



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

JAN 29 1981

Report Nos. 50-369/80-38 and 50-370/80-20

Licensee: Duke Power Company  
 422 South Church Street  
 Charlotte, NC 28242

Facility Name: McGuire 1 and 2

Docket Nos. 50-369 and 50-370

License Nos. CPPR-83 and CPPR-84

Inspection at Corporate Office, Charlotte, NC and McGuire Nuclear Station near Charlotte, NC (Dec. 3-5, 1980); EDS Nuclear, Inc., San Francisco, CA (Dec. 17-18, 1980).

Inspectors: <u><i>A. R. Herdt</i></u>	<u>1/28/81</u>
A. R. Herdt	Date
<u><i>L. E. Foster</i></u>	<u>1/27/81</u>
L. E. Foster	Date
<u><i>L. E. Foster for</i></u>	<u>1/27/81</u>
H. Wong	Date

Accompanying Personnel:

- M. Hartzman, NRR (December 4-5)
- E. Chelliah, NRR (December 3-5)

Approved by: *C. E. Murphy* 1/29/81  
 C. E. Murphy, Chief, RCES Branch Date

SUMMARY

Inspection on December 3-5, 1980 (McGuire); December 17-18, 1980 (EDS)

Areas Inspected

This special, announced inspection involved 128 inspector-hours on site and at EDS Nuclear, Inc. (EDS) in the areas of pipe support base plate designs using concrete expansion anchor bolts (IEB 79-02); seismic analysis for as-built safety related piping systems (IEB 79-14); overlap technique and modelling methods; contract with EDS, Inc.; anchor

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and piping analysis for bellows type penetrations; QA manuals and procedures; interface between EDS and Duke Power Company (DPC); design control; 50.55(e) items; and previously reported noncompliances and unresolved items.

#### Results

Of the nine areas inspected, no violations or deviations were identified in eight areas; one violation was found in one area (Violation-Failure to establish adequate measures for the control of design interfaces and for coordination among participating design organizations - paragraph 8).

## DETAILS

### 1. Persons Contacted

#### Licensee Employees

- \*J. R. Wells, Corporate QA Manager
- \*S. K. Blackley, Chief Engineer
- \*R. B. Priory, Principal Engineer
- \*T. F. Wyke, Principal Engineer
- \*\*\*A. P. Cobb, Senior Engineer
- \*J. N. Underwood, Senior Engineer
- \*W. H. Scheffler, Senior Engineer
- J. E. Beall, Assistant Engineer
- \*W. O. Henry, QA Manager, Construction
- \*G. A. Copp, Nuclear Engineer
- \*E. B. Abrams, Manager, Hanger Installation
- M. Curtis, QA Manager, Vendors
- H. Hu, Stress Analyst
- \*B. L. Peele, Senior Engineer
- A. Azaz, Stress Analyst
- \*C. L. Ray, Senior Engineer
- \*\*\*H. L. Atkins, QA Engineer

#### Other Organization

#### EDS Nuclear, Incorporated

- \*\*R. J. Stuart, Vice President
- \*\*\*H. P. Robertson, Division Manager
- \*\*B. F. Phipps, Manager, Quality Assurance
- \*\*\*R. Hobgood, QA Engineer
- \*\*D. M. Whitt, Manager, Structural Design
- \*\*H. P. Roberts, Manager, Pipe Analysis
- \*\*D. W. MacNeill, Project Manager
- \*\*F. A. Dougherty, Manager, Planning
- C. I. Browne, Supervising Engineer
- C. A. Hoffman, Supervising Engineer
- S. M. Jaffer, Section Manager
- J. Bisset, Supervising Engineer

\*Attended exit interview on December 5, 1980

\*\*Attended exit interview on December 18, 1980

\*\*\*Attended both exit interviews

### 2. Exit Interviews

The inspection scope and findings were summarized on December 5 and December 18, 1980 with those persons indicated in paragraph 1 above. The violation concerning design control (paragraph 8) was discussed in detail. The unresolved item (paragraph 9) was discussed and the licensee agreed to take appropriate corrective action.

