U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

Division of Quality Assurance, Vendor,
and Technical Training Center Programs

Report No.: 50-400/84-48, Supplement 1

Docket No.: 50-400

Licensee: Carolina Power and Light
P.O. Box 1551
Raleigh, North Carolina 27602

Facility Name: Shearon Harris Nuclear Plant, Unit 1

Inspection at: EBASCO Services Incorporated, New York, New York

Inspection Conducted: July 22-24, 1985

Inspection Team Members:

Team Leader: R. E. Architzel, Senior Inspection Specialist, IE

Mechanical Systems: G. J. Overbeck, Consultant, Westec Services
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Ralph E. Architzel 9/25/85
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Team Leader

Approved by: James L. Milhoan 9/25/85
James L. Milhoan Date
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SHEARON HARRIS IDI FOLLOW-UP REINSPECTION

1. Background and Persons Contacted

The NRC conducted an Integrated Design Inspection of the Shearon Harris Nuclear Plant between December 3, 1984 and February 13, 1985. The inspection report was issued on April 15, 1985. The applicant responded to the report on June 13, 1985. The NRC reviewed the response in an NRC letter dated July 12, 1985 and identified Integrated Design Inspection items to be addressed in a NRC reinspection of July 22-24, 1985.

This report lists each item addressed in the reinspection. For each item, the first sentence summarizes the deficiency identified in the Integrated Design Inspection report. Items are indicated as closed based on the information provided in either the reinspection or in a subsequent applicant letter dated August 6, 1985. For items remaining open, the required action is indicated. Items not listed in this report were closed out based on NRC staff review of the applicant's June 13, 1985 letter.

The team contacted the following personnel during reinspection:

Name	Organization	Position
J. F.Nevill	CP&L	Principal Engineer-Hanger Unit
A. Boehm	EBASCO	Supervising Engineer-Stress Analysis
P. Fiala	EBASCO	Lead Piping Engineer-Mech. Engineer
R. Nilan	EBASCO	Lead Engineer-Support/Restraints
T. Cheung	EBASCO	Lead Engineer-Stress Analysis
M. Chuaprasert	EBASCO	Senior Engineer-Support/Restraints
A. Naumescu	EBASCO	Senior Engineer-Support/Restraints
A. Polack	Bergen-Paterson	Project Engineer
E. Erikson	Bergen-Paterson	Vice President-Application Engineering
G. Attarian	CP&L	HPES Electrical Unit Manager
P. Gaffney	EBASCO	Electrical Supervisor
W. Pehush	EBASCO	I&C Supervisor
L. Loflin	CP&L	HPES Manager
M. Thompson	CP&L	HEMS Manager
E. Harris	CP&L	HEMS Principal Engineer
M. Gagliardi	EBASCO	Mechanical Lead Discipline Engineer
T. Grant	EBASCO	Appplied Physics Lead Discipline Eng.
R. Stewart	CP&L	Lead Mechanical Engineer
W. Malec	EBASCO	Project Engineer
S. Ostrow	EBASCO	Principal Engineer Applied Physics
D. Shan	EBASCO	Lead System Engineer
J. Ruggiero	EBASCO	Assistant Project Engineer
R. Iotti	EBASCO	Vice President of Advanced Technology
R. Prunty	CP&L	Principal Engineer, I&C, Harris Plant
T. Morales	EBASCO	Assistant Project Engineer

C. Rogovin	EBASCO	NYO Project Design Eng. Manager
H. Williams	CP&L	HPES Civil Unit Supervisor
E. Laske	EBASCO	Project Engineering Manager
E. Odar	EBASCO	Senior Supervising Engineer/Civil
A. Anderson	EBASCO	Project Manager - SHNPP

2. Mechanical Systems

(Closed) Deficiency D2.2-1, Westinghouse Design Interface Drawing List (DIDL)

Three of eighteen drawings that Westinghouse had determined to be part of the DIDL were not included in an EBASCO transmittal of design interface information. The team reviewed the revised computer drawing list and verified that the missing drawings now had the correct code assigned to them. This will assure that the drawings in question will be included in all future DIDL transmittals. The team also reviewed the latest DIDL transmitted from EBASCO to Westinghouse and verified that the missing drawings had been included. The team reviewed results of a review by Westinghouse of the design change notices associated with the missing drawing revisions. This review concluded that there was no impact on the proof-of-design calculations.

(Closed) Deficiency D2.2-2, Errors in Westinghouse Proof-of-Design Calculations

Errors were found in calculations concerned with confirming the NPSH available for the charging pumps and with determining the effect of an EBASCO pipe rerouting. The team reviewed the revisions to calculation CWS-CQL-025 and verified that the errors were corrected. There was no impact on the conclusion of the calculation. The team also reviewed the calculation in which a pressure drop error was found. The calculation has been superseded by calculation FSD/SS-CQL-642 which completely reanalyzed the system for minimum and maximum flowrates along with flow orifice sizing. This calculation was reviewed and found to be satisfactory.

(Open) Deficiency D2.3-1, Containment Recirculation Sump Design

The water level in the containment following safety injection does not result in the sump being fully submerged. In addition, the approach velocity of water at the face of the sump screen does not "approximate" the value identified in Regulatory Guide 1.82 (0.2 feet per second). The team did not agree with the licensee's conclusions. This item has been referred to NRR as a licensing issue.

(Closed) Deficiency D2.3-3, Refueling Water Storage Tank Vortexing

An unsubstantiated assumption was used for the volume of water required to remain in the tank to prevent vortex formation. EBASCO revised calculation TANK-16 and determined a submergence requirement for vortex prevention which was less submergence than the available 5 ft. (bottom of outlet elbow to minimum water level). This calculation was reviewed and found to be satisfactory.

(Closed) Deficiency D2.3-5, Containment Spray System Eductor Flow Rate

An EBASCO calculation contained two areas of deficient work. One was the methodology used to determine the eductor minimum and maximum flow. The other pertaired to the hydrodynamic conditions under which each eductor will operate. The team reviewed the revised EBASCO calculation, CT-27 revision 1, and found that the algebraic and modeling errors had been corrected. Correcting these errors resulted in changes to the minimum and maximum eductor flowrates. The Chemical Analysis Department of EBASCO had been notified of the revised values. This dialogue between EBASCO's project Mechanical group and the Chemical Analysis Department has produced a clear interface with respect to the correct utilization of these revised values.

(Closed) Unresolved Item D2.4-1, Cable Tray Combustible Load Calculations

No justification existed to document that a typical cable type is representative of all other cable types. The team reviewed revised calculation 46-AO and determined that there is adequate criteria and justification for assumptions and that conservative selections of cable types to be used in analyses had been made.

(Closed) Deficiency D2.4-2, Cable Tray Overfill

Cable trays with power cable filled in excess of the design criteria were not reflected in the fire protection design calculations. The team reviewed evidence that EBASCO's Fire Protection Department was aware of the cable tray overfill situation and that this awareness had led to a commitment to evaluate the as-built condition. An approved FSAR change identifies the licensee's commitment to evaluate the as-built condition after cable routing is complete.

(Closed) Deficiency D2.4-3, Combustible Load Within Fire Area 1-A-BAL

The documented total combustible load within fire area 1-A-BAL was incorrect because of an oversight when the calculation was revised. The team reviewed the revisions to EBASCO calculation FP-1-A-BAL, revision 3, and found that the correction to total loads was implemented. The team also verified that the FSAR had been revised to reflect the corrected total load values.

