Wall Reinforcement, dated March 15, 1984) which analyzed the limiting cases for masonry walls at Waterford. It was stated that all the existing masonry walls were enveloped by these sets of calculations. However, during the NRC CAT inspectors' review of masonry walls in the plant, it was identified that the design analysis for solid block masonry walls assumed a "steel cap" to tie the top of the wall with the ceiling above. However, the design drawing calls for only mortar fill at the top. Based on discussions with Ebasco engineering, it is understood that the calculations will be reviewed to reflect proper end connection configuration.

Eleven multi-wythe, solid block masonry walls were inspected and, except in one case, were found to conform to design drawings. For nine of the ten masonry walls which were in conformance with design drawings, the design calculations did not agree as discussed in the previous paragraph. For one masonry wall, number 6 of Table V-9, the free end connection in the field did not match

the detail (Detail BV) as specified in the drawing. In addition, this wall spans 11'-6" whereas Detail BV allows a maximum span of 10'-0". The one wall (number 11 of Table V-9) in which an interior portion was exposed showed acceptable workmanship in that Dur-O-Wall reinforcement was evident in each course of block, corrugated tie straps were placed approximately every six inches, the wythes were staggered in elevations as specified in the design drawings, and there was no mortar between wythes (collar joint) as specified in design drawings. It was noted that none of the masonry walls reviewed in the field supported any major piping or equipment loads.

c. Conclusions

The lack of inspection documentation for masonry walls at Waterford caused design calculations to be performed to confirm their design adequacy. Calculations were provided to the NRC CAT inspectors and will be further reviewed by the NRC. In addition, it is understood that calculations will be evaluated by Ebasco engineering to ensure that the details specified in drawing G-765-S02 are reflected in design assumptions. For the one wall (number 6) which did not match Detail BV of the design drawing, it is understood that the wall will be evaluated for structural adequacy. The issue of the adequacy of masonry wall construction will be further reviewed by the NRC, as stated in the NRC Standard Review Plan, Section 3.8.4, Appendix A, paragraph 4(j).

TABLE V-1

CONCRETE PLACEMENTS

| Structure | Concrete Pour No. | Pour Date | Activity Reviewed |
|---|---|---|---|
| Common Foundation Basemat | 499-S02-6 | 12/2-3/75 | Pour package records |
| | 499-S03-13B | 03/30/76 | " |
| | 499-S03-19 | 04/28/76 | " |
| | 499-S01-13A | 04/16/76 | " |
| | 499-S02-3 | 12/19/75 | " |
| Reactor Auxiliary Building | 570 S01-1A | 07/14/76 | " |
| | 570-S01-J8A | 06/25/76 | " |
| | 544-S02-9 | 12/13/76 | " |
| | 558-S01-1 | 09/10/77 | " |
| | 573-S02-23 | 09/30/77 | " |
| Shield Building | 511-5 (wall) | 04/27-28/76 | " |
| | 511-5 (wall) | 05/7-8/76 | " |
| | 521-3A & 3B (dome) | 10/17-18/79 | " |
| | 521-9A & 9B (dome) | 01/03/80 | " |
| | 521-10A & 10B (dome) | 01/10/80 | " |
| Component Cooling Water System Structure (Cooling Towers) | 499-S04-8A1 | 10/14/76 | " |
| | 499-S04-3A1 | 09/20/76 | " |
| | 499-S04-1A3 & 1A4 | 06/27/77 | " |
| | 499-S04-8A4 | 08/11/77 | " |
| Fuel Handling Building | 593-S01-6AA | 10/08/76 | " |
| | 588-6 | 06/16/77 | " |
| | 593-S04-6A | 10/05/77 | " |
| Reactor Auxiliary Building | Core hole 469 | 11/19/82 | Repour package records |
| | Exterior diagonal wall at column lines 10A and P at Elevation +31.75 (Dwgs. G-563-S02 and G-564-S06) | --- | Concrete chip out area (NCR-W3-5146) |
| | Pipe chase walls in charging pump A room, column lines 1A and J, Elevation -30.00 (Dwgs. G-570-S04 and G-569-S01) | --- | Concrete chip out area (FCR AS-2626) |
| | 570-S01-J6A | 07/23/76 | Placement used for Windsor Probe correlation |

TABLE V-1 - Continued

CONCRETE PLACEMENTS

| Structure | Concrete Pour No. | Pour Date | Activity Reviewed |
|---|---|---|---|
| Component Cooling Water System (Cooling Towers) | 499-S05-15A1 | 10/22/76 | Placement used for Windsor Probe correlation |

TABLE V-2

CONCRETE MATERIAL CERTIFICATION RECORDS

| Material | Date | | Comments | |
|---|---|---|---|---|
| Cement | Rec'd | 12/09/75 | Sample | S43-1.00-49-MT |
| | " | 12/22/75 | " | S38-1.00-51-MT |
| | " | 03/24/76 | " | S38-2.00-152-MT |
| | " | 04/03/76 | " | S.A.11.0.0.23.W |
| | " | 04/19/76 | " | S.A.12.4.0.0.84.W |
| | Shipped | 11/24/76 | " | S.A.2.8.0.0.305.W |
| | | 12/11/76 | " | S.A.6.9.0.0.318.W |
| | " | 12/16/76 | " | S.A.6.9.0.0.318.W |
| | " | 08/16/77 | " | S.A.2.15.0.0.497.W |
| | " | 08/25/77 | " | S.A.2.15.0.0.498.W |
| | " | 09/21/77 | " | S.A.6.16.0.0.523.W |
| | " | 07/18/77 | " | S.A.2.14.0.0.470.W |
| | " | 09/28/79 | " | S.A.3.19.0.0.959.W |
| | " | 10/18/79 | " | S.A.2.35.0.0.974.W |
| | " | 02/08/80 | " | S.A.1.21.0.0.1035.W |
| Aggregate (Sand) | Shipped | 12/15/75 | Ticket | B-31016 |
| | " | 12/17/75 | " | B-31105 |
| | " | 12/18/75 | " | B-31173 |
| | " | 12/24/75 | " | B-31330 |
| | " | 09/01/76 | " | B-40321 |
| | " | 09/02/76 | " | B-40343 |
| | " | 09/08/76 | " | B-40441 |
| | " | 09/07/77 | " | B-53258 |
| | " | 09/12/77 | " | B-53471 |
| | " | 09/14/77 | " | B-53581 |
| | " | 09/27/77 | " | B-54353 |
| | " | 09/29/77 | " | B-00006 |
| | " | 12/05/79 | " | B-32744 |
| | " | 12/06/79 | " | B-32797* |
| | " | 12/13/79 | " | B-33428* |
| | " | 12/20/79 | " | B-34100* |
| (½ Inch Coarse Aggregate) | Shipped | 12/10/75 | Ticket | B-30913 |
| | " | 12/27/75 | " | B-31343 |
| | " | 12/30/75 | " | B-31420 |
| | " | 09/01/76 | " | B-40315 |
| | " | 09/16/76 | " | B-40683 |
| | " | 09/20/76 | " | B-40752 |
| | " | 09/15/77 | " | B-53720 |
| | " | 09/15/77 | " | B-53700 |
| | " | 09/19/77 | " | B-53847 |
| | " | 09/19/77 | " | B-53843 |

*Slightly out of specification requirement for #100 sieve, respectively 0.8, 1.6, and 1.4% vice specification requirement of 2-10%

TABLE V-2 - Continued

CONCRETE MATERIAL CERTIFICATION RECORDS

| Material | Date | Comments |
|---|---|---|
| | Shipped 12/06/79 | Ticket B-32857 |
| | " 12/10/79 | " B-33077 |
| | " 12/13/79 | " B-33466 |
| | " 12/17/79 | " B-33751 |
| (1 Inch Coarse Aggregate) | Shipped 09/09/76 | Ticket B-40502 |
| | " 09/13/76 | " B-40595 |
| | " 09/19/77 | " B-53875 |
| | " 09/20/77 | " B-53907 |
| | " 09/22/77 | " B-54029 |
| | " 12/03/79 | " B-32537 |
| | " 12/18/79 | " B-33806 |
| | " 12/19/79 | " B-33974 |
| | " 12/26/79 | " B-34327 |
| Admixture (Protex) | Shipped 07/22/77 | Ticket 1193 |
| | " 09/29/77 | " 1213 |
| | " 10/26/77 | " 0548 |
| | " 03/23/78 | " 7420 |
| | " 07/27/79 | " 6399 |
| | " 02/80 (approx.) | P.O. 59550 |
| | Bar Size | |
| Reinforcing Steel | 18 | I.D. No. 27-0291 |
| | 18 | " 27-0293 |
| | 18 | " 27-0298 |
| | 14 | " 27-0239 |
| | 11 | " 174804 |
| | 10 | " 160619 |
| | 9 | " 161289 |
| | 9 | " 175503 |
| | 9 | " 175625 |
| | 8 | " 161238 |
| | 8 | " 174695 |
| | 6 | " 160823 |
| | 6 | " 161189 |