3. Licensee Action on Previous Inspection Findings

- a. (Closed) Infraction 369/80-04-01 Part A. Concrete Expansion Anchor Torque. The licensee examined expansion anchors and performed tests to determine whether adequate torque had been applied. Results of tests showed that the initial torque set the anchors and that the final retorquing inspection was adequate. The licensee's response dated November 7, 1980 discussed the evaluation for reportability under 50.55(e). Results of the evaluation were that this item was not reportable. The licensee had reinspected anchor bolts associated with 274 hangers and found that all except one anchor bolt met the minimum specified torque. Based on the above reinspection results, this item is closed.
- b. (Closed) Unresolved Item 369/80-29-03 Resolution of Concrete Expansion Anchor Safety Factor less than Four. The licensee had completed work to determine which expansion anchors had a safety factor less than four. Approximately 30 systems had been rigorously analyzed and some of the anchors in six alternate analysis systems did not meet the Bulletin requirement of 95% confidence level having a safety factor of four. The licensee stated that they are performing more detailed analyses and will modify the supports to obtain a minimum safety factor of four. The licensee has submitted a list of systems analyzed and agreed to complete all modifications prior to the anticipated full load date of January 28, 1981. This item is closed.
- c. (Closed) Anchors Installed with Insufficient Embedment IE Report 50-369/80-18 noted that pipe support 1-MCA-ND-249 had concrete expansion bolts installed without sufficient depth. Subsequently, the licensee examined documentation concerning 6417 expansion bolt installations and found 23 that failed to meet the required embedment depth. Seventeen of these 23 had been repaired and the licensee stated that the other six would be modified/repaired by January 28, 1981. The licensee also explained that this isolated case was caused by a designer selecting the incorrect bolt for the installation; however, their normal inspection program had identified the 17 insufficient embedments. Corrective action has been taken, therefore this item is closed.
- d. (Closed) Infraction 369/80-04-01 Part C. Hanger Gap in Excess of Drawing Requirements. During an NRC inspection, the inspector noted that Hanger No. 1-MCA-ND-H76 had excessive gap (3/16 inch vs 1/8 inch). The licensee has inspected and evaluated this item and stated that it was not reportable under 50.55(e). The licensee's analysis and evaluation dated December 3, 1980 was reviewed and discussed. Even though the

asbuilt configuration (clearance) exceeded the design value, the licensee's analysis shows there was no safety significance; however, they have inserted a shim between the members in order to meet the design drawings. This item is closed.

- e. (Closed) Unresolved Item 369/80-29-01 Structural Overlap Method. The applicability of the overlap technique for resolution of piping stress analysis was reviewed with DPC and EDS personnel along with the review of drawings. Based on the above reviews and discussions the following information was obtained:

- (1) DPC had applied the five (5) restraint criteria to the design of the McGuire piping.
- (2) DPC had calculated the loads in the axial restraints and had used these loads in the proper manner.

Based on the above, this item is closed.

#### 4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violation or deviations. A new unresolved item identified during this inspection is discussed in paragraph 9.

#### 5. Independent Inspection

- a. The status of the inservice base line inspection was discussed. The licensee stated that the completion of the Unit 1 base line inspection was being verified and no indications have been identified. The licensee stated that a formal report would be submitted to Region II prior to fuel load.
- b. IE Bulletin 79-13 Feedwater Piping Cracks was discussed. The licensee was previously informed that their response to this Bulletin was not adequate and complete. The licensee agreed to reevaluate this response letter and submit a supplementary response to Region II prior to fuel load.
- c. The licensee's QA Manual, EDS QA Manual, the licensee's contract with EDS Nuclear, Inc. and associated procedures were reviewed and discussed. The inspector noted that the licensee's QA Manual and procedures for auditing vendors and AE's did not specify that technical audits would be performed and that their QA audit procedure did not address the retraining of personnel. Audits of EDS has been conducted by the licensee. These were QA audits (administrative) which were performed by qualified personnel using licensee's approved procedure and check lists. Design reviews had been performed, but technical audits had not been performed, nor were they required by

current procedure. The inspector pointed out the advantages of technical audits, i.e., technical audit may have found the problems associated with LOCA loads, valve flexibility, mismatch of hanger loads with current loads, lack of considering loads on all hanger/restraint components (welds, bolts, etc.). The licensee stated that the design reviews should have also detected these areas; however, they would evaluate the possible benefits of technical audits. The licensee's evaluation and any corrective action will be examined during subsequent inspections. This item is identified as Inspector Followup Item 50-369/80-38-01, 50-370/80-20-01, QA Technical Audit.