(Closed) Deficiency D2.4-4, Use of Minitrim (PVC) in Areas Outside Containment

Expanded use of PVC was approved through a field change request (FCR) without being sent to the fire protection discipline or to EBASCO's Fire Protection Group for review and approval. The team reviewed evidence of a recently completed training program on the use of PVC and its effect on fire protection. The team observed a restriction implemented by the licensee that halted the continued use of Minitrim. The licensee has agreed to have all future FCRs that propose the use of PVC (plastic) product to be approved by Carolina Power and Light Fire Protection. The licensee recognized their commitment to detail in the Fire Hazards Analysis all use of PVC material and that the current level of Minitrim usage will be identified. The team verified that this item (detailing of Minitrim use in the Fire Hazards Analysis) was being tracked by the licensee to ensure completion.

(Closed) Deficiency D2.5-1, Volume Control Tank Shielding Analysis

The team reviewed Applied Physics Calculation 040 which superseded the calculation reviewed during the inspection. The team confirmed that the discrepancies and errors identified in this deficiency had been corrected. However, the team noted that the calculation referenced information obtained from the FSAR as a source of design input. Although the information in this instance was correct, the FSAR is not a design document and should not be used as a source of design input. The team confirmed that the design information was available in other design analyses. This deficiency is considered closed based on a commitment to review Applied Physics calculations and correct instances where the FSAR was incorrectly referenced as source of design input.

(Closed) Deficiency D2.5-3, Post-LOCA Shielding Design Review

The team reviewed revised calculations which superseded the calculation which was the subject of the deficiency. The team confirmed that the errors and discrepancies previously identified had been corrected in the reviewed calculations. In addition, an FSAR change deleting a commitment to consider 20 percent Cesium source term will be submitted to NRR.

During the team's review of Applied Physics Calculation 041, the team noted that portions of this completed calculation related to determining the Reactor Auxiliary Building dose had been deleted without initiating a revision. This is contrary to EBASCO's procedures and design control commitments. In an August 6, 1985 letter the licensee stated that calculation 041 was improperly revised by crossing out portions after it had been signed by the verifier. A formal revision to this calculation has been issued, noting previously revised pages and deleting any FSAR references as the design input.

(Open) Deficiency D2.5-4, Gamma Radiation Source Strength Assumptions for Equipment Qualification

Calculation EQ-027 used an incorrect source term for an instantaneous release of radioactive material from the fuel to the atmosphere. The team reviewed calculations which superseded the calculation initially reviewed and found that the error associated with halogen source terms had been corrected. The dose maps used to transmit design information for electrical equipment qualification had not yet been revised. As a consequence, an assessment of the design adequacy of electrical equipment affected by the increased radiation dose has not been completed. In an August 6, 1985 letter, the licensee stated that revised dose maps have been issued subsequent to the reinspection and that the assessment of electrical equipment qualification is an ongoing effort. The NRC will review the licensee's equipment assessments and identification of design changes, if any, (i.e., equipment replacement, equipment movement, etc.) that resulted from the design error.

(Open) Deficiency D2.5-5, Equipment Qualification Beta Dose

Calculation EQ-027 contained an incorrect assumption which reduced the Post-LOCA integrated Beta doses by 30 percent. The team reviewed Applied

Physics Calculation 046 which superseded portions of the calculation reviewed during the inspection. The team found that the checked and verified calculation did not consider the contribution to the Beta dose inside containment from the decay of daughter product.

In an August 6, 1985 letter, the licensee indicated that the Beta daughter contribution had been calculated subsequent to the reinspection. The licensee stated that revised dose maps have been issued and the assessment of electrical equipment qualification is ongoing. The NRC will review the licensee's equipment assessments and identification of design changes, if any, (i.e., equipment replacement, equipment relocation, etc.) that resulted from the design error.

(Open) Deficiency D2.5-6, Integrated Dose Analysis for Equipment Qualification

This item involved incorrect decay constants, missing gamma radiation energy levels, computational errors, incorrect methodologies, failure to consider the gamma dose contribution from the decay of daughter product in the Auxiliary Building, and lack of rigorous analysis of the contribution to the Beta dose from the decay of daughter isotopes.

The team reviewed new calculations which supersede the calculation reviewed during the inspection. The team found all errors and discrepancies resolved with the exception of the contribution of decay daughters to the inside containment Beta dose. As previously stated, the licensee has calculated the Beta daughter contribution subsequent to the inspection. Because the assessment of the adequacy of electrical equipment is ongoing, the NRC will review the licensee's equipment assessments and identification of design changes, if any.

(Open) Deficiency D2.5-7, Radiation Dose in Equipment Qualification Zone R-6 of RAB

This item involved discrepancies found during the review of Calculation 039. The team reviewed revised calculations which supersede the calculation reviewed during the inspection. The team found that all of the errors and discrepancies had been corrected in the revised calculations. However, radiation dose maps had not been revised. Subsequent to the reinspection the licensee has completed the dose maps and has an assessment ongoing to identify the impact on electrical equipment. The NRC will review the licensee's equipment assessments and identification of design changes, if any.

(Closed) Deficiency D2.6-1, Installation of Charging Pump Room Air Handling Units

This item involved concerns with respect to the field installation of the charging pump room air handling units. Specifically, the anchor bolts were not torqued to 19 KIPS as assumed in the seismic design analysis and the equipment installation packages were not complete. The licensee has reviewed the Seismic Qualification Report and noted that none of the anchor bolts experience uplift in a seismic event. Since shear is the primary force

considered in the analysis, bolt preload is only critical to assure contact between nut and bolted surface and that "snug tight" as defined in Work Procedure 105 is sufficient. This assessment has been confirmed by the design organization who performed the original analysis.

With respect to the completeness of equipment installation packages, the licensee informed the team of an ongoing special effort at the site to reassemble the equipment installation packages prior to system turnover. A special group with an approved plan to correct the problem of fragmented installation packages was established prior to the Integrated Design Inspection cutoff date. The team reviewed the plan and implementing procedures and found them acceptable. This deficiency is considered closed. The NRC Region II Office may monitor the corrective action being implemented.

(Open) Deficiency D2.7-1, Non-Seismic Piping Interaction Damage Study

This item involves the use of results from unchecked preliminary calculations in an FSAR submittal contrary to established procedures. The team was informed that an effort to review, check, and document the subject calculations was initiated within the Mechanical Design Engineering Department. During the reinspection the team observed the ongoing checking effort. The team found evidence of completed checked calculations for various safety-related areas and adequate controls to initiate corrective action. The checking effort, to date, has identified two instances where the status of lines was changed from non-seismic to seismically designed (DCN-FD-1072, lines 7SA-39-1-4 and 7SZ-133-1-4). This deficiency remains open pending completion of the calculation checking effort and identification of any other design changes required.

(Open) Deficiency D2.7-2, Seismic II/I Interactions of Field Routed Piping

This item involves observations by the team of non-safety-related, non-seismically supported piping lines in the Auxiliary Building over safety-related equipment. In addition, the installation was contrary to the guidelines approved in a field change document.

The team reviewed the case study which examined the specific II/I item identified in the deficiency. The resolution of the case study was based on the acceptance criteria in the recently developed Regulatory Guide 1.29 Verification Walkdown procedure. The team reviewed the walkdown procedure and a schedule commitment for the completion of this Regulatory Guide 1.29 activity. The team was informed that the Seismic II/I walkdown had identified changes of lines 7SC8-26-1-4 and 7SC3-82-1 from non-seismic supports to seismic supports. The deficiency remains open subject to the team's review of the backup justification for the walkdown procedure acceptance criteria and review of selected case studies that result from the ongoing walkdown effort.