TABLE V-3

CONCRETE MATERIAL TESTING

| Test | Required Testing Frequency | Date of Records Reviewed | Notes |
|---|---|---|---|
| Gradation & Materials Finer than No. 200 Sieve (ASTM C-136, C-117) | Daily | 10/75 | 1, 2 |
| | | 11/75 | 1, 2 |
| | | 06/76 | 1, 2 |
| | | 10/76 | 1 |
| | | 01/77 | 1 |
| | | 3/1/78-3/8/78 | |
| | | 4/13/78-4/21/78 | |
| | | 5/8/78-5/13/78 | |
| | | 10/3/79-10/11/79 | |
| | | 11/12/79-11/20/79 | |
| | | 12/21/79-12/31/79 | |
| | | 1/80 - 4/80 | 3 |
| Moisture Content (Sand and Coarse Aggregates) (ASTM C-566) | Daily | 10/75 - 1/76 | 3 |
| | | 12/76 | 1 |
| | | 05/77 | 1 |
| | | 09/78 | 1 |
| | | 10/78 - 11/78 | 3 |
| | | 05/80 | 1 |
| Organic Impurities, Specific Gravity and Absorption, and Percent Voids (ASTM C-40, C-127 or C-128, C-30) | Weekly | 11/75 - 3/77 | 3 |
| | | 01/79 - 02/79 | 3 |
| Clay Lumps and Friable Particles, Lightweight Pieces, and Soft Fragments (ASTM C-142, C-123, C-235) | Monthly | 08/76 - 2/80 | 3 |
| | | 04/80 | |
| L.A. Abrasion, Flat and Elongated Particles, and Soundness (ASTM C-131 or C-535, CRD C-119, C-88) | Semi-Annually | 09/76 | 4 |
| | | 12/76 | 5 |
| | | 03/77 | |
| | | 09/77 | 6 |
| | | 10/77 | 7 |
| | | 04/78 | |
| | | 09/78 | 7 |
| | | 03/79 | 7 |
| | | 09/79 | 7 |
| | | 03/80 | 7 |

TABLE V-3 - Continued

CONCRETE MATERIAL TESTING

| Test | Required Testing Frequency | Date of Records Reviewed | Notes |
|---|---|---|---|
| Water Quality: (Ice, Tap, Mixer) | Monthly | | 8 |
| Acidity and Alkalinity, | | 07/76 - 10/76 | 3 |
| Mohr Method Chloride, | | 12/76 | |
| Bolhard Method Chloride | | 01/77 - 10/78 | 3 |
| (when required), and | | 12/78 | |
| Scotts Mineral Analysis (AASHO T-26) | | 01/79 - 08/79 | 3 |
| Effects on Compressive Strength, Setting Time, and Soundness (ASTM C-109, C-191, C-151) | Semi-Annually | 03/77<br>09/77<br>03/78<br>07/78 | |

NOTES:

1. Entire month
2. Gradation testing only
3. Entire interval
4. (Flat and Elongated Particles) and Soundness testing only
5. L.A. Abrasion testing only
6. Soundness testing only
7. L.A. Abrasion and (Flat and Elongated Particles) testing only
8. Test records folder noted missing documentation for 9/75 - 11/75, 11/76, and 11/78

TABLE V-4

MIXER UNIFORMITY TESTING (SEMI-ANNUAL)

| Truck No. | Month of Testing 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| 100 | | 5 | | | | |
| 102 | 12 | 5 | | | | |
| 103 | | 5, 10 | | | | |
| 104 | 12 | 5, 10 | | | | |
| 105 | 12 | 3, 5, 10 | | | | |
| 106 | | 5, 10 | | | | |
| 107 | 11 | 5, 10 | | | | |
| 110 | | 3, 5, 10 | 4, 10 | 9 | 7, 11 | |
| 112 | 11 | 5, 10 | | | | |
| 113 | 11 | 5, 10 | 4, 10 | 9 | 3 | |
| 114 | 11 | 5, 10 | 4, 10 | 4, 9, 10 | 4 | |
| 119 | 11 | 5, 10 | 4, 9, 10 | 9 | 3 | |
| 120 | 11 | 5, 10 | 4, 10 | 6, 12 | | |
| 126 | | | 2, 8 | 2, 8 | | 1 |
| 127 | | 9 | 9 | 3, 9 | 3, 4, 10 | 3 |
| 128 | | 9 | 2, 9 | 6 | | |
| 129 | | | 4, 10 | 6 | | |
| 130 | | | 8 | 1, 7 | 7, 11 | 1, 4 |
| 131 | | | 2 | | | 3, 4 |
| Central Mixer | 12 | 4, 10 | 4 | | | |

TABLE V-5

CADWELDING REVIEW

| Cadwelder ID No. | Date of Cadwelding Start | End |
|---|---|---|
| 1W | 10/22/75 | 12/07/78 |
| 3W | 10/29/75 | 03/10/76 |
| 5W | 10/22/75 | 04/25/77 |
| 6W | 10/27/75 | 02/27/78 |
| 8W | 10/24/75 | 03/13/76 |
| 152W | 04/04/78 | 06/21/79 |
| 203W | 04/05/78 | 09/15/78 |
| 255W | 01/24/79 | 06/04/79 |
| J59 | 06/22/77 | 08/01/78 |
| J97 | 07/06/79 | 09/26/80 |
| E14 | 03/11/84 | To Present |
| E15 | 03/11/84 | To Present |

TABLE V-6

CADWELD TESTING FREQUENCY DISCREPANCIES

| Cadwelder ID No. | Bar Size and Position | Caldweld No. | Test Schedule | Number of Cadwelds to Next Test |
|---|---|---|---|---|
| J59 | #11 - Vertical | 202-295 | 1-10 | 22 |
| J97 | #11 - Vertical | 99-111 | 1-10 | 13(1) |
| | #8 - Horizontal | 81-98 | 1-10 | 16 |
| | #6 - Horizontal | 156-163<br>165-177 | 1-10 | 13 |
| 152W | #11 - Horizontal | 12-40 | 1-10 | 17 |
| | | 67-103 | 1-10 | 12(2) |
| 203W | #14- Horizontal | 30-57 | 1-10 | 13 |
| | #6 - Vertical | 188-198 | 1-10 | 12 |
| 5W | #11 - Horizontal | 44-55 | 1-10 | (3) |

NOTES: (1) 13 #11 - Vertical cadwelds made without any testing

(2) Visual reject at cadweld #66

(3) It appears that a production test splice could have been sampled as required, however a sister splice was tested instead.

TABLE V-7

SOILS BACKFILL RECORDS

| Fill No. & Volume | Date of Records | Notes |
|---|---|---|
| Fill #1, Vol. 8 | 3/2/78 | 1 |
| | 3/3/78 | |
| | 3/6/78 | |
| | 3/8/78-3/10/78 | |
| | 3/13/78 | 1 |
| | 4/14/78 | |
| Fill #3, Vol. 1 | 6/7/76-6/9/76 | (6/7/76) 3 |
| | 9/1/76 | |
| | 9/2/76 | |
| | 9/13/76 | 1 |
| | 9/14/76 | |
| | 9/16/76 | |
| Fill #4, Vol. 14 | 4/18/79-4/20/79 | (4/8/79) 1 |
| | 5/14/79-5/1/79 | |
| | 5/21/79 | |
| | 5/22/79 | |
| | 9/4/79-9/6/79 | (9/6/79) 1 |
| Fill #6, Vol. 2 | 10/23/76 | 3 |
| | 10/26/76-10/28/76 | (10/28/76) 3 |
| | 11/11/76 | |
| | 11/12/76 | 2 |
| Fill #7, Vol. 10 | 9/30/77 | |
| | 10/3/77 | |
| | 10/4/77 | |
| | 10/25/77 | |
| | 12/14/77 | |
| | 12/16/77 | |
| | 12/19/77 | |

Notes:

1 - Material acceptance tests were not performed until one day after placement.

2 - Material acceptance test (gradation) was not performed until three days after placement.

3 - In-place density tests with moisture contents greater than 3% above optimum.