6. IE Bulletins (IEB)

- a. (Open) IEB 79-02 Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts, Unit 1

The requirements of IEB 79-02 and the licensee's responses dated December 1, 1980 and December 16, 1980 were reviewed and discussed with the licensee. Results of the review and discussions are as follows:

- (1) The portion of IEB 79-02 concerning the safety factor was resolved (see paragraph 3b). The licensee will verify a minimum safety factor of four. Hangers/restraints with a safety factor less than four will be modified/repared to obtain the required safety factor. The licensee committed to include a safety factor of four minimum on all new hanger/restraints. Region II will examine this during subsequent inspections. This item is identified as Inspector Follow-up Item 369/80-38-02. Safety Factor on all new hangers/restraints.
- (2) The licensee's method and sample size to assure the IEB 79-02 95% confidence level was resolved. The 5% which fell outside the acceptance criteria will be corrected/repared.
- (3) Scheduling of repairs was discussed and the licensee stated that all repairs would be completed by January 28, 1981 (prior to fuel load). Therefore, the question of scheduling is resolved.
- (4) Lack of adequate torque on some anchor bolts was resolved. The licensee had implemented a torque check program and found that the torque was adequate. (See paragraph 3.a)
- (5) Wrong embed depth of bolts for piping supports was resolved (See paragraph 3.c). The licensee reviewed the documentation of approximately 6400 bolts and only found seven which needed repair.

- (6) During inspections relating to IEB 79-02, it was noted that a 1/8 inch space existed between a baseplate and a support (See paragraph 3.d). Further inspections by the licensee showed that this 1/8 inch clearance was an isolated case and only existed on one of four bolts associated with the baseplate. The licensee's evaluation showed that no safety significance existed.

IEB 79-02 will remain open until the licensee's actions are complete and evaluated by Region II.

- b. (Open) IEB 79-14 Incorrect Pipe Support Analysis and Design

The inspector examined documents (See paragraph 10) prepared by the licensee and EDS Nuclear, reviewed piping drawings, discussed stress analysis, overlap method, hangers and supports.

Several piping drawings were obtained by the NRR personnel for further evaluation. During NRR's piping drawing review, it was noted that one area of the overlap section of piping (3" schedule 160 pipe) was approximately 16 feet long and only had supports at both ends. The licensee was requested to analyze this section of piping as a simple supported "I" beam to determine its frequency and to notify NRR of the results. The applicability of the overlap method for resolving piping stress analysis was examined and the results are discussed in paragraph 3.e of this report. The licensee stated that there are approximately 224 inaccessible hangers.

The licensee is to provide in his final response to the Bulletin a breakdown by system of the inaccessible hangers which could not be re-inspected in detail together with which portions (attributes) of these hangers were inspected and the results.

7. Licensee Identified Items (LII), 10 CFR 50.55(e) (CDR)

- a. (Open) LII 369/80-33-02, 370/80-18-02 Pipe Support Hanger Loads Incorrect. On October 28, 1980, the licensee notified Region II that a potential CDR had been found concerning pipe support hanger loads. IE Report 369/80-33 and 370/80-18 discussed the above and the licensee formally submitted a CDR report on November 26, 1980.

A review of the licensee's report, appropriate documents listed in paragraph 10, and subsequent discussions during this inspection revealed the following:

- . This problem was found during a review of LOCA load deficiencies on other supports
- . Comparison of current piping analysis loads with loads shown on design drawings (sketches) revealed that the

loads did not match, regardless of the LOCA or valve discharge loads

- . Sketches had not been revised by EDS to show the current (reanalyzed) loads unless the increase in loading required a modification of the support
- . Responsibility for future update of loads on these sketches was transferred from EDS to the licensee in mid 1979
- . The licensee's engineers had used the original loads shown on the sketches during redesign and re-evaluation of supports, instead of using current loads
- . The licensee had reviewed the supports and determined that approximately 1600 supports were affected and that approximately 450 of these supports may require some hardware changes
- . Safety consequence was that certain support/restraints may not be able to withstand the latest revised loads
- . The affected support/restraints are the ones that the licensee had responsibility for preparing the sketches
- . Failure of these supports could transmit higher loads to other supports
- . Failure to include the effects of LOCA loads on components, welds, anchors, bolts, hanger/restraint welds, etc.