(Open) Deficiency D2.8-1, Field Installation Tolerances for Hangers

This item involves inadequate spacing for seismic and thermal movements. The team reviewed a preliminary case study for the specific equipment clearance

item identified during the inspection. The rationale behind the resolution was found to be lacking and subjective in nature. The licensee committed to provide additional justification with specific references to design drawings and design analyses. Likewise, the licensee committed to strengthen all other case studies. The team reviewed the recently developed Interdisciplinary Clearance Verification Walkdown procedure and a schedule commitment to complete the effort. The deficiency remains open subject to the team's review of selected case studies that result from the ongoing walkdown effort.

(Closed) Deficiency D2.9-1, Pump Vendor Drawing Error

A pump vendor drawing incorrectly indicates the elevation for minimum submergence. The team reviewed the revised pump vendor drawing EMDRAC-1364-7370. The error in elevation for minimum submergence had been corrected.

3. Mechanical Components

(Closed) Deficiency D3.1-4, CP&L Pipe Support Procedures

Two separate pipe support design guidelines used by personnel performing new design and by personnel resolving field problems specified different deflection criteria. The team reviewed revision 1 of Harris Plant Engineering Section Guideline 7.2.A, which now solely stipulates the pipe support deflection criteria to be implemented by Harris Plant Engineering Section personnel. An amendment to FSAR table 3.9.3-7 initiated on July 17, 1985 will revise the deflection criteria detailed in note 4 of the table to correspond to the Harris Plant Engineering Section Guideline. The team concludes that licensee action taken to revise the HPES Guideline and to amend the FSAR is acceptable.

(Closed) Deficiency D3.1-5, Supplementary Steel

Pipe support supplementary steel tabular data originally developed by Bergen-Paterson for non-seismic use was incorporated into the Harris Plant Engineering Section piping support/restraint design guideline. However, the design guide did not limit the use of this tabular data to non-seismic applications. Discussion with Bergen-Paterson representatives held during the reinspection period revealed that only the symmetric steel beams listed in Standard E102 are fully qualified for uplift loads. The allowable concentrated loads specified for the single angle beam listed in the standard are valid only when the leg of the angle in the plane of the applied load (i.e., the web) is subjected to tensile rather than compressive stress. In order to resolve this issue, Harris Plant Engineering Section conducted a complete review of all rolled-up hanger packages. That review indicated that no single-angle supplementary steel based on Standard E102 has been installed on the site. Carolina Power and LIght has additionally revised Harris Plant Engineering Section Guideline 7.2.8 to restrict Standard E-102 to non-seismic applications. The team concluded that licensee action taken to review existing hanger packages and to limit the use of Standard E-102 to non-seismic applications is acceptable.

(Closed) Deficiency D3.1-6, Pipe Support Stress Check

The Harris Plant Engineering Section support/restraint design guidelines incorrectly specified the square root sum of the squares combination of torsional shears in tubular members. The team reviewed a Carolina Power and Light memo which indicates that (1) Harris Plant Engineering Section Guideline 7.2.A has been revised to delete square root sum of the squares combination of pipe stresses due to direct shear and torsion; (2) that this method of combining pipe stresses was not used in any pipe support calculations performed prior to the inspection, and (3) that other equations contained in the Harris Plant Engineering Section Guideline were found to be correct. Licensee action taken to revise and review the Harris Plant Engineering Section Guideline and to review pipe support calculations performed in accordance with the guideline is acceptable.

(Closed) Unresolved Item U3.1-7, U-Bolt Load Interaction

The Harris Plant Engineering Section piping support/restraint design guidelines specified the use of a straight-line interaction equation to select Bergen-Paterson U-bolts subjected to both tension and shear loads without formal substantiation from Bergen-Paterson. The team reviewed a Bergen-Paterson letter which confirms acceptability of use of a linear interaction equation to select U-bolts subjected to simultaneous shear and tension loads. The team finds the Bergen-Paterson letter acceptable.

(Closed) Unresolved Item U3.1-8, Friction Anchor Clamps

EBASCO had not formally considered the pipe wall stresses induced by the use of friction anchor clamps to restrain small-bore pipe. Computer stress analyses of piping subsystems containing friction anchor clamps computed pipe stresses and stress ratios at pipe clamp node points without considering the additional stresses induced by the friction clamps. The team reviewed an EBASCO calculation which independently confirmed the Bergen-Paterson contention that 12,000 psi is the maximum local pipe wall stress induced by the use of friction anchor clamps. The team also reviewed revised stress summaries for a sample of 18 of a total of approximately 150 pipe node points at friction clamp restraints. This review considered the additional pipe stress induced by the friction clamps, and confirmed that sufficient stress margins exist to satisfy ASME code equations for local pipe attachments. The team concluded that the EBASCO friction clamp analysis and the summary of revised pipe stresses, which included friction clamp pipe stress, are acceptable.

(Closed) Deficiency D3.2-1, DBE Inertia/Functional Capability

Carolina Power and Light committed to a functional capability check for Class 2 and 3 piping below 400 degrees F in FSAR section 3.9.3-11 by a comparison of faulted stress levels with emergency level stress allowables. However, a number of piping subsystems were not stress analyzed for the DBE seismic event. EBASCO has indicated that the upset rather than the emergency condition is the critical load case, since the emergency level stress limit is 1.5 times the upset level stress limit, while the emergency level stresses are always less than 1.5 times the upset level stresses. In order to substantiate this assumption EBASCO selected ten calculations for which the DBE analysis

had been performed, and tabulated the ratios of the emergency and upset level stresses, which ranged from 1.0 to 1.24. During the reinspection period, the team reviewed an additional seven calculations for which the DBE analysis had been performed. The ratios of emergency and upset level stresses for this supplementary sample varied in magnitude from 0.915 to 1.158. In light of the additional sample reviewed by the team, we found the licensee response adequate.

(Closed) Observation 03.2-3, Evaluation of Valve Accelerations

EBASCO did not initially evaluate calculated valve accelerations against the allowables for several pipe stress calculations. Carolina Power and Light addressed this observation in a memo which noted that Harris Plant Engineering Section Design Guideline 7.2.I requires the evaluation of valve accelerations, and that Harris Plant Engineering Section Design Guideline 7.2.H requires a review of all open items listed on the calculation status form which accompanies each pipe stress calculation transferred to the site. The team finds this response to be acceptable.

(Closed) Deficiency D3.2-4, Westinghouse Active Valve Qualification Program

Stress calculation 141-2 did not initially qualify three Westinghouse active valves to acceleration and end load criteria. These acceleration and end load calculations were subsequently performed as part of EBASCO's active valve qualification program, but the acceleration calculations were incorrect. EBASCO has since concluded that two-mass valve models were used in the piping stress analysis, and that the valve accelerations were calculated by an acceptable procedure. The team reviewed calculation 141-2 which was revised to incorporate two design change notices. The two-mass valve models were also replaced with one-mass valve models to be consistent with Shearon-Harris practice. End loads were found to be acceptable for the three active valves. Valve accelerations exceeded allowables, but were subsequently accepted by Westinghouse. The team concluded that revised calculation 141-2 is acceptable.