TABLE V-8

STRUCTURAL STEEL INSTALLATION

| Review | Structure | Number of Connections | Number of Member or Bolt Insp. |
|---|---|---|---|
| Configuration | Reactor Containment Building | 9 | 21 members |
| | Steam Generator Upper Structure | 4 | 9 " |
| | Dry Cooling Tower | 3 | 5 " |
| | Reactor Coolant Pump (1A) Support | 1 | 3 " |
| | Polar Crane Support | 2 | 2 typical sections |
| | TOTAL | 19 | 40 |
| Bolt Torque | Reactor Containment Building | 29 | 228 bolts |
| | Steam Generator (1B) Upper Structure | 3 | 48 " |
| | Dry Cooling Tower | 10 | 63 " |
| | TOTAL | 42 | 339 |

TABLE V-9

MASONRY WALLS

| Structure | Location | Drawing No. | Inspection | Comment |
|---|---|---|---|---|
| Reactor Auxiliary Building | (1) Elev. -35.0; Col. lines K and 2A; Gas Decay Tank A room (Room B8) | G-765-S02 | Exterior Only | 1 |
| | (2) Elev. -35.0; Col. lines K and 3A; Gas Decay Tank C room (Room B7) | " | " | 1 |
| | (3) Elev. -35.0; Col. lines K and 4A; Gas Decay Tank B room (Room B6) | " | " | 1 |
| | (4) Elev. -35.0; Col. lines J and 14' east of 10A; Heat Exchanger Area B (Room B21) | " | " | 1, 2 |
| | (5) Elev. -35.0; Col. lines J and 14' east of 11A; Heat Exchange Area A (Room 48A) | " | " | 1, 2 |
| | (6) Elev. -35.0; Col. lines H and 11A to 12A; Waste Tanks A and B (Rooms B22 and B24) | " | " | 3 |
| | (7) Elev. -35.0; Col. lines H and 14' cast of 10A; Laundry Tank room (Room B26) | " | " | 1 |

TABLE V-9 - Continued

MASONRY WALLS

| Structure | Location | Drawing No. | Inspection | Comment |
|---|---|---|---|---|
| | (8) Elev. -35.0; Col. lines H and 11' east of 8A; Waste Condensate Pumps Room (Room B32) | G-765-S02 | Exterior Only | 1 |
| | (9) Elev. -35.0; Col. lines 9A and 16' north of G; Waste Condensate tanks Room (Room B31) | " | " | 1 |
| | (10) Elev. +21.0; Col. lines 5A and 10' east of L; outside Decontamination Room (Room 227) | G-775-S02 | " | 4 |
| | (11) Elev. -4.0; Col. lines J and 2A; Volume Control Tank Room (Room B102) | G-765-S01 | Exterior and Partial Interior | 1 |

Notes:

1 - Wall meets the design drawing, but not the design analysis assumptions.

2 - The joint for steel embedded in the wall was evident.

3 - Wall spans 11'-6" which is greater than the 10'-0" maximum specified by Detail BY of drawing G-765-S02.

4 - Wall meets the design drawing.

## VI. MATERIAL TRACEABILITY

### A. Objective

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

### B. Discussion

The approach used to perform this portion of the inspection was to identify and select samples of installed safety-related material and equipment for examination. Some samples of delivered material (such as protective coating materials) not yet installed, but observed in warehouses or shops, were included, and some samples of installed material not accessible were selected from records. A total of 293 samples were examined to varying extents.

Applicable procedures for these activities were reviewed. Table VI-1, "Summary of Samples", indicates the major Waterford-3 contractors involved and the types of activities and samples examined. Samples included structures, equipment, piping, valves, instruments, tubing, weld joints, weld filler material, embedments, electrical cables, hangers/supports, cadweld sleeves, coatings, fasteners and other safety-related items. Table VI-2, "Sample Breakdown by Contractors", shows the number and type of samples applicable to each selected contractor. Table VI-3, "Weld Filler Material Compliance", contains a list of weld filler material samples.

The following sections describe the inspection results.

#### 1. Material Traceability

##### a. Inspection Scope

Samples were examined for traceability to drawings, specifications and procurement records, as applicable. Traceability to supplier certifications, including required Certified Material Test Reports (CMTRs) or Certificates of Compliance (C of C), heat numbers or other required documentation were reviewed. Table VI-2 indicates the types and quantities of samples examined and the contractors involved for the total of 293 samples.

##### b. Inspection Findings

In general, it was noted that the applicant and contractors performing safety-related work had appropriate procedures in place for control of material traceability. Computerized and manual material and equipment record indices, lists, and status reports were used by the contractors, the Architect-Engineer (Ebasco) and the applicant, Louisiana Power & Light (LP&L), to help control the identification and status of material and equipment during construction. An overall computerized records management system is

being developed and applied to provide a consolidated index of records, which will include microfilm records for use during the plant operation phase.

Fifteen samples of weld filler material listed in Table VI-3 were examined for traceability and compliance with codes, and were found to be acceptable. Ten weld rod holding ovens in the active Ebasco weld rod issue station were examined and found to meet requirements.

Material and equipment listed in Table VI-2 were examined for traceability with no significant deficiencies found, except in the area of fasteners.

Deficiencies involving material traceability and control for fasteners were noted as follows:

(1) Deficiencies in safety-related fasteners were noted for such fastener items as anchor bolts, equipment mounting bolts and studs, nuts, washers, and other items. The deficiencies included: a lack of required markings on installed fasteners, lack of required traceability documentation, and dat[illegible] documentation did not match markings on material. Of [illegible] safety-related equipment fastener installations inspected for correct fasteners, 18 were found to have discrepancies. The following is a list of fastener installations found to have discrepancies:

- High-Pressure Safety Injection (HPSI) Pump B - traceability data not available for anchor bolts or for pump mounting bolts to base structure.
- Battery Rack, Room B - traceable records not available to confirm that bolts met requirements.
- Hydrogen Recombiner - base mounting bolts were marked 316 which conflicts with Westinghouse Drawing # 7189019 Rev. 13 which specifies type 304 ASTM A-193 Grade B8.
- CVC Charging Pump B, Inlet Flange Joint - different markings on nuts were not traceable.
- HPSI Pump A/B, Stuffing Box Flange Joint (Inner) - studs sensitive to magnet and corroded, yet stainless steel is specified. Nuts had different markings and were not traceable.
- HPSI Pump A/B, Mounting Bolts - no records available to check traceability of unmarked pump mounting bolts.
- HPSI Pump A, Stuffing Box Flange Joint (Outer) - CMTR for nuts (Ht. 19747) does not match material specified on drawing or installed in the field.

- HPSI Pump A, Top Flange Joint - different configuration of nuts (some with flat face, others not flat) and different markings on nuts. Not traceable.

- HPSI Pump B, Stuffing Box Flange Joint (Outer) - CMTR for nuts does not match material specified on drawing or installed.

- HPSI Pump B, Stuffing Box Flange Joint (Inner) - no traceable markings visible on studs. Markings on nuts do not match specified material.

- Polar Crane Rail Clamp Bolts - markings on bolt heads were not traceable. Documentation was not found for traceability.

- Pressurizer Relief Tank (Quench Tank), Mounting Bolts - markings and records were not available to provide for traceability of these fasteners, or confirm that they were procured from a certified vendor.

The following list of items did not have required code markings as specified on drawings and other documentation for bolts, nuts, and washers:

- Safety Injection Tank 1A, Skirt to Ring Girder

- Safety Injection Tank 1B, Ring Girder to Structure

- Safety Injection Tank 2A, Skirt to Ring Girder

- Safety Injection Tank 2A, Ring Girder to Structure

- Safety Injection Tank 1B, Skirt to Ring Girder

- Safety Injection Tank 1B, Ring Girder to Structure

During the inspection, the applicant initiated Nonconformance Reports (NCRs), Discrepancy Notices (DNs) and Field Verification Requests (FVRs) for corrective actions relative to fastener concerns, identified by the NRC CAT inspectors.

c. Conclusions

Review of the material traceablity program revealed traceability and material control deficiencies for fasteners. Eighteen of 35 safety-related fastener installations examined revealed a lack of traceability and material control to assure that correct fasteners of correct materials were installed.

TABLE VI-1

SUMMARY OF SAMPLES

| Contractors | Activities & Samples | No. of Samples |
|---|---|---|
| Ebasco Construction (EC) | Misc. Construction Completion | 24 |
| Tompkins-Beckwith (T-B) | Piping & Supports | 86 |
| American Bridge (AB) | Structural Steel Erection | 10 |
| Fischbach & Moore (F&M) | Electrical Construction | 21 |
| Dravo (DRA) | Piping (Shop) | 2 |
| Nuclear Installation Services Co. (NIS) | NSS Installation | 4 |
| Mercury (MER) | Instrumentation/Installation | 49 |
| Bergen-Paterson (BP) | Hangers/Supports | 10 |
| Gulf Engineering (GUL) | Mechanical Equip. Installation | 27 |
| Nooter (NOO) | Stainless Steel Tanks | 4 |
| Chicago Bridge & Iron (CBI) | Containment Liner | 7 |
| Waldinger (WAL) | HVAC Installation | 9 |
| Peden Steel (PED) | Steel Fab. (Shop) | 13 |
| J. A. Jones (JAJ) | Civil/Structural | 21 |
| Sline (SLI) | Coatings | 6 |
| | TOTAL | 293 |

TABLE VI-2

SAMPLE BREAKDOWN BY CONTRACTORS*

| | EC | T-B | AB | F&M | DRA | NIS | MER | BP |
|---|---|---|---|---|---|---|---|---|
| Equipment | 5 | 5 | - | 2 | - | - | 6 | - |
| Pipe/ Tubing | - | 8 | - | - | - | - | 6 | - |
| Steel- Struc. | - | - | 2 | 2 | - | - | - | 2 |
| Steel- Plate/ Sheet | - | - | 2 | 2 | - | - | - | - |
| Hangers/ Supports | - | 8 | - | 3 | - | - | - | - |
| Embed- ment | - | - | - | - | - | - | - | - |
| Weld Filler Material | 15** | - | - | - | - | - | - | - |
| Weld Joints | 3 | 61 | 5 | 7 | 2 | 2 | 37 | 8 |
| Elec. Cables (Reels) | - | - | - | 2 | - | - | - | - |
| Fasteners | 1 | 4 | 1 | 3 | - | 2 | - | - |
| Cadweld Sleeves/ Powder | - | - | - | - | - | - | - | - |
| Coatings | - | - | - | - | - | - | - | - |
| TOTALS | 24 | 86 | 10 | 21 | 2 | 4 | 49 | 10 |