The licensee has initiated corrective action to identify all affected supports/restraints; to perform engineering review and revise designs as required; revise sketches to show the higher loads and modify hardware as required; review procedures to correct interface methods; and maintain a list of supports/restraints which show the current loads. All of the corrective actions are expected to be completed by January 28, 1981. The licensee also committed to evaluate the above problems to determine whether these are "Generic" to other DPC plants.

This item will be examined during subsequent inspections.

- b. (Open) LII 369/80-33-03, 370/80-18-03, Additional Axial Load on Piping Penetrations (50.55(e)) (CDR). The licensee's CDR report dated November 26, 1980 and other appropriate documents (paragraph 10) were reviewed and discussed. During the licensee's design review of pipe penetrations through bellows-type penetrations, the design reviewer questioned how the internal containment

loads (caused by LOCA) were used in the calculations. Further review and analysis revealed that the loads caused by a LOCA had not been considered in 26 piping analysis math models. These 26 math models may affect and require changes to approximately 82 supports/restraints. Two other problems were also found during the above reviews. These problems were that the support/restraint designer failed to use the formula correctly when considering the SSE loads, and did not properly interpret the load definitions given by EDS. Results were that bellows-type penetrations may not be qualified for the faulted condition and pressure build-up inside containment resulting from a LOCA.

The licensee and EDS have initiated corrective action which includes the following:

- . Review all bellows-type piping penetrations between the containment and the reactor building
- . Identify locations of these penetrations and whether pipe run is straight or offset
- . Identify and review locations of piping penetrations other than the bellows type
- . Perform stress analysis of piping, review support/hanger design, and review penetration design.
- . Review structural calculations for other penetrations to assure that LOCA pressure and the faulted condition have been accounted for in the calculations
- . Revise drawings (sketches) and modify hardware as required
- . Review piping analysis procedures to confirm that the LOCA pressure loading is properly accounted for in subsequent calculations
- . Add definitions to adequately describe what loads are included in the calculations
- . Review special loading conditions in which mis-interpretations of loads could occur.

The licensee had prepared schedules for completion of the above work. They plan to complete Unit 1 work by January 28, 1981 and complete Unit 2 work during 1981 (depending upon construction schedules). The licensee committed to evaluate the above problems to determine whether they are "Generic" to other DPC plants.

This item will be examined during subsequent inspections.

- c. (Closed) Item "d" of CDR 70-14 Valve Flexibility in Piping Analysis Model. As part of the followup action regarding valve flexibility, DPC had performed corrective actions to account for non-rigid valves in the stress analysis of two piping runs located below elevation 733 feet. Previous reviews by DPC had incorrectly considered that valve rigidity was insignificant below elevation 733 feet.

The inspector randomly selected the following three valves and reviewed the piping analysis associated with these valves to verify the incorporation of valve rigidity into the analysis.

<u>Valve No.</u>	<u>System</u>	<u>Elevation</u>
ND-33	LHSI	730'
NI-332A	UHI	718'
NI-100B	UHI	718"

Based on the review of the above analysis, the licensee's corrective action was confirmed. This item is closed.

- d. (Open) LII 369/80-38-03, 370/80-20-02 Post LOCA Dynamic Effects on Containment Vessel. The licensee notified the inspectors on December 17, 1980 and subsequently submitted a CDR to Region II on December 18, 1980 that the short term dynamic effects on the containment vessel had not been previously evaluated for McGuire. The licensee also stated that this problem was an extension of CDR of November 3, 1980 concerning post LOCA loads on piping penetrations. DPC and EDS are evaluating the effects of the short term dynamic forces on the containment vessel and will submit a formal response by January 9, 1981.
8. (Closed) Inspector Followup Item (IFI) 369/80-33-01 and 370/80-18-01 Document Control of Design Manuals and Procedures. During inspection of this item, the inspectors found that the licensee did not have adequate measures for the control of design interfaces as required by Criterion III of 10 CFR 50 Appendix B; therefore this previously identified followup item is being upgraded to a violation and is identified as 369/80-38-04 and 370/80-20-03.

Criterion III of 10 CFR 50, Appendix B, states in part that measures shall be established for the identification and control of design interfaces and for coordination among participating design organizations and these measures shall provide for the review, approval, release, distribution and revision of documents involving design interface. Contrary to the above, the following discrepancies were identified:

- . The licensee had utilized original piping analysis loads to evaluate design and fabricate hangers/restraints for safety related piping instead of using the current reanalyzed piping loads.