(Closed) Deficiency D3.2-6, Emergency Condition Stress Ratio

EBASCO did not tabulate the maximum emergency condition pipe stress ratio of 1.069 for pipe stress calculation 3125, which occurred at a piping node point adjacent to the boric acid tank nozzle. In addition, a revised analysis checklist provided to the team shortly after the inspection showed a drop in that stress ratio from 1.069 to 0.259. The team reviewed the latest revision to the pipe stress isometric, which indicates that several supports were relocated in the field, and that one support was added. The reduction in the stress ratio at the piping node point adjacent to the boric acid tank nozzle is apparently due to the added support. The team confirmed that the maximum emergency condition pipe stress ratio is now less than 1.0.

(Closed) Deficiency D3.2-8, Thermal Expansion Input

EBASCO did not analyze pipe stress calculation 141-1 for the 130 degrees F thermal mode case. The team reviewed a reanalysis of pipe stress calculation 141-1 and confirmed that the 130 degrees F thermal mode case is now included.

(Closed) Deficiency D.3.2-9, Volume Control Tank Nozzle Displacement

EBASCO did not analyze pipe stress calculation 142-3 for the nozzle thermal displacements associated with the 250 degrees F thermal mode case. The team reviewed a reanalysis of pipe stress calculation 142-3 and confirmed that the nozzle thermal displacements for the 250 degrees F thermal mode case are now included.

(Closed) Deficiency D3.2-17, Regenerative Heat Exchanger Seismic Analysis

EBASCO did not model the vertical support adjacent to the tube side inlet nozzle of the flexible regenerative heat exchanger in pipe stress calculation 3006. The team reviewed the isometric drawing schedule for pipe stress calculation 3006, which indicates that the regenerative heat exchanger vertical restraint will be modeled as a snubber when the calculation is reanalyzed. The team finds this response acceptable.

(Closed) Unresolved Item U3.3-1, ITT Grinnell Air Operated Valves

Westinghouse procured air-operated diaphragm valves from ITT Grinnell that were initially qualified by analysis as rigid. ITT Grinnell qualified similar valves by test for another project, and found these valves to be flexible. Piping subsystems in which these valves were located therefore required reanalysis to assess the impact of valve flexibility. The team reviewed the procedure that EBASCO developed in conjunction with Westinghouse to model flexible Grinnell diaphragm-operated valves. The team also confirmed that the affected pipe stress calculations had been reanalyzed as required by the procedure.

(Closed) Deficiency D3.4-1, Pipe Support Strut Design

The team questioned the design basis for the slender struts installed at the Shearon Harris site. In response to this, Carolina Power and Light conducted field walkdowns and drawing reviews and identified twenty-seven slender struts for detailed review. EBASCO subsequently selected seven slender struts for detailed dynamic analysis. The team reviewed this analysis effort, which indicates that calculated stresses fall within code requirements, and that calculated strut axial displacements fall within project commitments. Carolina Power and Light is also revising Harris Plant Engineering Section Guideline 7.2.C to detail strut analysis criteria for implementation by Harris Plant Engineering Section site engineering.

(Closed) Deficiency D3.4-2, B-P/CP&L Pipe Support Design

Carolina Power and Light had improperly analyzed a revision to a pipe support design that was originally prepared by Bergen-Paterson. The team reviewed the revised Harris Plant Engineering Section analysis of pipe support A-6-236-1-CS-H-2027, which addresses the deficiencies originally identified by the team. The team found the revised analysis acceptable.

(Closed) Unresolved Item U3.5-1, Westinghouse Supplied Non-Active Valves

EBASCO was not evaluating end load criteria for Westinghouse non-active valves, as required by the Westinghouse valve specifications, which were implicitly written for active valves. The team reviewed a Westinghouse letter which now agrees with the EBASCO position on non-active valves. The team had no further questions on this item.

4. Civil/Structural

(Closed) Deficiency D4.2-4, Preparation of Calculation

Several examples of inadequate preparation of calculations were noted during the inspection. The applicant response indicated that a program to review the cited design calculations had been completed. The team reviewed the remedial work and found that all the deficiencies were corrected, but the team also found that the corrective work contained inadequacies, such as improperly referenced pages. This documentation problem has no effect on analyses or designs. Carolina Power and Light indicated that they will ascertain the acceptability of the calculation books at the calculations turnover time. Since this deficiency has no effect on analyses or design, the team considers the response acceptable.

(Closed) Deficiency D4.2-7, Shear Area

EBASCO assumed the shear areas to be the same and equal to the cross-sectional areas for several members in the seismic models of the tank building and main dam spillway. In the intake structure model, the shear areas were taken as 85% of the cross-sectional area in both directions. The team reviewed the reanalyses and found the reanalyses acceptable.

(Closed) Deficiency D4.4-1, Loading Combination

This item concerns the design of the containment building polar crane girders and the internal structural steel platforms using estimated vertical seismic loads. The response from the applicant indicated that the estimated vertical seismic loads used in the design were conservative. The team reviewed the comparison performed by EBASCO as documented in calculation books CAS-1 and 2168-G-253502, and confirmed that the assumed vertical seismic acceleration of 1.0 g enveloped the actual acceleration values from the seismic analyses.

(Closed) Deficiency D4.5-1, Slab Design Using Direct Design Method

This deficiency concerned the design of reinforced concrete slabs in the reactor auxiliary building and fuel handling building using ACI-318-71 Code, Section 13.3, without satisfying the limitations listed in Section 13.3.1.1 and 13.3.1.3. The applicant reanalyzed these slabs using alternate methods in the code and found that the design of the slabs was adequate. The team confirmed this response by reviewing calculations A-351 and FH-540, which used the equivalent frame method contained in ACI-318-71, Section 13.4.

(Closed) Deficiency D4.5-3, Load Combination for Slab Design

The load combination used in the design of the reactor auxiliary building reinforced concrete slab differs from the load combination listed in FSAR 3.8.4.3.2. The team reviewed a revision of calculation A-153 and found that the slab design is adequate for the FSAR committed load combination.

(Closed) Deficiency D4.5-4, Seismic Analysis for Masonry Wall

The solid masonry walls located in the vicinity of the reactor auxiliary building volume control tank were not analyzed seismically. The applicant response committed to perform seismic analyses of these walls. The team reviewed the calculation (CAR-C91) and found the calculation acceptable.

(Closed) Deficiency D4.5-5, Use of Floor Response Spectra

In the reactor auxiliary building, the hollow masonry walls around stairway A-4 were designed using unbroadened floor response spectra curves. The applicant stated that those walls were subsequently redesigned due to a field change request (FCR-AS-1045), at which point the broadened response spectra curves were used. The team confirmed this by reviewing the calculation contained in FCR-AS-1045 which indicated that the broadened floor response spectra curves were used.

(Closed) Deficiency D4.5-6, Design of Masonry Wall Around Stairway A-4

The as-built condition does not agree with the design as described in FCR-AS-1045. These differences make the as-built walls less conservative than the requirements of the design. The response from the applicant indicated that the as-constructed condition is not what the FCR shows (as-built) but Carolina Power and Light informed the team during the reinspection that they will ensure that the design on the FCR be constructed accordingly. NRC Region II will be requested to inspect the final as-constructed condition.

(Closed) Deficiency D4.8-1, Load Combinations for Main Dam Spillway

In the design of the main dam spillway, only the load combination which includes the Design Basis Earthquake (DBE) was used. The load combination with the Operating Basis Earthquake (OBE) was not checked. EBASCO performed reanalysis to check the load combination with OBE and found the design adequate.

The team reviewed the calculation (R-104, revision 2) and found the calculations acceptable.