TABLE VI-2 - Continued

SAMPLE BREAKDOWN BY CONTRACTORS*

| | GUL | NOO | CBI | WAL | PED | JAJ | SLI | TOTAL*** |
|---|---|---|---|---|---|---|---|---|
| Equipment | 3 | - | - | - | - | - | - | 21 |
| Pipe/ Tubing | - | - | - | - | - | - | - | 14(L) |
| Steel- Struc. | - | 2 | 2 | 2 | 2 | 2 | - | 16(L) |
| Steel- Plate/ Sheet | - | 2 | 2 | 2 | 2 | - | - | 12(L) |
| Hangers/ Supports | - | - | - | 2 | - | - | - | 13 |
| Embed- ment | - | - | - | - | - | 3 | - | 3 |
| Weld Filler Material | - | - | - | - | - | - | - | 15(L) |
| Weld Joints | - | - | 3 | 3 | 9 | - | - | 140 |
| Elec. Cables (Reels) | - | - | - | - | - | - | - | 2(L) |
| Fasteners | 24 | - | - | - | - | - | - | 35(L) |
| Cadweld Sleeves/ Powder | - | - | - | - | - | 16 | - | 16(L) |
| Coatings | - | - | - | - | - | - | 6 | 6(L) |
| TOTALS | 27 | 4 | 7 | 9 | 13 | 21 | 6 | 293 |

* See Table VI-1 for abbreviations used for contractors on this Table.
** Used by Ebasco-Construction (EC) and other contractors.
*** (L) - Lots

TABLE VI-3

WELDER FILLER MATERIAL COMPLIANCE

| Material Designation | Heat No./ Material I.D. | Compliance Comments |
|---|---|---|
| E11018-M 5/32 | 421P6011 | Acceptable |
| E11018-M 1/8 | 412S5501 | Acceptable |
| E7018 3/32 | 20147 | Acceptable |
| E308-16 5/32 | 0F2B-4 Wet Mix B | Acceptable |
| E309-16 5/32 | 9F34B Mix 2A | Acceptable |
| E6011 3/32 | 8L209101 | Acceptable |
| E6011 1/8 | 8L206103 | Acceptable |
| E7018 1/8 | 32655 | Acceptable |
| E7018 5/32 | 8132B22145 | Acceptable |
| E309-16 3/32 | 50087-1 | Acceptable |
| E309-16 1/8 | 10219-2 | Acceptable |
| E308-16 3/32 | 50144-1 | Acceptable |
| E308-16 1/8 | 09580 | Acceptable |
| 7018 MO 1/8 | 412J4861 | Acceptable |
| ER308 1/8 | 190107 | Acceptable |

NOTE: Samples were selected from the only active on-site weld rod issue station, which is operated by Ebasco.

## VII. DESIGN CHANGE CONTROL

### A. Objective

The objective of the appraisal of design change control was to determine whether design activities were conducted in compliance with the requirements described in the facility Safety Analysis Report (SAR).

### B. Discussion

Within the broad category of design change control, attention was given to four principal areas. These areas included control of design documents, handling of design change documents, use of contractor information requests, and use of Condition Identification Work Authorizations (CIWAs). These areas were selected to augment the review of the design change control process performed within the individual disciplines.

#### 1. Control of Design Documents

##### a. Inspection Scope

Design documents were reviewed for proper posting of design change documents and for current revision numbers. Four drawing stick files containing controlled drawings were compared with document control records to determine whether design changes affecting the particular drawings were posted on the drawing and whether the latest drawing revision was on file. In addition to a review of controlled drawings, the inspection scope included a review of a construction specification and of Ebasco's Drawing Close-out Schedule.

##### b. Inspection Findings

Discrepancies found during the review of drawing stick files which contained controlled documents were:

(1) Drawings within various design groups of Ebasco Site Services Engineering (ESSE) were not properly posted with the applicable Field Change Request (FCR) and Design Change Notice (DCN) numbers.

| Design Group | DWG # | Rev. | FCR/DCN Not Posted |
|---|---|---|---|
| ESSE Electrical | G310 sh4 | 3 | DCN-E-1193 |
| ESSE Electrical | G314 | 8 | FCR-E-3192 R3<br>DCN-E-825 R4 |
| ESSE Mechanical | G435 sh6 | 3 | FCR-IC-P-602<br>DCN-IC-1247 R1 |

(2) Drawing stick files which contained controlled drawings within various design groups of ESSE were not kept current with respect to the latest drawing revisions.

| Design Group | DWG # | Revision Found | Latest Revision |
|---|---|---|---|
| ESSE Mechanical | G432 sh8 | 7 | 8 |
| ESSE Mechanical 4305 1893 | EMDRAC | 3 | 4 |
| ESSE I&C Mech. | G161 sh2 | 6 | 14 |
| ESSE I&C Mech. | G164 sh3 | 8 | 10 |
| ESSE I&C Mech. | G164 sh4 | Missing | 2 |

During the inspection, Ebasco deleted drawings from various controlled lists which were no longer applicable to a particular design group or control center. For example, the ESSE I&C Mechanical design group had the mechanical system flow diagrams deleted from their lists of controlled drawings.

At the request of the NRC CAT inspector, Ebasco conducted a survey of the posting on ESSE Electrical G-size drawings. The G-size drawings in ESSE Electrical reflect the routing of the primary safety and nonsafety cable and conduit runs. From this survey Ebasco identified 35 missing postings out of a population of 732.

During the review of Ebasco's Drawing Close-out Schedule, it was found that the list of outstanding FCRs and DCNs on various drawings were incorrect. The following are examples of errors in the Drawing Closeout Schedule of January 20, 1984.

| Drawing | Improper FCR/DCN Listing | FCR/DCN Not Listed But Outstanding |
|---|---|---|
| G435 sh6 R3 | | FCR-IC-P-602 |
| G190 sh3 R3 | DCN-MP-704 R1 | |
| G162 sh2 R11 | | FCR-MP-2474 |
| G162 sh4 R1 | FCR-MP-2474 | FCR-MP-2589 |
| G310 sh2 R2 | FCR-E-850 | |
| G310 sh3 R3 | DCN-E-1444 | |
| G311 sh1 R8 | DCN-E-1023 | |
| G315 R6 | FCR-E-533 | DCN-E-1345 R2 |
| | FCR-E-988 R3 | |
| | FCR-E-1089 | |
| | FCR-E-1188 | |
| | DCN-E-463 R2 | |
| | FCR-E-2567 | |
| G319 sh1 R8 | | |
| G320 sh1 R8 | | FCR-E-1444 |
| G320 sh1 R10 | | FCR-E-1444 |
| G432 sh5 R7 | DCN-IC-1179 R2 | FCR-IC-?-37 |

Discrepancies found during the review of General Specification MC-1, "General Specification Covering Installation of Mechanical Equipment" were:

(1) A copy of specification MC-1 did not have the correct posting upon receipt from field Document Control. Specifically, the revisions of FCR-CH-1101 were not posted.

The missed posting in Document Control occurred because the orginating and reviewing organizations of FCR-CH-1101 Rev. 2 and Rev. 3 did not correctly identify that specification MC-1 was an affected document. As a consequence, Document Control could not properly post these two revisions against the document.

(2) ESSE Mechanical's controlled copy of specification MC-1 did not have the following applicable FCRs posted:

| | | | |
|---|---|---|---|
| FCR-M-13 | FCR-M-110 | FCR-M-118 | FCR-M-123 |
| FCR-M-129 | FCR-M-196 | FCR-CH-1237R1 | FCR-M-1101R3 |

From a review of the dates of approval of these FCRs, it can be concluded that posting of applicable FCRs against specification MC-1 was not performed after April 4, 1981.

c. Conclusions

The incorrect posting of design changes on controlled documents and the use of outdated drawing revisions within ESSE engineering disciplines reflect a deficiency in the design control process. The concern is that design disciplines within ESSE are not working with accurate drawings.

The incorrect listing of outstanding FCRs and DCNs for numerous drawings in Ebasco's Drawing Closeout Schedule reflect a breakdown in the maintenance of this document. The Drawing Control Closeout Schedule is a listing of Ebasco's design drawings and, by procedure, site Document Control is responsible for auditing their files against it. From our inspection and interviews with cognizant design supervisors, the Drawing Closeout Schedule is not periodically updated (monthly by procedure). Descrepancies between the Document Control posting and the Drawing Closeout Schedule are not resolved until a drawing is about to be revised. The failure to maintain the Drawing Closeout Schedule in accordance with the project procedure is in part responsible for the posting errors in Document Control and on design drawings.

