



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA ST., N.W., SUITE 3100
 ATLANTA, GEORGIA 30303

Report No. 50-395/81-16

Licensee: South Carolina Electric and Gas Company
 Columbia, South Carolina 29218

Facility Name: V. C. Summer Nuclear Plant

Docket No. 50-395

License No. CPPR-94

Inspection at Gilbert Associates, Incorporated, Reading, PA (June 29, - July 2, 1981) and at Summer Nuclear Plant near Columbia, SC (July 7-9, 1981)

Inspectors:	<u>L. E. Foster for</u>	<u>7/29/81</u>
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	J. W. York	Date Signed
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Approved by:	<u>A. R. Herdt</u>	<u>7/29/81</u>
	A. R. Herdt, Section Chief	Date Signed
	Engineering Inspection Branch	
	Engineering and Technical Inspection Division	

SUMMARY

Inspection on June 29 - July 2, 1981 (Gilbert Associates); July 7-9, 1981 (Summer Plant)

Areas Inspected

This special, announced inspection involved 86 inspector-hours onsite and at Gilbert Associates, Incorporated in the areas of pipe support baseplate designs using concrete expansion anchor bolts (IEB 79-02); seismic analysis for as-built safety related piping systems (IEB 79-14); verification of calculations, design changes, and installation of piping supports; contracts with consultants; audits of contractor and sub-contractors; interface between Gilbert Associates, SCE&G, and other consultants; and previously reported inspector follow-up items.

Results

Of the areas inspected, no violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- **O. S. Bradham, Station Manager
- **J. F. Algar, Site Manager
- ***O. W. Dixon, Group Manager, Production Engineering
- **D. A. Nauman, Group Manager, Nuclear Services
- *D. R. Moore, Manager, Quality Assurance
- ***G. D. Moffatt, Mechanical Engineer
- ***S. S. Howze, Licensing Engineer
- **T. A. McAlister, QA Surveillance Specialist
- ***A. G. Alvarez, Senior Engineer
- **F. A. Miller, Lead QC Inspector
- **A. A. Smith, QA Director
- **S. J. Smith, Maintenance Supervisor
- ***K. W. Nettles, Senior Engineer
- **B. G. Croley, Technical Support Supervisor

Other Organizations

Gilbert Associates, Incorporated

- *H. E. Yocum, Project Manager
- **H. A. Bamberger, Resident Engineer
- *D. R. Kershner, Project Piping Analyst
- *J. E. Lisney, Structural Project Engineer
- *J. B. Muldoon, Manager, Specialty Engineering
- *C. N. Rentschler, Manager, Piping Verification
- *R. J. Hoffert, QA Program Manager

NRC Resident Inspector

J. L. Skolds

- *Attended exit interview on July 2, 1981
- **Attended exit interview on July 9, 1981
- ***Attended both exit interviews

2. Exit Interview

The inspection scope and findings were summarized on July 2 and July 9, 1981 with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings listed below. No dissenting comments were received from the licensee.

(Open) Inspector Followup Item 395/81-16-01 Verification of Safety Factor - Bolt Skewness

3. Licensee Action on Previous Inspection Findings

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. (Open) IE Bulletin 79-02 - Pipe Support Base Plate Designs Using Concrete Expansion Anchors

An inspection was performed at Gilbert Associates Incorporated (GAI) Design, Engineering Offices to verify South Carolina Electric and Gas Company (SCEG) compliance with IEB 79-02 requirements and SCEG commitments for the V. C. Summer Plant. Follow-up on inspector questions noted in IE Report 50-395/80-04 was also accomplished by the inspectors.

Design calculations for concrete expansion anchors and base plates for pipe supports on the following piping subsystems were randomly selected and inspected.

- a. MS-03 - Isometric C-314-011 Sheet 3 Rev. B, Main Steam from Steam Generator "C" to Penetration 202.
- b. SI-02 - Isometric C-314-691, Sheet 7, Rev. 0, Safety Injection from Accumulator "B" to Cold Leg, Loop "B".
- c. RC-11 - Isometric C-314-601 Sheet 24, Rev. B, Reactor Coolant. Reactor Vessel Head - Seal Monitoring.