(Closed) Deficiency D4.8-2, Main Dam Spillway Abutment Design

The existing design of the main dam spillway abutment had an error in the magnitude of the abutment's vertical compressive force. The team reviewed the corrected calculation (R-104, revision 2) and found the corrected calculation acceptable.

(Closed) Deficiency D4.9-1, Boron Recycle Hold-up Tank Seismic Loads

The design of the slab and beam at EL. 236.0 ft. of the fuel handling building, which supports the boron recycle hold-up tank, did not consider the effects of horizontal seismic load from the tank. The team reviewed the revised calculation (FH-540, revision 2) and found the existing slab to be adequate.

EBASCO also conducted a program to check slabs that support large tanks in other buildings and found that all the slabs are adequate. This program included the review of the low conductivity holding tank in the fuel handling building (calculation FH-540, revision 2), the laundry and hot shower water tank in the waste process building, and the recycle monitor tank and volume control tank in the reactor auxiliary building (calc. A-345, revision 3 and A-155).

(Closed) Deficiency D4.10-1, Cable Tray Support Frequency

In the reactor auxiliary building, two types of longitudinal bracing with either one or two rows of struts were used for cable tray supports. The EBASCO calculation did not include a frequency analysis for the bracing using one row of struts. A frequency of 16 Hz was assumed in the design of this type of support. The response indicated that a program initiated to evaluate the frequency calculations of all cable tray and HVAC duct supports had been partially completed. The frequency of a longitudinal bracing with one row of struts had been calculated to be above 16 Hz. The team confirmed this by reviewing the calculation (2168-G-170501, revision 8, July, 1985) which showed the fundamental frequency to be 19.16 Hz.

(Closed) Deficiency D4.11-1, Frequency of HVAC Ducts

The maximum span of a given HVAC duct is limited in order to maintain a minimum frequency of 16 Hz. This deficiency indicated that in two instances the actual spans are longer than the maximum calculated span. EBASCO indicated in the response that all seismic HVAC spans were reviewed and it found that, in five cases, the maximum spans were exceeded. Reanalyses showed that the frequencies are still above 16 Hz. The team reviewed the reanalyses and found that all frequencies are over 16 Hz.

(Closed) Deficiency D4.11-2, Loads on HVAC Duct Supports

The HVAC duct along column line B in the reactor auxiliary building EL. 216.0 ft shows that the two anchors F-1152 and F-1161 are approximately 169 ft apart. Between these anchors there are guides which are spaced at shorter intervals. The longitudinal and lateral static loads transferred to the

anchors should be different. Calculations reviewed during the initial inspection indicated that they were identical. EBASCO's review found 141 cases where actual loads were higher than those originally used in the support design. All cases were reanalyzed and found to be adequate. The team reviewed samples of the supports contained in the calculation (#IDI 4.11-2, revision 0, July 1985) and concluded that the HVAC duct supports are adequate.

(Closed) Deficiency D4.11-3, Frequency of HVAC Duct Supports

The frequency of the HVAC duct supports in the direction of the axis of the duct was never calculated. If the frequency in that direction is less than 16 Hz (as per the original design basis) the design may not be adequate. EBASCO and Carolina Power and Light initiated a program to completely review all cable tray supports, HVAC duct supports and, in congested areas, the combined supports for cable tray and HVAC duct. In each category, EBASCO randomly selected approximately 10% of the total number of supports (approximately 2300). At the time of the reinspection, EBASCO had completed the review of the first two categories. They had reviewed over 200 cable tray supports and over 200 HVAC duct supports and found all of them to be adequate. The team reviewed calculation CAR-2168-G-171502, revision 8, July 1985, pp 88-95, for HVAC duct supports and found that all supports reviewed had a fundamental frequency of 16 Hz or higher.

5. Electrical

(Closed) Unresolved Item U5.2-1, Electrical Power Design Procedures and Guidelines

This item questioned the guidance available to the Harris Plant Engineering Section electrical unit. The team reviewed the new electrical organization, the twelve new electrical design guidelines, records of formal training sessions on these guidelines and on other electrical areas and examples of work presently in progress in the Harris Plant Engineering Section electrical unit implementing the new guidelines. The team found this response to be acceptable.

(Closed) Unresolved Item U5.3-1, Independence of Electric Systems

This item questioned the inconsistency between the FSAR description and the actual design of the load shedding philosophy for non-safety loads on safety buses. The team reviewed design change notices DCN 251-532 (Train A) and DCN 251-533 (Train B) with the accompanying control wiring diagrams. The team is satisfied that, following implementation of these design change notices, the non-safety loads will be shed from the safety buses during a LOCA-only condition. The team found this response to be acceptable. NRC Region II will be requested to inspect implementation of this design change.

(Closed) Deficiency D5.4-1, Protection of Safety-Related Buses

This deficiency identified a problem with the electrical protection for the 480 volt load center buses, wherein the 1600A bus section was protected by a 3200A breaker and four 720A (2880A total) breakers downstream. The team reviewed design guide 7.5L for the load analysis program and the results of

the load analysis calculation, E-6000. This analysis program identified the distribution equipment, equipment rating, connected load, and worst case operating load. The calculation included an analysis to justify the connected and operating loads. The team found this response to be acceptable. NRC Region II will be requested to verify these relay settings.

(Closed) Deficiency D5.4-2, Motor Operated Valve Thermal Overload Protection

This deficiency identified the incorrect application of motor starter thermal overload heater relays in the electrical protection of motor operated valves. The team reviewed the new criteria included in field change request FCR-E-4980 and accompanying drawing CAR-2166-B-041, sheets 4A and 4B, for the protection of motor operated valves. The team also reviewed startup procedure 1/2-9000-E-06, revision 5, which now includes an acceptable method for sizing overload heaters for motor driven valve operators. The team found this response to be acceptable. NRC Region II will be requested to verify correct selection of thermal overloads.

(Closed) Deficiency D5.4-3, Design Verification of Thermal Overload Settings

This deficiency identified a problem in which the person selecting thermal overloads was the same person who approved the selection. The team reviewed procedures 1/2-9000-E-01 and 1/2-9000-E-06 and noted that the data sheets of both procedures have been revised to have signoffs for (1) the person making the selection, (2) review by the startup engineer, and (3) verification by the electrical startup engineer. Although no completed data sheets were available for review, the team is satisfied with this response. NRC Region II may examine implementation of thermal overload selection verification.

(Closed) Deficiency D5.4-4, Station Service Transformer Protective Relaying

This deficiency identified inadequate protection for the Class 1E Station Service Transformers which permitted the transformers to be overloaded by 39% of their qualified rating. The team reviewed new calculation E2-002-2 which resulted in the overcurrent relay setting being reduced by one tap. The relay will now provide an overcurrent protection of 125% of the transformer's qualified rating. While the team would have preferred the relay setting to be reduced by an additional tap (which would have still permitted an 11% current swing for system transients), we consider the approach, in light of the fact that the licensee has in place a load management program (see response to D5.4-1), to be acceptable. NRC Region II may inspect implementation of relay settings.

(Closed) Unresolved Item U5.4-5, Procurement of Quality Components

This item questioned a field change request which permitted the substitution of terminal boxes purchased by catalog number only in safety-related applications. The team reviewed the report of the inspection program contained in letter MS-853553(E) which verified that the boxes purchased from Austin and General Metal were of equal construction to the specified safety-related Hoffman boxes. The team considers this inspection program acceptable.