2. Design Change Control

a. Inspection Scope

The design change program and applicable procedures used at Waterford 3 were examined. The NRC CAT inspectors selected a sample of eight DCNs and 33 FCRs to review in detail. The detailed review consisted of determining the reason or need for the change, the impact on original design intent, the adequacy of the review and approval sequence, and whether the change was incorporated into design documents. When errors were found in the design configuration as described on design documents, a field inspection was made of the installed condition.

The following documents provided the acceptance criteria for this review:

10 CFR 50 Appendix B

ANSI N45.2.11

Ebasco Procedure No. E-69, "Design Change Notice/Field Change Request"

Ebasco Procedure No. ASP-I-4, "Design Control"

Ebasco Procedure No. ASP-IV-73, "Processing of Design Changes IN ESSE"

Ebasco Project No. II B-6, "As-built Design Drawings"

b. Inspection Findings

Of the eight DCNs reviewed, one DCN was found not to be properly incorporated into the plant design. DCN-MP-247 was a major change which was initiated to add motor-operators to certain valves because of an FSAR commitment. The following discrepancies associated with this DCN were found:

(1) Changes to piping drawing G195 Sheet 1 were not accomplished, although the drawing revision block indicated that DCN-MP-478 had been incorporated. The most significant items not incorporated were the addition of details M and N.

(2) The DCN did not list seven piping isometric drawings that were affected by the change.

(3) Of the seven isometric drawings, five were changed and the DCN was referenced in the revision box. The other two isometrics were not changed.

(4) Valve 2SI-V-305B is not installed in the position required by DCN-MP-478 or as shown on ISO SI-IC-59 (i.e., the valve operator is installed in a horizontal plane rather than rotated 15 degrees from the horizontal plane).

(5) Valve actuators for valves 2SI-V-305B, 2SI-V-307A, 2SI-V-308B, 2SI-V-353, and 2SI-V-346B are rotated about their axis in a position which differs from that specified in the DCN.

For the 33 FCRs in the inspection sample, the following deficiencies were noted:

(1) FCR-MP-1446 Revs. 0 and 1 were not properly incorporated into affected design documents. The FCR was prepared to document a change to a piping configuration based upon a red line drawing. Rev. 0 of the FCR did not list one of the two affected piping isometric drawings. Isometric drawing CS-IC-26 was not listed as an affected drawing. In addition, Rev. 0 of the FCR had dimensional errors. Consequently, Rev. 1 was prepared to correct the dimensional errors of Rev. 0, but it too contained dimensional errors.

(2) FCR-MP-2326 was prepared to correct the dimensional errors of FCR-MP-1446 Rev. 0 and Rev. 1. However, it too had dimensional errors. To correct this error Ebasco initiated a third FCR during the inspection.

(3) FCR-E-2567 was an FCR initially prepared to revise safety-related cable routing based upon contractor information requests generated by Fischbach and Moore. The FCR was prepared and revised three times because of an unclear contractor information request, and because of a failure on the part of the preparer of the FCR to ascertain the actual wiring condition in the field. The development sequence of this FCR had numerous procedural errors. For example, Rev. 1 of the FCR stated that "Rev. 1 of this FCR voids the original in its entirety." In accordance with the procedure in effect at the time (ASP-I-4, Issue H) a revision to an FCR should have included all the information and attachments contained in the original FCR. When a revision would be impractical because of the volume of material a new FCR should have been written.

(4) Document Control had 16 FCRs posted against Specification MC-1 dating from May 1977 through May 1983. None of the FCRs had been incorporated into the document. Although each individual FCR was classified as a minor change, the sum total of all of these changes was extensive. In addition, a few of the later FCRs changed installation requirements of previous FCRs. Consequently a contractor, design organization, or a quality assurance inspector would have had a very difficult

time knowing which requirements were current without a detailed personal knowledge of each FCR and the contents of specification MC-1.

(5) The recommended dispositions of some FCRs applicable to specification MC-1 were approved by an organization that was different from the organization that performed the original review and approval.

Specification MC-1 was a construction installation document prepared by Construction Engineering and reviewed by Quality Assurance and by the Construction Manager. However, Ebasco Field Engineering reviewed and approved the recommended disposition of FCRs which cited specification MC-1 as an affected document. The following FCRs were approved by Ebasco Field Engineering:

| | | |
|---|---|---|
| FCR-M-19 | FCR-M-129 | |
| FCR-M-110 | FCR-M-118 | FCR-M-123 |
| FCR-M-1101 Rev. 3 | FCR-HVAC-323 | FCR-CH-123 Rev. 1 |

A problem arose in the definition used by Ebasco to define a minor change. As defined in Ebasco Procedure Number ASP-I-4 a minor change "does not affect intent of latest approved design including equipment, component, system or structure, which relates to function, operation or safety, or future extension of plant; and results in extra costs of less than $100,000 and has no adverse effect on the critical path of the Project Schedule." However, ANSI N45.2.11 indicated that a minor change to design documents are inconsequential editorial corrections or changes to commerical terms and conditions. ANSI N45.2.11 further indicated that changes that fall into this category may not require the revision to receive the same review and approval as the original document. Each of the posted FCRs identified above, when they were approved, in effect revised specification MC-1. Although each fulfilled the definition of a minor change per Ebasco procedure, they were not inconsequential editorial corrections and would have been classified as a significant change per ANSI N45.2.11.

(6) FCR-CH-1101 Revs. 2 and 3 did not identify that specification MC-1 was an affected document.

c. Conclusions

In the small sample of design control documents, three instances were identified where an affected drawing or specification was not included as an affected document. Two of these occurred on FCRs involving minor changes as defined by Ebasco procedure.

However, the other instance occurred on a DCN identified as a major change, and it involved more than one document. The failure to identify all of the affected documents on a DCN can be attributed to a procedural breakdown. Specifically, Ebasco procedures for the preparation and handling of design change documents do not require that all affected documents be listed on a design change notice.

Ebasco Company Procedure No. E-69 is the procedure which describes the handling of design change documents. This procedure indicates that it is used to effect changes to approved Ebasco drawings, design documents, or specifications. The NRC CAT inspectors were informed that in the piping area, DCNs only list the affected Ebasco design drawings. The inspectors were further informed that Ebasco design drawings are system flow diagrams and piping arrangement drawings. Review of Waterford Unit 3 Project Procedure No. II B-6, "As-built Design Drawings" confirms that piping isometric drawings are not included in the list of Ebasco design drawings to be verified as as-built drawings. However, piping isometric drawings are used to verify completed work and to facilitate various system walkdowns. Because isometric drawings are used to verify completed work, the NRC CAT inspectors are concerned that the as installed condition in the plant may not reflect the design as prescribed on Ebasco design drawings.

Whether major or minor changes, FCRs are normally incorporated into design documents. However, project procedures do not require that all FCRs be incorporated into effected design documents. Consequently, for a construction installation specification like MC-1, FCRs were not incorporated. Although LP&L has committed to ANSI N45.2.11 in their FSAR, Ebasco is using a definition of minor change significantly different from that stated in the standard. Not only can this result in a document not being revised, but it can result in changes to that document which have not been reviewed by the organization that performed the original review and approval. Ebasco procedures should be revised to ensure that all significant changes are correctly translated into specifications, drawings, procedures, and instructions.

3. Request for Information

a. Inspection Scope

Construction contractors used a request for information to identify a condition inconsistent with available design or specification data or to obtain an appropriate reference to design or specification information. Contractors submitted requests for information in various formats consistent with their contracts. A sample of information request documents were reviewed to verify that changes to design documents were accomplished by FCRs and DCNS.

The NRC CAT inspectors reviewed 527 contractor information requests and selected a sample of 144 to review in detail. The contractor information requests subjected to detail review included information requests from four contractors working in the areas of installation of mechanical equipment (Gulf Engineering Company), of electrical equipment (Fischbach and Moore), of piping and pipe supports (Tompkins-Beckwith), and of instrumentation and control equipment (Mercury Company).

Ebasco procedure number ASP-IV-56, "Control of Information Requests Between Ebasco and Site Contractors" provided the basic acceptance criteria for the review. Specifically, a contractor's information request may only be a clarification of construction details, a directive to remove equipment or material, or a directive to install and document in accordance with the applicable site procedures for control of as-built information. A contractor's information request may not be used to authorize a design or specification change.

b. Inspection Findings

The following is a synopsis of the inspection findings for each of the contractors' information requests reviewed.

Fischbach and Moore

The engineering dispositions on Fischbach and Moore requests for information consistently referenced outstanding FCRs and DCNs or indicated that a design change was forthcoming through an FCR or DCN. Of the 107 request for information forms reviewed one had an engineering disposition directing Fischbach and Moore to perform work which should have been accomplished by a design control document. A memorandum attached to a Fischbach and Moore request for information, RFI 5088, directed the contractor to remove valve position switches from safety-related valves and to replace them with environmentally qualified position switches when received from the valve supplier. The July 29, 1982 memorandum, F-54412-AST, was written by an Ebasco Startup engineer to the Chief Engineer of Fischbach and Moore. The memorandum listed 24 valves, all but two of which were safety related. The position switches for each of the 22 safety-related valves were visually inspected to verify that the correct position switches were installed in accordance with the valve manufacturer's drawings and LP&L's response to NUREG-0588. Of these valves, one valve has a position switch which does not agree with its associated design documents. Specifically, valve CC-F-272A has one position switch that is a NAMCO Model EA 170 32302, while the valve manufacturer's drawing indicates that a Model EA 170 42302 is required.