IE Report 50-395/80-04 noted that DBE loads were not used for the initial base plate calculations. Design calculations for base plates and concrete expansion anchors used for the sampled pipe supports in the subsystems noted above used loadings for faulted conditions, including DBE. An isolated case for pipe support RCH-1018 was noted where the upset load was used. The pipe support would still have been adequate had the faulted load been used. The condition was acknowledged by GAI as an isolated error. All other calculations for pipe supports for that subsystem were verified to have taken faulted loads into consideration. Both GAI and the licensee agreed to perform additional checks and audits to assure that the error was an isolated case.

The following Nonconformance Notices (NCN) and Deficiency Notices (DN) were reviewed and compared with the design calculations to verify the as-built accuracy of the design calculations.

- a) NCN 1091H
- b) NCN 1061H
- c) NCN 1043H
- d) NCN 5199H
- e) NCN 1007H
- f) NCN 1145H
- g) NCN 1132H
- h) DN 5786H

NCN 1007H reported that a concrete expansion anchor for pipe support CSH 332 had been installed with an 8° angle instead of the maximum allowed angle of 6°. GAI indicated that a 6° maximum tolerance was given to the field but their design criteria allows a 10° angle. GAI further indicated that since a 10° angle would not significantly reduce the capacity of the concrete expansion anchors, any angle less than 10° would not be taken into consideration in the design calculations. However, subsequent discussions and review of sample problems indicated that where the loading on the concrete expansion anchor is sufficient to cause only an acceptable safety factor of 4, the 10° angle could reduce the safety factor below the acceptance criteria. GAI and the licensee agreed to assure that conditions, including bolt skewness, that could reduce the safety factor of the concrete expansion anchor would be verified by means of design calculations. If the calculations result in an unacceptable safety factor, then a redesign of the pipe support would be required. Pending confirmation of the above noted condition, this shall be identified as Inspector Follow-up Item 81-16-01.

No violations or deviations were noted.

6. (Open) IE Bulletin 79-14 - Seismic Analysis for As-Built Safety Related Piping Systems

An inspection was performed at the GAI Design Engineering Offices to verify SCEG compliance with IEB 79-14 requirements and SCEG commitments for the V. C. Summer Plant. The inspection also included follow-up on inspector questions noted in IE Report 50-395/80-04.

The piping analysis for the following subsystems were inspected. Pipe support design calculations for the subsystems were randomly selected and inspected.

- a. MS-03 - Isometric C-314-011 Sheet 3 Rev. B, Main Steam, From Steam Generator "C" to Penetration 202 (GAI Analysis)
- b. SI-02 - Isometric C-314-601 Sheet 7, Rev. O, Safety Injection from Accumulator "B" to Cold Leg - Loop "B" (Teledyne Analysis)
- c. RC-11 - Isometric C - 314-601 Sheet 24, Rev. B, Reactor Coolant, Reactor Vessel Head - Seal Monitoring (EBASCO Analysis)

- d. CS-01 - Isometric C-314-671 Sheet 1, Rev. F, Chemical Volume Control System, Penetration No. 409 to Regenerative Heat Exchanger (EDS Analysis).
- e. SF-06 - Isometric C-314-551 Sheet 7, Rev. E. Spent Fuel Cooling System, Spent Fuel Cooling Heat Exchanger to Spent Fuel Pump B and Spent Fuel Pool (EDS Analysis).

IE Report 50-395/80-04 noted an analysis that had used incorrect Modulus of Elasticity values and that a design verification procedure that could have identified this error had not yet been approved and issued. The piping analysis problems inspected did not show any additional examples of this condition. The design verification procedure, GAI procedure DS-8, had been approved and issued on May 28, 1980. The procedure includes a verification that correct design conditions, including Modulus of Elasticity, had been used in the analysis. The inspectors had no further questions on this item.

IE Report 50-395/80-04 noted that GAI used an overlapping modeling technique for its seismic analysis in lieu of anchors in limited applications. Piping analysis inspected modeled the piping from anchor to anchor. GAI reconfirmed the use of the overlapping modeling technique. However, GAI further stated that when overlapping was used, the overlap region was chosen such that it contained 3 supports in each of the 3 mutually perpendicular directions and the region was located in relatively more rigid spans of the piping. The licensee was requested to document the extent of the usage of the overlapping modeling technique and to document the criteria used for choosing the overlap region in their response to IEB 79-14.