(Closed) Deficiency D5.5-1, Battery Sizing Calculation

This deficiency identified a number of incorrect assumptions and load data used to establish the load profile for the battery sizing calculation. The team reviewed the new battery sizing calculation 56-JRG which established the load profile by a comprehensive review of each Class 1E dc circuit. The new calculation confirmed the adequacy of the existing Class 1E batteries. The team considers this calculation acceptable.

(Closed) Deficiency D5.5-2, DC Equipment Rated Maximum Voltage

This deficiency questioned the design basis for the dc system maximum permissible voltage. The licensee is presently conducting a survey of the dc system and vendor data which will document the maximum permissible voltage of all Class 1E dc equipment. The team reviewed the methodology and results to date of that survey. The team is satisfied that, based on no problems being detected by the survey, the extent of the review already completed by the licensee, and the commitment to complete the survey, no questions will remain with the maximum permissible dc system voltage of 140 volts. NRC Region II may inspect satisfactory completion of this study.

(Closed) Deficiency D5.5-3, Battery Discharge Voltage Profile

This deficiency identified certain correction factors which were not included in the development of the battery discharge voltage profiles. The team reviewed new calculation 20-WRE, confirmed the inclusion of the previously missing correction factors and found the new profile acceptable.

(Closed) Deficiency D5.5-4, DC System Minimum Voltage

This deficiency identified errors in the assumptions used in the calculation of voltage drop for the switchgear control circuits. The team reviewed revision 3 to calculation 44-SKD which used the results of calculation 20-WRE for the safety-related circuits. The team also reviewed DCN 251-572 which calls for the addition of interposing relays in the close circuits of the preferred and backup power supply breakers to the safety-related 6.9kV buses. Based on the commitment to add interposing relays to permit remote manual operation of these safety-related breakers from the control room, the team found this response to be acceptable. NRC Region II may inspect implementation of this design change.

(Closed) Deficiency D5.6-1, Penetration Protection Qualification

This deficiency identified a single failure potential with the redundant protection of the electrical containment penetrations for the reactor coolant pump motors. The team reviewed design change notice DCN 251-534 which will add a Train B overcurrent trip to the primary breaker protection and hand off an additional input to the backup breaker. A minor documentation error was noted by the team on control wiring diagram 2166-B-401, sheet 1621 which EBASCO committed to correct for all four backup breakers. The team finds this design change an acceptable response to this deficiency. NRC Region II may inspect implementation of this design change.

(Closed) Deficiency D5.7-1, Use of Motor Data in Setting Procedure

This deficiency identified a problem with the use of assumptions in the selection of 480 volt motor protection. The team reviewed calculations E1-001.1 through E1-001.4 for the large safety-related 480 volt motors and field change request FCR-E-5114 which revises the overcurrent relay settings as a result of the new calculations. The team identified an inconsistency on the relay setting drawing for the residual heat removal pump motor which was acknowledged and corrected by the licensee. The team agreed with the resulting overcurrent protection for these large 480 volt motors and found this response acceptable. NRC Region II may inspect implementation of these relay settings.

(Closed) Deficiency D5.7-2, 480 Volt Bus Undervoltage Alarm

This deficiency identified an inconsistency between the relay setting calculation and the relay setting drawing. The licensee's response acknowledged this error and noted new settings as a result of recent system voltage studies. The team reviewed calculations E1-008.1 and E1-008.2 and field change request FCR-E-5114 which revises the undervoltage relay settings and discovered settings different than those noted in the licensee's response. The licensee explained that these relays are not used for equipment protection (the PSB-1 relays perform this function), but are used to detect loss of ac. With this explanation, and the consistency that will exist between the undervoltage relay calculation and the relay setting drawings, the team found this response acceptable.

(Closed) Observation 05.7-3, Motor Acceptance Testing

This item observed that the initial checkout testing of motors performed by startup was missing data that could have been used by Harris Plant Engineering Section to support assumptions used in relay setting calculations. The team reviewed new startup procedure 1-9000-E-19 which responded satisfactorily to the team's observation.

(Closed) Deficiency D5.8-1, Motor Operated Valve Voltage Drop

This deficiency identified a lack of criteria for dc motor operated valve voltage drop analysis and insufficient wire size selected for the dc motor operated valves. The team reviewed design change notice DCN 560-564 which revised the wire size from AWG Number 10 to Number 2. The team reviewed the EBASCO PDMD Verification Study, which was identified only by a reference to the applicable control wiring diagram number. The team again identified the lack of specific criteria for dc motor operated valves and identified an error which resulted in the voltage drop analysis because of this lack of criteria. These errors were immediately corrected and specific criteria were added to Design Criteria 18. No additional conductor sizing resulted from this correction. These changes satisfactorily respond to the team's concerns.

(Closed) Deficiency D5.9-1, Reactor Vessel Level Instrumentation RCP Inputs

This deficiency identified multiple potential failures of the reactor coolant pump inputs into the redundant reactor vessel level instrumentation systems

(RVLIS). The original design used a common reactor coolant pump switchgear breaker auxiliary contact, a common isolation cabinet power supply circuit and a common isolation relay to develop the input to the redundant RVLIS cabinet. The team reviewed design change notice DCN 251-527 which revised the circuit so that the Train B RVLIS input uses a separate switchgear breaker auxiliary contact and a different isolation relay in a different isolation cabinet. The team noted that both isolation cabinets are powered from the same uninterruptible power supply but are on different circuits. The team considers that this response presents an acceptable level of redundancy between the sets of reactor coolant pump inputs to the RVLIS. NRC Region II may inspect implementation of this design change.

(Closed) Deficiency D5.10-1, Site Engineering Design Change Control

This deficiency identified incorrect wire sizes that were installed to the transfer panels. The team reviewed field change procedure FCR-E-4052 and calculation 28-HHC which routed larger size cable to sufficiently handle the load. The team considers this new wire size and the existence of Design Guideline 7.5A on cable sizing to be an acceptable response to this item.

6. Instrumentation and Control

(Closed) Deficiency D6.1-2, FSAR/Instrument Index Consistency

The team had identified a number of differences between statements in the FSAR and data provided in the EBASCO instrument index, and agrees with the proposed EBASCO and Carolina Power and Light action plan to resolve these differences. The team examined revision 3 of EBASCO instrumentation and control procedure E-35 for applicable standards and codes to be used for future equipment procurement, and determined that the recent changes made in this procedure were satisfactory.

(Closed) Observation O6.1-6, CVCS Design Basis

During review of EBASCO design basis document DBD-107 for the chemical and volume control system, the team observed an apparent classification difference for the chiller surge tank level transmitter between design drawings and the design basis document. EBASCO stated that three different design basis documents exist for this system, and that the particular document reviewed by the team was not the appropriate one for this transmitter. Consequently, the team reviewed design basis document DBD-108 for the boron thermal regenerative portion of the chemical volume and control system, and noted that the transmitter classification was correct with respect to the design drawings.

(Closed) Deficiency D6.1-9, EBASCO Procurement Specification

Numerous differences were noted by the team in the specification of industry standards and codes between EBASCO instrumentation procurement specifications and the EBASCO E-65-SH and E-35 instrumentation and control procedures used as input documents for procurement specification preparation, review, and approval. EBASCO indicated that some procurement specifications reflected

over-conservative cross-referencing. The team agreed with this EBASCO comment, particularly since system level considerations need not be imposed on some vendors. EBASCO subsequently revised procedure E-35 to reflect those codes, standards, and NRC Regulatory Guides listed as requirements in the instrumentation specifications. The team reviewed the changes made in this revised procedure and considered them acceptable.