During the inspection, Ebasco could not identify an approved FCR or DCN which authorized the change out of the position switches. To evaluate the effect of this apparent unauthorized design change Ebasco has prepared a nonconformance report.

Gulf Engineering Company

The engineering disposition on Gulf Engineering's Design Engineering Notices (DENs) was annotated when a design change was required. However, the engineering dispositions did not consistently identify the design change document nor the expected date of issuance as required by ASP-IV-56. Of the 150 DENs reviewed, one had an engineering disposition authorizing Gulf Engineering to perform work without directing them to existing design information or to appropriate design change documents. In another DEN, Gulf Engineering identified that a discrepancy existed between design documents and vendor supplied equipment. However, Ebasco did not generate a design change document.

In DEN 1545, Gulf Engineering identified that the lube oil cooler for the emergency feedwater pump (turbine-driven) was installed with one-inch 150-lb R.F. flanges on the tube inlet and outlet, while vendor supplied piping had one-inch 300-lb R.F. flanges. In addition, the pump manufacturer's technical manual indicated that the flanges should be 300-lb. R. F. flanges. The engineering disposition stated that the technical manual would be revised and that a design change was required. However, a design change document was not initiated to revise the technical manual, and no reference was made to correct design documentation on the DEN. Field inspection verified that the 150-lb. R.F. flanges were used in the field installation of the lube oil cooler and its associated piping.

To correct the discrepancy between the vendor's technical manual and vendor design drawings, an FCR was initiated by Ebasco to revise the technical manual to the current design configuration.

In DEN 492, Gulf Engineering informed Ebasco that upon their field inspection of the Auxiliary Component Cooling Water pumps they noticed that these pumps had a seal arrangement which differed from that described in the manufacturer's technical manual. Specifically, Gulf Engineering informed Ebasco that the pumps had mechanical seals on both outboard and inboard bearings, while the technical manual called for the inboard bearing to have a stuffing box. The Ebasco Construction mechanical engineer stated in the engineering disposition that mechanical seals are acceptable and that an engineering change will be forthcoming to correct the discrepancy. However, an engineering change was never generated to correct the discrepancy. Review of EMDRAC drawings associated with the pumps indicated that EMDRAC DWG 1564-1536 R2 dated June 2, 1978, showed one mechanical seal on the outboard bearing and a stuffing box on the inboard bearing (side closest to coupling).

During the inspection, Ebasco initiated an FCR to correct the discrepancy on design documents.

In some instances, Ebasco's engineering dispositions were different for similar DENs. In DEN 1554, Gulf Engineering requested information concerning the correct type of bolts to be used when installing the Regenerative Heat Exchanger, because vendor drawings did not specify the anchoring details. For this DEN, Ebasco initiated an FCR and revised the vendor drawing. For DEN 1562, Gulf Engineering requested clarification concerning the acceptability of using A307 bolts in the anchoring of the Quench Tank to structural steel. Although the Quench Tank is not safety-related, it is located within the Reactor Containment Building and is required to be restrained from impacting safety-related equipment following a Safe Shutdown Earthquake (SSE). However, for this DEN Ebasco informed Gulf Engineering that A307 bolts were not acceptable and referred Gulf Engineering to the general note on a miscellaneous steel drawing (LOU-1564-G-814). This note stated that "Field connections, unless noted, shall be ASTM A325 ... in accordance with LOU 1564.723." Field inspection verified that six of the eight bolts holding the Quench Tank had been installed as non-nuclear safety (NNS) equipment without suitable quality control inspection commensurate with its importance to safety. Further information concerning the structural bolting of the Quench Tank can be found in the Material Traceability section of this report.

In DEN 473, Gulf Engineering requested torque value increases on mechanical draft dry cooling tower plugs from 175 ft-lbs to 225 ft-lbs. In Ebasco's engineering response, Gulf Engineering was advised to see FCR M-120 for revised torque values. In addition, the engineering disposition stated that work may proceed since an FCR is forthcoming. Review of the FCR revealed that it was initiated and approved on July 16, 1981, the same day that the engineering disposition was signed. Although the engineering disposition seemed to violate Ebasco procedure ASP-IV-56 and authorize Gulf to proceed with work without an approved design change document, an approved FCR was available from site Document Control that same day.

Mercury Company

The information requests between Ebasco and Mercury were handled by Information Request (IR) prior to July 17, 1979 and by Request for Engineering Information (REI) after that date. Although Ebasco Procedure ASP-IV-56 was approved and issued on March 19, 1979, the requirements of the procedure were not closely followed until Mercury had switched to the REI form. The team reviewed 137 information requests between Ebasco and Mercury. Of this number, 94 were REIs and 43 were IRs. From this sample size, a total of 54 information requests (43 REIs and 11 IRs) were reviewed in detail. IRs prior to March 19, 1979 were excluded from the sample.

In three instances, Ebasco's engineering disposition permitted deviations from the approved engineering design without an appropriate design control document. Specifically, the engineering dispositions of IRs 47 and 63 approved seismic restraint details for instrumentation and control tubing and valves which were not in accordance with approved seismic restraint details on Ebasco design drawings. Likewise the engineering disposition of REI 1464 authorized Mercury to leave a low point in an instrument impulse line contrary to Ebasco general design criteria. The following is a description of each of these contractor information requests:

In IRs 47 and 63, Mercury requested approval of seismic restraint details which differed from the details provided on approved Ebasco drawings. IR 47 was approved on June 5, 1979, and IR 63 was approved on June 14, 1979. Both of these IRs were approved by an I&C Construction Engineer. IRs 47 and 63 each contained two restraint details. On December 4, 1980, a Stop Work Order was issued by Site Quality Assurance, because of Ebasco's non-compliance with design control procedures. The stop work was issued when it was determined that Mercury had been installing seismic supports in accordance with their drawing details which had not undergone a proper design review by Ebasco. NCR-W3-2333 was prepared to address this condition. Included in NCR-W3-2333 were two of the seismic restraint details initially approved in IRs 47 and 63 (i.e., one detail per IR); however, the other two Mercury support details were not included in the NCR. For each of these support details Mercury had voided the detail prior to issuance of the Stop Work Order. On November 5, 1979, Mercury voided the seismic restraint detail shown as sketch 3 on IR 47. Likewise on April 31, 1980, Mercury voided the seismic restraint detail shown as sketch 2 of IR 63. Consequently, Mercury was in a position to use these unreviewed support details for seismic support purposes for five months in the case of IR 47 and 10 months for IR 63.

When asked if the support details had been used by Mercury during the period between IR approval and Mercury's voiding of the drawing, the response was "No." The reason given for that response was that Quality Control inspectors had to verify that each seismic support was in accordance with approved Ebasco details and would have identified a discrepancy if a Mercury support detail had been used.

In REI 1464, Mercury requested permission to leave an existing one-inch low point in an impulse line. In the REI, Mercury identifies the process line, the design conditions, the installation detail (i.e., instrument mounted below process connection), as well as the current configuration. The engineering disposition directed Mercury to proceed as stated in their information request and categorized the engineering disposition as a clarification of a construction detail. Ebasco Design Drawing LOU-1564 B-430 requires that instrument sensing lines slope continuously toward

an instrument when mounted below the process connection. Although the engineering disposition of the REI authorized a design deviation without an approved design change document, field verification confirmed that the slope of the instrument line does meet Ebasco design requirements. Apparently the instrument line was reworked after the REI was submitted on November 27, 1981.

Tompkins-Beckwith

Approximately 230 Tompkins-Beckwith (T-B) information requests were reviewed and a sample size of 74 was selected for detailed review. The information requests were prepared between December 14, and October 12, 1981. Seventy-eight percent of the engineering dispositions referenced outstanding FCRs and DCNs or identified revised hanger drawings. The remaining information requests were clarifications of construction details with two exceptions. In both of these instances the engineering disposition directed T-B to shim incorrectly installed hangers. An Ebasco engineer explained that T-B could perform the work without an FCR or DCN, because the design intent had not been changed. He further indicated that T-B would have performed the work in accordance with existing redline procedures. A verification was performed to determine if T-B had performed the rework in accordance with approved redline procedures.

For IR 4965, T-B did shim the hanger in accordance with a marked up redline drawing prepared on September 19, 1981. This date corresponds to the date of the contractor information request. In response to the engineering disposition of IR 5010, T-B prepared another information request, IR 5137, indicating that shimming was not going to be successful. Based upon this information request Ebasco redesigned the hanger, deleted the previous design, and revised the hanger drawing (CCRR-901 Rev., 5).

In summary, the engineering dispositions of IRs 4965 and 5010 did not meet the procedural requirements of ASP-IV-56 in that the dispositions did not direct T-B to install and document in accordance with the applicable ASP procedure for control of as-built information. However, T-B rework was actually performed in accordance with approved procedures.