- . Memoranda were being used to define and change design parameters and to add or delete requirements to procedures
- . The licensee failed to compare the current piping loads with the original loads
- . The licensee gave verbal instructions to EDS not to incorporate new loads unless the increase in loads required modification of the hanger/restraints
- . An adequate review of the effects of new loads on hanger/restraint welds and anchors was not performed. Only the effects on member stress was calculated.
- . A current list of hangers/restraints and associated loads on these components was not being kept at the site.
- . Lack of adequate design control and interfacing procedures caused problems in four areas
  - (1) Loads resulting from LOCA loads not included in calculations for bellows type cold penetration supports.
  - (2) Incorrect loads used for hanger/restraint design
  - (3) Valve discharge forces not included on Pressurizer Relief Valve Piping Supports
  - (4) Definitions of loads and use of these loads in formulas used to design the hangers/restraints were not interpreted correctly by all parties.

The licensee and EDS, Inc. have initiated corrective actions to resolve the above problems. These actions and schedule for completion were reviewed and discussed. The proposed corrective actions and completion dates appear adequate.

#### 9. Design Review Certification

The inspector reviewed current piping stress and frame analysis being performed for the McGuire project at the EDS Nuclear, Inc., San Francisco Offices. The piping stress analysis consists of a recertification review of the preliminary stress analysis performed by EDS in conjunction with the site as-built verification program. The inspector interviewed several engineers performing these analysis as well as reviewing the design inputs. The inspector reviewed the as-built certification packages listed below:

<u>System</u>	<u>As-Built Cert. Package</u>	<u>EDS Problem Number</u>
CVCS	NV Rev 3 Dtd 9/17/80	0920-202-NV-21 Rev 1
Lube Oil	LD Rev 5 Dtd 7/9/80	0920-301-LD-301 Rev 2

The following differences were noted:

- . For the CVCS systems, the design input log which is the controlled document in current revisions of drawings was not up-to-date and differed from an engineering memorandum which was being used as the input data source
- . For the lube oil system, a valve on the as-built certification package was not listed on the math model used for stress analysis. It is to be noted that an equivalent valve was used, but the documentation was not clear.
- . An additional attribute referring to the modulus of elasticity has been added to the check-list to assure this has been accounted for in the analysis. EDS agreed to provide assurance that this attribute is included in the recertification of all applicable analyses.
- . For the CVCS system, revisions of valve weight drawings were different on the Duke certification package and the As-Built Certification Package

The licensee and EDS agreed to resolve these differences, correct the appropriate documents and modify any procedures. This item is identified as unresolved item no. 50-369/80-38-05, 50-370/80-20-04 As-Built Certification Package Documentation.

#### 10. Documents Reviewed

- a. Contract between DPC and EDS, Nuclear (CN-SA-80000)
- b. Scope of work assigned to EDS
- c. DPC Procedure QA-PR-100 Revision 2 "Design Control"
- d. DPC Procedure PR-140 "Engineering Correspondence"
- e. DPC Procedure MPR-101 and EPR-101
- f. DPC QA Manual Procedure QA-601 and 602 "Vendor Evaluation" and "Vendor Surveillances"
- g. McGuire Procedure MCSR 15 dated December 4, 1980 "Support Restraint Design"
- h. Audit of EDS by CASE on April 25, 1980 and approved by DPC on June 27, 1980
- i. CASE approved audit checklist No. 710-CE-023
- j. DPC audit of EDS dated March 25, 1980 and September 20, 1979 concerning design control
- k. DPC Procedure PR-130 Revision 4, "Engineering Drawings"
- l. DPC Procedure PR-301, "Control of Drawings"
- m. DPC Procedure MPR-130 Revision 1, "Field Revision to Support/ Restraint Drawings"
- n. DPC Procedure MRP-140 Revision 2, and Form S-4A concerning responsibilities associated with Stress Analysis, As-built conditions, and review of hanger and loads.
- o. Appendix V-1 and V-2 of QA Manual which describe functional responsibilities of QA and technical personnel.
- p. EDS Pipe Support Design Memo dated December 2, 1980 and DPC design Memos to file dated November 4 & 5, 1980

- q. Various Piping Drawings
- r. EDS Interface Control Instructions, Rev. 10, dated November 17, 1980
- s. Selected EDS procedures concerning responsibilities associated with the McGuire Project
- t. EDS Project Engineer's QA Responsibilities (Guideline)