(Closed) Deficiency D6.1-10, Incomplete and Unissued Drafting Manual

At the Shearon Harris site, the team noted that issued instrumentation and control drawings were being modified without a drafting manual for the instrumentation and control discipline. The team reviewed the Carolina Power and Light electrical and instrumentation and control drafting manual issued as revision 1 on July 3, 1985, and determined that it provided appropriate drawing format and content guidance. The team also reviewed a recently prepared Carolina Power and Light instrumentation and control design guide that provides detailed instructions on a number of instrumentation and control topics for use by both engineering and drafting personnel. The team anticipates that this design guide will expand over time as additional instructions are prepared. In addition, the team reviewed a quality assurance audit report of the Harris plant engineering section dated May 13, 1985. Revision of the drafting manual and development of the design guide for the instrumentation and control discipline resolved the team's concerns in this area.

(Closed) Deficiency D6.3-2, Conduit Separation

During the inspection of main control room panels at the plant, the team noted numerous instances of redundant flexible conduits that were in direct contact with one another, and expressed a concern about conformance with electrical separation criteria provided in IEEE Std. 384-1974 and NRC Regulatory Guide 1.75. Separation distances less than those prescribed in these documents may be justified by an analysis of the particular installation. The team reviewed a Westinghouse analysis of their panels dated May 10, 1985, and a corresponding EBASCO analysis of their panels dated May 20, 1985. Each of these analyses used a technical basis of wire size, control circuit fusing, voltage level separation, and control wiring insulation characteristics. These actions satisfactorily resolve the team's concern.

(Closed) Unresolved Item U6.3-3, Instrument Impulse Line Separation Distance

The team determined that a Carolina Power and Light field change request had been issued and subsequently revised to permit reduced separation distances between redundant safety-related instrument impulse lines as well as between safety and non-safety-related instrument impulse lines. This field change request had been designated as a minor change not subject to design verification. An extensive discussion of the separation distance requirements in EBASCO's design criteria and other minimum values used to accept the instrument tubing installation was conducted with Carolina Power and Light and EBASCO personnel during the reinspection. The team reviewed seismic walkdown procedures and the corresponding EBASCO acceptance criteria for the walkdown. Telephone discussions were held with EBASCO plant site personnel regarding the

preliminary results of a phase 1 walkdown covering the 40 percent of instrument tubing installed to date. The team also reviewed a number of recent instrument tubing relocations accomplished by Carolina Power and Light field change requests.

EBASCO stated that no situations had arisen where safety-to-safety instrument tubing distances were less than the installation criteria of 24 inches, and that no safety-to-non-safety installations were less than the thermal expansion criteria of one inch. Any exceptions to these minimum distances, due to space limitations at instrument process taps, penetrations, and instrument racks will be justified on a case-by-case basis.

The team closed this item on the following basis:

(1) the minor design change designation was determined to be correct based on additional documentation provided for review by the team;

(2) the design criteria remain unchanged, which should ensure adequate separation for future plant modifications;

(3) the installation criteria appear reasonable, and have not been violated in the current configuration, and

(4) the seismic walkdown process appears to be comprehensive and is addressing the specific separation concerns raised by the team.

(Closed) Deficiency D6.4-2, Vendor Conformance to Specification

The team was concerned that the hydrogen analyzer and remote sample dilution panel could present, under worst case environmental conditions, the potential for buildup of excessive hydrogen concentrations due to the design of the installed hardware. The EBASCO procurement specification contained a requirement prohibiting the accumulation of an explosive mixture in these panels. The team reviewed a worst case hydrogen leak rate analysis provided by the vendor in March 1985 which demonstrated that hydrogen concentrations would not reach the 4 percent acceptance limit even for a postulated double ended instrument tubing break coupled with loss of forced circulation. The results of this analysis were considered satisfactory by the team.

(Closed) Unresolved Item U6.5-1, Design Basis for Safety-Related Instrument Setpoints

The team had noted a number of safety-related instrument setpoint issues involving HVAC, Emergency Service Water, Spent Fuel Cooling, and reactor auxiliary building sump pumps. In addition to these specific issues, the team was concerned that design basis documentation would not be provided for all safety-related balance-of-plant setpoints based on the Carolina Power and Light commitment in FSAR section 1.8.

Each of the specific setpoint issues raised by the team was satisfactorily resolved by revisions made to EBASCO design basis documentation and the completion of one Carolina Power and Light calculation.

During discussions with Carolina Power and Light and EBASCO personnel, it was determined that the current EBASCO method for establishing and documenting the design basis of safety-related setpoints is accomplished through either a calculation or by a specific technical justification analysis. The team reviewed a number of specific examples, and determined that the EBASCO approach was satisfactory for safety-related setpoints. Carolina Power and Light personnel indicated to the team that the current EBASCO setpoint design basis documentation process would be used for all safety-related setpoints except for those already designated to conform with the Westinghouse setpoint methodology. The team considers this approach acceptable.

A change notice for FSAR section 1.8 (R.G. 1.105) was initiated by EBASCO during the reinspection to state that "safety-related setpoints not covered by Technical Specifications have sufficient documentation to support the setpoint value, tolerance, and margin to safety process limits." A Carolina Power and Light letter dated August 6, 1985 confirmed this commitment.

(Closed) Deficiency D6.7-1, Westinghouse Reactor Coolant Pump Instrumentation

The team had noted that variations in instrument ranges existed for bypass flow switches for the reactor coolant pumps. Revised Westinghouse and EBASCO documentation was reviewed and found to be consistent.

(Closed) Deficiency D6.8-5, Battery Room Service Sink

The team noted that the installed sink had wooden support legs rather than metal as required by the EBASCO equipment specification, and that the FSAR commitment regarding flammable materials had not been fulfilled with this material substitution. Carolina Power and Light provided photographs of field fabricated metal legs used to replace the wooden legs, and provided a procurement procedure used to control material substitutions. As this was an apparently isolated situation and controls exist for future material substitutions, this item is closed.

(Closed) Deficiency D6.8-6, Calculation Basis for Licensing Amendment

The team had noted that an FSAR change had been accomplished by Carolina Power and Light on the basis of an incomplete, unreviewed, and unverified design calculation at the plant site. The team reviewed the completed calculation and the revised Harris Plant Engineering Section Instruction 3.8 that requires that FSAR changes be supported by a design document as appropriate. These actions resolve the team's concern.

7. Design Control Aspects Related to More than One Discipline

During the course of the reinspection the team reviewed Carolina Power and Light and EBASCO's actions which were taken to address the concerns common to more than one discipline which were identified by the team during the Integrated Design Inspection.

7.1 Computer Software Control

As noted in the Integrated Design Inspection report, problems relating to documentation of computer error reviews existed at EBASCO and had been previously identified by the NRC (I&E Vendor Inspection Branch Inspection Report 9990505/84-02). The team reviewed a new EBASCO procedur A-35, "Control of Operating Systems Software Problems Affecting Comp er-Based Safety-Related Programs," issued on May 31, 1985. The main features of this procedure are:

1. Responsibilities of users encountering operating system software problems are included.

2. Management responsibilities are defined.

3. Guidelines for evaluating the effects of software problems are provided.

4. Responsibilities of the Project Engineer are included.

The team had no further questions in this area, however additional inspection of EBASCO's programs in this area may be conducted in the future by the I&E Vendor Program Branch at the EBASCO offices.