During the review of T-B information requests, it was noticed that "white out" was used on four information requests to obliterate written text. In examining original documents, it was determined that in two instances the text of the engineering disposition paraphrased the obliterated text. For the other two information requests no determination could be made.

c. Conclusion

In many instances the use of contractor requests for information was in accordance with the requirements of Ebasco procedure ASP-IV-56. However, four examples were identified where the engineering disposition approved a change to the plant design without an approved design change document. Procedural violations with respect to the engineering dispositions in three contractor information requests could have resulted in the contractors altering the design. In addition, the engineering dispositions of two contractor information requests indicate that a design change document was forthcoming; however, action was never initiated.

4. Condition Identification Work Authorization (CIWA)

a. Inspection Scope

CIWAs were the mechanism by which LP&L identified actual or potential hardware and software discrepancies and requests for technical evaluation. The CIWA was used by LP&L to request completion, modification, or rework on systems for which the contractor had relinquished responsibility and that were substantially complete. Should LP&L have discovered a situation that was considered inconsistent with available design or specification data, then a CIWA would be generated to identify the condition. A sample of CIWAs were reviewed to verify that changes to design documents were accomplished by appropriate design control methods.

The NRC CAT inspector selected a sample of CIWAs based upon a review of a computer listing of all CIWAs prepared against the Containment Spray System. A sample size of 25 CIWAs were chosen for detailed examination.

Waterford 3 Administrative Procedure UNT-5-002, "Condition Identification and Work Authorization" provided the basic acceptance criteria for the review.

b. Inspection Findings

No discrepancies were identified.

c. Conclusions

The use of CIWAs was found to be satisfactory with respect to the design control process.

## VIII. CORRECTIVE ACTION SYSTEMS

### A. Objective

The objective of the appraisal of the corrective action systems was to determine whether measures are established and implemented to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. The appraisal was made to determine whether the measures were accomplished in accordance with regulatory requirements, Final Safety Analysis Report (FSAR) commitments, and project procedures.

### B. Discussion

The specific areas of the corrective action system examined were nonconformance reports (NCRs), discrepancy notices (DNs) [includes engineering discrepancy notices (EDNs), discrepancy reports (DRs), inspection reports (IRs)], audits, and corrective action taken to preclude recurrence.

#### 1. Nonconformance Reports

##### a. Inspection Scope

Nonconformance reports of Ebasco Services, Inc. (Ebasco) were reviewed by the NRC Construction Appraisal Team (CAT) inspectors. A random sample of NCRs (encompassing most safety-related systems, contractors, and work disciplines) were examined for adherence to procedural requirements, correct dispositioning of nonconformances, and accountability of documents.

(1) A total of 200 NCRs were selected at random to verify adherence to procedures. Ebasco NCRs were examined for the following companies:

- Ebasco Services, Inc.
- Tompkins-Beckwith, Inc.
- Mercury Company
- Fischbach and Moore, Inc.
- Gulf Engineering Company, Inc.
- Sline Industrial Painters, Inc.
- Nuclear Installation Services Company
- J. A. Jones Construction Company
- Nooter Corporation
- The Waldinger Corporation
- American Bridge Division
- B&B Insulation, Inc.

(2) The NRC CAT inspector selected 133 NCR numbers to determine accountability of reports.

(3) A field inspection was performed to verify that the corrective action listed on selected closed NCRs was actually accomplished. A sample of 12 NCRs in the areas of electrical, instrumentation, mechanical, civil, and welding were inspected.

b. Inspection Findings

(1) The NRC CAT inspector found that Ebasco Procedure ASP-III-7, Issue "J", dated December 9, 1983, did not require the use of field applied hold tags on nonconforming equipment or material when an NCR was written without a lower level discrepancy notice having been initiated. Also, this procedure revision, entitled "Processing of Nonconformances," removed the requirement to complete the Corrective Action Report (Ebasco Form 6009-11/2-82-B). This form requires corrective action to be taken to preclude repetition of the nonconforming condition. Subsequently, Procedure ASP-III-7 was revised under Issue "K" on March 7, 1984, to restore both the requirements to apply hold tags and take action to preclude recurrence of the nonconforming condition.

The review of the NCRs showed the following violations of Procedure ASP-III-7:

° The 10 CFR 50.55(e) and 10 CFR 21 reportability stamp was not initialed and dated prior to the NCR being transmitted for corrective action in 26 instances.

° A statement of the requirement violated by the nonconforming condition was missing from 24 NCR samples.

° The Ebasco QA trend code (each nonconforming condition has a unique number) was left off four NCRs.

An LP&L site audit (W3S 83-22), performed from September 20 to October 5, 1983, had similar findings. Ebasco responded to the audit on October 31, 1983, by stating that continued training in Procedure ASP-III-7 requirements was being implemented to assure compliance. Subsequently, the NRC CAT inspector reviewed 14 NCRs that were initiated after the Ebasco audit response. The sampled reports showed adherence to procedural requirements in each deficient area except for six instances where the requirement being violated by the nonconforming condition was not stated. The six NCRs are: W3-7257, W3-7391, W3-7495, W3-7518, W3-7564, and W3-7567.

(2) The 133 random NCR numbers selected for accountability were found to have corresponding reports either closed out and on file in the Ebasco records vault or were still in open status.

(3) The NRC CAT inspector selected 12 closed reports to verify the actual field accomplishments of the corrective action indicated on the NCRs. The NRC CAT inspector found the field dispositions of each NCR selected to be as stated on the reports.

c. Conclusions

Except as noted (missing statement of requirement violated), the reporting and documenting of nonconforming conditions appear to be in compliance with regulatory requirements.

Ebasco QA stated that a determination would be made as to how many nonconforming items do not have hold tags applied and would install tags where appropriate.

The requirement to take action to preclude repetition of the nonconforming condition was removed from procedures for only a three-month period. Although during this period timely action to preclude repetition would not have been taken, these nonconformances did become part of the data base for the Ebasco quarterly trend analysis. This trend analysis would look at these nonconformances and, if the problems were repetitive, action would be taken to preclude recurrence. The lack of this procedural requirement for a three-month period does not appear to be of major concern.

Generally, Ebasco's program of continuing training in procedural requirements appears to be working. The remaining deficiency (missing statement of requirement violation) by contractors requires further action.

2. Discrepancy Notices

a. Inspection Scope

DNs, EDNs, DRs, and IRs are vehicles used by various companies to report discrepant conditions. These notices or reports are reviewed and, if the discrepant condition warrants, they are upgraded to an Ebasco NCR.

The NRC CAT inspector reviewed a random sample of reports for NCR upgrading and accountability of documents.

(1) A total of 359 DNs, EDNs, DRs, and IRs were examined from the following companies to determine whether any should have been upgraded to NCR status:

- Ebasco Services, Inc.
- Tompkins-Beckwith, Inc.
- Fischbach and Moore, Inc.
- Gulf Engineering Company, Inc.
- Sline Industrial Painters, Inc.
- J. A. Jones Construction Company
- The Waldinger Corporation

(2) The NRC CAT inspector selected 1,100 DNs for Tompkins-Beckwith, Inc., and 92 DRs for Gulf Engineering Company, Inc., to determine accountability of documents.

b. Inspection Findings

(1) The NRC CAT inspector discovered five Ebasco DNs and two Ebasco EDNs that should have been upgraded to NCR status but were not. These notices all involved discrepant conditions where an as-built condition was accepted and a field change request (FCR) was initiated. Discrepancies do not have to be upgraded to NCRs if the condition can be corrected by approved procedures, specifications, or drawings. The discrepancies reviewed do not appear to fit into this definition. The seven notices are as follows:

° DNs C-0365, C-0367, C-0383, C-0388, C-0393

° EDNs EC-1502, EC-1519

(2) Each of the 1,100 DNs and 92 DRs selected were accounted for by the NRC CAT inspector.

c. Conclusions

Generally, DNs, EDNs, DRs, and IRs are handled properly. The seven discrepancies that the NRC CAT inspector determined should have been upgraded to NCR status received adequate evaluation, and in some cases as much as an NCR would have had. On an item by item basis each discrepancy appears to have no safety significance. However, only NCRs are entered into the data base for the Ebasco trend analysis. Thus, some repetitive problems may not be analyzed to preclude recurrence.

3. Audits

a. Inspection Scope

The NRC CAT inspector reviewed one LP&L audit of Ebasco performance and ten Ebasco audits of contractor performance in the area of corrective action systems. The audits were reviewed to determine if they were performed when required, if responses were timely, and if action was adequate to preclude recurrence.

b. Inspection Findings

The audits reviewed appeared to satisfy procedural and regulatory requirements except for corrective action taken to preclude repetition as noted above.

c. Conclusions

From the above findings, it appears the audit requirements for corrective actions are generally being met.