IE Report 50-395/80-14 noted a lack of SCEG and GAI QA audits on IEB 79-02 and IEB 79-14 related activities. Subsequently, audits were performed by GAI and SCEG. The following GAI and SCEG audit reports were reviewed.

- a. SCEG Audit of GAI on January 27-28, 1981
- b. GAI Audit of ENCUMP Systems Limited on September 19, 1980
- c. GAI Audit of Teledyne on January 28-29, 1980
- d. GAI Audit of GAI, Jackson, Michigan, on May 5, 1981
- e. SCEG Pre-award Survey of EBASCO on October 9-10 and of EDS on March 24-25, 1980
- f. SCEG Audit of Westinghouse on March 9-11, 1981
- g. SCEG Audit of EDS, Atlanta, on October 24, 1980

The inspectors had no further questions on this item.

GAI's pipe support cold spacing criteria delineated by GAI Report Number 1923 was inspected. It was noted that the criteria was based on a 0.5% damping value for OBE. A study was performed by GAI to verify the conservatism of the criteria. An analysis of a hypothetical straight run of pipe proved the criteria to be conservative. However, an analysis of an actual

run of pipe showed that approximately 10% of the analyzed pipe support loads would be higher than the pipe support loads obtained by the cold spacing criteria. GAI noted that an FSAR change had been submitted to use 2% damping for SSE. Further studies using the requested damping values were being conducted by GAI to confirm the conservatism of the cold spacing criteria.

Pending confirmation of the conservatism of the cold spacing criteria and submission of a final licensee response, IEB 79-14 will remain open. No violations or deviations were identified.

7. Station (Site) Inspection

Subsequent to the inspection at Gilbert Associates, Incorporated, an inspection was performed at the V. C. Summer Station. The purpose of this on-site inspection was to confirm and verify that the modifications and design changes to supports as required by analysis were being implemented.

- a. (Open) IE Bulletin 79-02, Pipe Support Base Plate Design Using Concrete Expansion Anchors. Several Field Change Requests (FCR), Nonconformance Notices (NCN), and Deficiency Notices (DN) initiated by the licensee and GAI were reviewed and the installations were examined as follows:
 - (1) DN No. 5328H - This Deficiency Notice included several typical deficiencies such as cracks in the Hilti bolts, bolts skewed in excess of 6°, 10d violation, undersize welds, and weld in the wrong location. Dispositions had been made and corrective actions had been implemented.
 - (2) NCN 1061H, 1043H, and 3851H - Cracks in Hilti bolt threads. These bolts plus several others were examined to determine the extent of the cracking problem. These cracks and others examined were minor and only extended into the first thread of the bolts. The inspectors also reviewed the bolt vendor's response dated March 18, 1980 concerning cracks and torque.
 - (3) NCN 1043H, and 1091H, - Identified cracks in bolt threads. Bolts were accepted based on manufacturer's letter of March 18, 1980.
 - (4) DN 5199H - A 3/4 inch diameter by 7 inch long bolt had been installed instead of 5/8 inch diameter by 6 inch long bolt. Disposition was to accept as is.
 - (5) NCN 1145H - Concerned the lack of correct bolt embed depth on four supports. Calculations revealed that the embed depth was satisfactory.
 - (6) DN 5786H - one Hilti bolt installed too close to embedded unistrut. Disposition by engineering was to accept as is.

- (7) NCN 1132H - Drawing specified 5/8 inch diameter by 8 inch long Hilti bolts for support VUH - 128. Inspection showed that 5/8 inch diameter by 6 inch long bolts were used and that Hilti does not manufacture 5/8 inch by 8 inch long bolts. UT inspection revealed that bolts were 6 inches long and measurements showed that the embedment depth met the 2 3/4 inch requirement.
- (8) NCN 1007H - Bolt skewness exceeds 6°, 5d violation and bolt had cracked threads. Disposition was made to replace the bolt, 5d was not violated, and to accept the cracks. Examination showed that bolt was replaced and 5d dimension was acceptable as it measured 4".
- (9) DN 4192H - Inspection revealed that Hilti bolts exceeded the acceptable skewness angle of 6° on support EFH-1005. Disposition was to cut off bolt, increase size of plate, and install a new Hilti bolt.
- (10) DN 4479H - Hilti bolt violates 10d requirement. Reanalysis showed that bolts were satisfactory for the imposed loads.