7.2 Design Capability of Harris Plant Engineering Section

The team questioned the availability of guidelines for the Harris Plant Engineering Section and also noted that the major technical expertise was provided by contract personnel. In their response the licensee stated that design technical guidelines are in preparation. They also stated that over 100 Design Basis Documents have been drafted and have been reviewed by Carolina Power and Light with about half of them being approved. A formal Engineering Transition Program has been established with senior level EBASCO engineers and supervisory EBASCO personnel working at the site.

During the reinspection, the team reviewed the design guides that had been prepared in the electrical and I&C areas and were satisfied that they covered the work presently in progress at Harris Plant Engineering Section in those disciplines. The team also talked extensively with the Harris Plant Engineering Section Electrical Unit Manager and the Harris Plant Engineering Section Manager of Engineering and were encouraged that steps had been undertaken to strengthen the technical expertise of the unit both as a working group, and also as a base for Carolina Power and Light leadership of the design effort for the Shearon Harris Plant.

7.3 Design Verification Process

The response stated that the concerns identified in each discipline were unique and did not have a commonality that would require or permit generically designed corrective action programs to be effective. EBASCO did conduct training for Shearon Harris Project personnel to inform them of the concerns identified in the IDI report and aid in preventing repetition of the problems identified. The team reviewed records of this training. Additional

discussions with both Carolina Power and Light and EBASCO Shearon Harris Project personnel were held with the team to discuss the concerns identified in the IDI report. As a result of these additional discussions EBASCO Company Procedure E-30, Preparation of Calculations, was revised (July 24, 1985) for the Shearon Harris Project to require review by the lead discipline engineer of any safety-related calculation or revision generated after July 24, 1985.

A discussion of Integrated Design Inspection concerns and corrective actions for each discipline that were undertaken was provided. The team reviewed these corrective actions within each discipline during the reinspection while examining the corrective actions for the particular findings. Team review of EBASCO's corrective actions in the Applied Physics area is provided below.

In the Applied Physics area, although the team found instances where EBASCO's procedures had not been followed in the revised calculations (i.e., the documentation of input assumptions and changes made to a completed calculation), the design analysis reviewed was significantly improved. The team was presented preliminary results of a technical review of 10 additional calculations. The team was also informed of an ongoing Quality Assurance audit of five Shearon Harris radiation protection calculations. Neither the results of these reviews, nor a description of scope, depth and corrective action methodologies, were available for evaluation during the reinspection.

The team was additionally informed that a technical review team was to be formed within the Advanced Technology Department. The charter of this team would be to conduct technical audits to ensure the adequacy of design activities within the department. The team believes this commitment to be a positive step toward resolving our concern regarding design control within the Applied Physics discipline. The NRC I&E Vendor Program Branch as part of its routine program may inspect the above actions in the Applied Physics area (further addressed in enclosures 6 and 7 of Carolina Power and Light's letter dated August 6, 1985) at EBASCO offices.

7.4 Minor Design Change Designation

During the inspection, the team determined that field initiated design changes affecting design documents transferred from EBASCO to Carolina Power and Light were, for the most part, designated as "minor" changes not subject to design verification. Inspection emphasis was placed on ensuring that field change requests identified as "minor" were properly designated. The team was also concerned that no definition was provided for "major" design changes in the Carolina Power and Light procedures.

Discussions were held between the team and Carolina Power and Light personnel on this issue during the reinspection at EBASCO. Carolina Power and Light stated that their practice is to assume that any change is considered a "major" change unless it is formally designated as "minor." In the former case, design verification is accomplished for each "major" design change, and in the latter case, a formal engineering justification statement is prepared, completed, and included with the "minor" design change documentation.

The team is satisfied that this Carolina Power and Light method, if diligently implemented, can provide satisfactory control over the proper designation and and treatment of design changes. To assure consistency in its future application, the team recommended that the wording of the "minor" change definition in Carolina Power and Light procedure 3.2 be revised for improved clarity.

7.5 Design Interface Problems

Section 7.5 of the Shearon Harris Integrated Design Inspection report identified design interface problems in the mechanical systems, electrical, and mechanical components areas. The team did not identify design interface problems in the civil/structural or instrumentation and control areas.

The Carolina Power and Light response to Section 7.5 of the Integrated Design Inspection report did not in all cases agree that the deficiencies cited by the Integrated Design Inspection team were evidence of faulty design interface. Carolina Power and Light also indicated that the design interface concerns identified by the Integrated Design Inspection team had been separately and individually addressed in Appendix A of the Carolina Power and Light response, that corrective actions had been initiated where necessary, and that these concerns were isolated instances. Carolina Power and Light finally noted programs that are currently in place, or that have recently been initiated, to improve interorganizational communication.

The team reviewed additional materials provided by Carolina Power and Light during the July 22-24 reinspection period which supplemented the original response. Carolina Power and Light also provided a description of the engineering transition program which controls the transfer of original design responsibility from the EBASCO New York office to the SHNPP site organization.

The team concluded that this supplementary information substantially addresses the concerns originally identified in Section 7.5 of the Integrated Design Inspection report.

8.0 Potential Enforcement Findings

The team reviewed the findings during the Integrated Design Inspection to identify which of these findings (unresolved items and deficiencies) were potential enforcement findings.

Attachment 1 to this report contains a list of the potential enforcement findings based on the NRC IDI findings. These are being reviewed by the Office of Inspection and Enforcement and the NRC Region II office for appropriate action.

POTENTIAL ENFORCEMENT ACTIONS
SHEARON HARRIS INSPECTION

1. Contrary to 10CFR50, Appendix B, Criterion III, design control has not been maintained. The applicant has:

   a. Failed to detect the use of incorrect assumptions in the calculations that established the allowable voltage drop in safety-related switchgear breaker close control circuits. (Deficiency D5.5-4)

   b. Failed to provide independence in the redundant protection circuits for the containment penetrations used for the reactor coolant pump motor power circuits. (Deficiency D5.6-1)

   c. Failed to detect that applicable regulatory commitments were not satisfied and that design inputs were incorrectly selected in the design of the containment emergency sump. (Deficiency D2.3-1)

   d. Failed to subject a field change to design control measures commensurate with those applied to the original design. (Deficiency D2.4-4)

   e. Failed to ensure that applicable regulatory requirements for calculation of radiation doses to equipment were correctly translated into design analyses. (Deficiencies D2.5-4, D2.5-5, D2.5-6, and D2.5-7)

   f. Failed to detect that an incomplete, unreviewed, and unverified design calculation was used to modify the equilibrium temperature value for the spent fuel pool. (Deficiency D6.8-6)

   g. Failed to provide independent verification of the correct selection of overload protection on safety-related motor operated valves by permitting the same individual who performed the activity to sign-off on the review of that selection. (Deficiency D5.4-3)

2. Contrary to 10CFR50, Appendix B, Criterion V, documented instructions, procedures, or drawings were not provided for activities affecting quality. The applicant has:

   a. Failed to provide adequate instructions, procedures, or drawings to aid in the selection of overload protective devices for intermittent duty motors operating safety-related valves. (Deficiency D5.4-2)

   b. Failed to issue an approved drafting manual although instrumentation and control drawings were being revised and reissued at the plant site. (Deficiency D6.1-10)

3. Contrary to 10CFR50, Appendix B, Criterion VII, the applicant failed to control the purchase of material or equipment used in safety-related applications in that unqualified terminal boxes were purchased for use without appropriate qualification testing or analyses. (Unresolved Item U5.4-5)

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