4. Corrective Action Taken to Preclude Recurrence

a. Inspection Scope

The CAT inspector compared previous NRC inspection findings to deficiencies discovered during this inspection to note any similarities.

b. Inspection Findings

The following are examples of previously reported deficiencies similar to those found during this inspection:

(1) NRC Inspection Report 50-382/83-13 contained a Notice of Violation concerning heating, ventilation and air conditioning (HVAC) supports that had additional loads attached that were not shown on detail drawings. In addition, allowable load capacity calculations were not made for these additional loads. LP&L responded to the violation on May 17, 1983, and corrective action was initiated to preclude recurrence.

The NRC CAT inspectors found 18 of 28 electric cable tray and HVAC supports with loads not shown on design documents. Six of the 15 tray supports contained loads in excess of the stated allowable with no evidence of the required engineering analysis. Refer to Sections II.B.1.b(2) and III.B.3.b of this report for a detailed discussion of the NRC CAT findings.

(2) A Notice of Violation and a Proposed Imposition of Civil Penalty were issued to LP&L on December 6, 1982, for a quality assurance breakdown. Safety-related instrument impulse piping was found to have been improperly installed and documented. Also discovered were hanger weld and orientation problems involving four emergency core cooling systems. LP&L's response on January 4, 1983, stated action had been taken to preclude repetition.

The NRC CAT inspectors found that numerous problems with supports/restraints as-built configuration still existed at the time of this inspection. Refer to Section III.B.2 of this report for a detailed discussion of the NRC CAT findings.

(3) The NRC in Inspection Report 50-382/81-23 issued a Notice of Violation concerning inadequate care and maintenance of station batteries and safety-related motors. LP&L responded to the violation on November 13, 1981, stating that corrective action was initiated to preclude recurrence.

The NRC CAT inspectors found a subsequent Notice of Violation issued in NRC Inspection Report 50-382/82-05 against the maintenance of safety-related motors, and further found that current electrical maintenance procedures are not in all cases being followed. Refer to Section II.B.3.b(1) of this report for a detailed discussion of the NRC CAT findings regarding electrical maintenance.

(4) Significant Construction Deficiencies (SCDs) 73 and 78 were issued on April 11, 1983, and April 28, 1983, respectively, to address welding deficiencies by American Bridge in the Reactor Containment Building and the Reactor Auxiliary Building. A comprehensive reinspection program by LP&L was completed and rework has been finished.

The NRC CAT inspectors found weld deficiencies in the shop welds fabricated by Peden Steel, which was an American Bridge subcontractor. Refer to Section IV.B.10 of this report for a detailed discussion of the NRC CAT findings.

(5) NRC Inspection Report 50-382/83-13 contained a Notice of Violation concerning piping to structure clearance problems not being properly identified. LP&L responded to the violation on May 17, 1983, that corrective action was initiated to preclude recurrence.

The NRC CAT inspectors found several instances where the clearance between piping and adjacent structures did not meet approved criteria. Refer to Section III.B.1.b of this report for a detailed discussion of the NRC CAT findings.

c. Conclusions

The NRC CAT findings in the area of corrective actions indicate that the commitments made to the NRC regarding the recurrence of nonconforming conditions have not been fulfilled. This is a recurring problem and is of considerable concern to the NRC CAT inspectors.

## 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 this inspection.

### 1. Exit Meeting

#### Applicant

L. Bass
R. Bennett
E. Blake
J. M. Brooks
R. F. Burski
J. M. Cain
N. S. Carns
K. W. Cook
A. Cutrona
J. DeBruin
F. Deloume
D. E. Dobson
N. E. DuBry
J. Fager
T. Gerrets
D. G. Graf
D. Grubic
J. B. Hart
R. A. Hartnett
J. Houghtaling
R. James
G. Koehler
R. S. Leddick
R. G. Lewis
L. Lubinski
J. McGaha
R. J. Milhiser
M. D. Mohundro
W. M. Morgan
R. M. Nelson
P. Pitman
R. G. Pittman
U. B. Quinby
G. Rogers
T. Rucci
R. Sandridge
J. Sleger, Jr.
P. R. Snowden
R. E. Sproles
L. A. Stinson
L. F. Storz
B. M. Toups
M. Walsh
J. L. Wills
M. K. Yates

#### NRC and Consultants

T. L. Chan
J. T. Collins
R. M. Compton
G. L. Constable
W. A. Crossman
D. M. Crutchfield
J. K. Devers
T. A. Flippo
D. C. Ford
J. F. Gagliardo
G. B. Georgiev
J. N. Grace
R. F. Heishman
P. Keshishian
L. Lazo
J. B. McCormack
W. S. Marini
E. Martindale
R. P. Mullikin
G. J. Overbeck
H. Phillips
W. J. Sperko
S. R. Stein
J. I. Tapia
J. M. Taylor
J. H. Wilson
H. J. Wong

### 2. Applicant's Coordinators

a. Overall CAT Coordinators

G. Rogers
R. G. Bennett

b. Electrical and Instrumentation

R. James
R. G. Pittman
G. Koehler

c. Mechanical

M. D. Mohundro

d. Welding and NDE

B. M. Toups
R. G. Lewis

e. Civil and Structural

R. Sandridge
D. Grubic

f. Material Traceability

R. A. Hartnett

g. Design Change Controls

D. G. Graf

h. Corrective Action Systems

L. Bass

3. Waterford SES Personnel Interviewed

| | | | |
|---|---|---|---|
| W. Beadle | J. DeBruin | T. Koppang | L. Richardson |
| R. Belline | B. Grant | D. Lott | P. R. Snowden |
| G. Bourgeois | M. Greaves | L. Lubinski | R. E. Sproles |
| V. M. Burgard | R. Greenwell | J. Luchetski | L. A. Stinson |
| V. Chandler | J. Grillo | J. McGaha | L. F. Storz |
| A. Cochran | P. Harrington | N. Martin | W. Tilley |
| S. Cockrell | G. Harris | S. O'Connor | J. Tompeck |
| J. D'Agostaro | J. Hart | M. Pecaut | M. Walsh |
| R. D'Alonzo | S. Horton | J. Pertuit | D. Wilder |
| J. Damitz | A. Jolly | U. B. Quinby | D. Wright |

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

| | |
|---|---|
| ACI | American Concrete Institute |
| ACCW | Auxiliary Component Cooling Water |
| ANI | Authorized Nuclear Inspector |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ASP | Administrative Site Procedure |
| ASTM | American Society for Testing and Materials |
| AWS | American Welding Society |
| B-P | Bergen Patterson |
| C of C | Certificate of Compliance |
| CAT | Construction Appraisal Team |
| CB&I | Chicago Bridge and Iron |
| CCRR | Component Cooling Rigid Restrairt |
| CCW | Component Cooling Water |
| CE | Combustion Engineering, Inc. |
| CH | Chilled Water Components |
| CIWA | Condition Identification Work Authorization |
| CMTR | Certified Material Test Report |
| CS | Containment Spray |
| CSSR | Containment Spray Seismic Restraint |
| CVCS | Chemical and Volume Control System |
| DCN | Design Change Notice |
| DEN | Design Engineering Notice |
| DN | Discrepancy Notice |
| DR | Discrepancy Report |
| ECN | Engineering Change Notice |
| EDG | Emergency Diesel Generator |
| EDN | Engineering Discrepancy Notice |
| EMDRAC | Prefix for Ebasco's Identification Number on Vendor Drawings |
| ESI | Ebasco Services, Inc. |
| ESSE | Ebasco Site Services Engineering |
| F&M | Fischbach and Moore, Inc. |
| FCR | Field Change Request |
| FD | Fire Damper |
| FQCP | Field Quality Control Procedure |
| FSAR | Final Safety Analysis Report |
| FVR | Field Verification Request |
| HPSI | High Pressure Safety Injection |
| HVAC | Heating, Ventilation, and Air Conditioning |
| I&C | Instrumentation and Control |
| IEEE | Institute of Electrical and Electronics Engineers |
| IEW | Industrial Engineering Works |
| IR | Information Request; Inspection Report |
| LP&L | Louisiana Power and Light Co. |

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| MCC | Motor Control Center |
| NCR | Nonconformance Report |
| NDE | Nondestructive Examination |
| NISCO | Nuclear Installation Services Co. |
| NRC | Nuclear Regulatory Commission |
| NNS | Non-nuclear Safety |
| OCR | Operations Control Report (Mercury Co. Traveler Form) |
| PWHT | Post Weld Heat Treatment |
| QA | Quality Assurance |
| QAI | Quality Assurance Instruction |
| QAIRG | Quality Assurance Installation Records Group |
| QC | Quality Control |
| QCIP | Quality Control Inspection Procedure |
| QCP | Quality Control Procedure |
| RAB | Reactor Auxiliary Building |
| RCB | Reactor Containment Building |
| REI | Request for Engineering Information |
| RFI | Request for Information |
| SAR | Safety Analysis Report |
| SCD | Significant Construction Deficiency |
| SDHX | Shutdown Heat Exchanger |
| SES | Steam Electric Station |
| SSE | Safe Shutdown Earthquake |
| T-B | Tompkins-Beckwith, Inc. |
| TBP | Tompkins-Beckwith, Inc. Procedure |
| TWC | The Waldinger Corporation |
| WSES | Waterford Steam Electric Station |