Within the areas examined no violations or deviations were observed.

- b. (Open) IEB 79-14 Seismic Analysis for As-Built Safety Related Piping Systems. Physical inspections of selected pipe support installations (modifications) required by the piping reanalysis were performed. Selected Field Change Requests (FCR), Deficiency Notices (DN), Nonconformance Notices (NCN), and Calculations were examined as follows:
 - (1) DN 5741H - Deficiency stated that the weld had been performed on the opposite side of the channel. Disposition was to use as is. The location of this weld was confirmed by the inspector.
 - (2) FCR 13664H - Calculations by EDS showed that the size of baseplate for hanger CCH-297 had to be increased and that 2 more bolts be added due to increased loads. Examination confirmed this had been accomplished.
 - (3) NCN 1145H - This NCN required a redesign of four supports (DCH 1190 - 1193) due to inability to meet minimum Hilti bolt embed depth. Supports had been redesigned and installed per drawings. Calculations performed by GAI site personnel and verification by GAI, Reading, were examined. The licensee was advised that the note requiring a 7 inch minimum embedment should be deleted from applicable drawings as the supports were redesigned to utilize the existing embedment.

- (4) FCR 12699H - Support strap for hanger WDH-1052 had to be removed to accommodate the installation of elastomer into a penetration. Examination of support revealed that elastomer had been installed and the support strap was reinstalled.
- (5) FCR 12670H - This FCR was initiated to allow rework of hanger CSH-154. A reanalysis of subsystem CS01 by EDS showed that four new supports needed to be added and that one support required removal. Supports affected were CSH-170, 4006, 4007 and 4008. GAI review of calculations for CSH-4008 resulted in a redesign per FCR-13519H.
- (6) NCN 318 - Lugs on pipe spool CS-25-03 were incorrectly positioned by the pipe fabricator. This NCN specified the addition of lugs at the correct location to accommodate pipe support BRH-075.
- (7) FCR 13676H - Reanalysis of subsystem SW05 by EDS resulted in a redesign of pipe support SWH-077 in order to meet the Safety Factor of 4. Support had not been installed; therefore, the installation will be examined during subsequent inspections.
- (8) Other pipe support installations and associated calculations examined were: WGH-1302, BHD-026, BDH-027, SIH-231, RHH-204, and CCH-096.
- (9) Inspection reports and associated deficiency reports for the following pipe support inspections were examined: SWH-32, SWH-045, CSH-402, CSH-150, SIH-322, RHH-283, 201 and 204, FWH-346, MSH-054, 285, 064, 065, 309, and 084, BDH-026, RCH-277, 153 and 284.
- (10) Field Change Requests examined were as follows: FCR 12804H, 14284H, 14501H, 13313H, and 12670H.

Based on review of pipe support calculations, field change requests, requests for information, pipe support drawings, deficiency notices, nonconformance notices, corrective actions, installation records, and procedures it appears that the licensee has and is implementing a program to verify that the pipe supports have been designed, installed, inspected, reanalyzed and modified to meet loading requirements.

Within the areas examined, no violations or deviations were observed.

8. Feed Water Check Valves and Supports

The Feed Water System has undergone a major modification due to check valve slam. The licensee's A/E (GAI) performed analysis work and Battelle Northwest performed a parallel analysis for verification purposes. The

analysis showed that the Feed Water System supports would be subjected to higher loads than originally calculated. Based on the results of these analysis, modifications were made to the Feed Water System, including the check valves and system supports. The installation of the valves and supports was examined by the inspectors. The licensee will perform a walkdown inspection of the system to verify the installation. The isometrics will be marked up to show the as-built dimensions, etc. These as-builts will be transmitted back to GAI for reanalysis.

Within the areas examined, no violations or deviations were observed.

9. Review of Procedures

The licensee is in the process of preparing management directives and procedures to control design changes and modifications after the plant is operating. Procedures reviewed and discussed with licensee personnel were:

- a. Management Directive Nos. 5, 6, and 7
- b. Administrative Procedure AP-1500, Modification Control
- c. Operation Quality Assurance Plan, Section 6, Design Control
- d. Nuclear Engineering Procedure Nos. NE-128, Initiation, Evaluation and Approval of Design Changes; NE-131, Design Verification; and NE-130, Design Analysis and Calculations.

Within the areas examined, no violations or deviations were observed.