Carolina Power & Light Company

Nuclear Services Department
411 Fayetteville Street Mall - P.O. Box 1551
Raleigh, North Carolina 27602

April 15, 1992

SERIAL: NLS-92-118

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 & 50-324/LICENSE NOS. DPR-71 & DPR-62
MASONRY BLOCK WALLS

Gentlemen:

The purpose of this letter is to respond to the NRC Staff letter dated April 9, 1992 concerning masonry block walls at the Brunswick Steam Electric Plant, Units 1 and 2. The four NRC questions, along with Carolina Power & Light Company's responses, are provided in Enclosure 1 of this letter. The NRC letter asks for a response the week of April 13, 1992. The responses in the attachment represent our best efforts to respond in a short time period and, in some cases, contain information that is preliminary in nature and subject to change with continuing review.

Please refer any questions regarding this submittal to Mr. D. C. McCarthy at (919) 546-6901.

Yours very truly,

R. B. Starkey, Jr.

WRM/wrm (mwall.wpf)

Enclosure

cc: Mr. S. D. Ebneter
Mr. N. B. Le
Mr. R. L. Prevatte

A001

ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
NRC DOCKET NOS. 50-325 & 50-324
OPERATING LICENSE NOS. DPR-71 & DPR-62
MASONRY BLOCK WALLS

NRC QUESTION 1:

Describe your corrective actions and evaluation criteria used in determining the acceptability of the diesel generator building masonry walls.

CP&L RESPONSE:

An investigation was performed to verify the integrity of the individual bolts used in the masonry block walls defining the boundaries of the diesel generator cells. A 100 percent inspection was performed on the bolts used at the perimeter of the Diesel Generator Building walls, and as-built bolt location sketches were generated. A 24 percent inspection sampling was performed on the through bolts supporting the missile shields. The percentage of through bolts with identified deficiencies was not considered significant to the total number of bolts necessary to ensure the missile shield and wall act as a composite section. Therefore, the identified through bolt deficiencies are not considered significant to the seismic analysis.

The as-built perimeter bolting sketches were reviewed and ranked according to the apparent safety margins. A detailed finite elemental analysis was performed on the worst case configuration and resultant bolt reactions compared to an assumed worst case anchor installation. This analysis determined that one masonry wall lacked sufficient integrity to withstand the design basis earthquake (wall 8, south wall of Diesel Generator #4 cell). This condition required declaring Diesel Generator #4 inoperable and placing the plant in a 7 day Limiting Condition for Operation (LCO). Corrective action to restore full design basis requirements for this masonry wall involved the installation of 58 new anchor bolts. This action was completed on April 12, 1992 and Diesel Generator #4 was declared operable.

The next three most critical walls were analyzed simultaneously using finite elemental techniques. Although the installation does not conform to the licensing basis structural requirements, the walls were determined to have sufficient structural integrity to withstand the design basis earthquake and are operable. The remaining walls forming the boundary of the Diesel Generator cells all had bolting deficiencies that were bounded by the analyses performed. The schedule for permanently repairing these walls is discussed in response to Question 2.

The evaluation criteria used in all cases was seismic static acceleration using floor response spectra for the 50 foot elevation. Block wall stresses and deflections were extremely small ($\approx$ 1 ksi, $<$ .02 inches). The wall design was limited by anchor bolt capacity only, which meets a factor of safety of three (3). The details of the evaluation criteria are contained in Nuclear Engineering Department (NED) Design Guide II.20, "Civil/Structural Operability Reviews" and is included as Attachment 1 to this letter. On April 9, 1992, Dr. Ma from the NRC visited the Brunswick Plant and reviewed NED Design Guide II.20. He indicated that his review determined that NED Design Guide II.20 is satisfactory for evaluating the operability of structures.

NRC QUESTION 2:

Describe the CP&L plan and schedule for evaluating the status of other walls and equipment to assure compliance with the licensing basis. If criteria different from those in the design basis are used to determine the acceptability of masonry walls or equipment for service, please provide those criteria.

CP&L RESPONSE:

Masonry Block Walls: Carolina Power & Light Company plans to perform a 100 percent inspection of bolts installed during original construction in all remaining masonry block walls containing anchor bolts in the Diesel Generator Building as a result of the deficiencies identified to date. Inspection of the Diesel Generator Building walls is planned to be complete by April 21, 1992.

An inspection of 25 percent of anchor bolts in masonry block walls in other buildings containing safety-related equipment will also be performed. This sampling will be expanded depending on the scope and nature of any identified deficiencies. Inspections of these walls are planned to be complete by May 5, 1992.

Attachment 2 provides a listing of each wall remaining to be inspected along with a schedule for accomplishing the inspection. If any walls are determined to have bolting deficiencies, they will be evaluated in accordance with NEL Design Guide II.20. Any wall failing this criteria will be declared inoperable and appropriate Technical Specifications LCOs for affected equipment will be entered. Any wall requiring permanent repair to restore the licensing basis structural requirements will be completed at the earliest opportunity consistent with operational and ALARA concerns. Every reasonable effort will be made to complete permanent repairs during the Unit 2 maintenance outage scheduled to begin April 30, 1992 and the Unit 1 surveillance outage scheduled to begin no later than June 5, 1992. Permanent repairs will be made no later than startup from the next refueling outage for the affected unit.

Other Anchor Bolt Applications: An assessment has been performed of areas other than masonry block walls where expansion anchors have been used. Four areas have been identified as follows:

A. Piping Supports: Anchor bolts used in piping supports were previously evaluated in response to IE Bulletin 79-02 and supplements. Because of the deficiencies identified in masonry block wall anchors, CP&L management directed that an audit of IE Bulletin 79-02 be conducted to determine if fraudulent installation of piping support anchor bolts had also occurred that warranted additional anchor bolt inspections. The audit was conducted by three anchor bolt specialists from the Harris Plant and two specialists from the Brunswick Plant. The audit determined that sufficient inspection of piping support anchor bolts had been performed to reasonably identify improper installation practices. The audit concluded that no further inspections were warranted. The scope of the audit and specific results are summarized in the following paragraphs:

1. Evaluate the adequacy of Brunswick Plant Special Test Procedure (SP); SP 79-22 "Inspection and Testing Procedure for Concrete Expansion Anchors", Rev. 4.

   Special Test Procedure 79-022 was written as a procedure for testing concrete expansion anchors in place to ensure that the installed anchors employed for selected piping systems meet or exceed the anchor's design strength.

   The audit team vigorously reviewed the procedure to ensure that the technical requirements of IE Bulletin 79-02 were adequately addressed and that test methods used were appropriate to meet the technical requirements and identify improper bolt

installations. Emphasis was placed on the inspection of the anchor's physical design characteristics such as anchor embedment in concrete, anchor diameter, anchor torquing, and bolt thread engagement in the anchor sleeve. The procedure adequately covered all the important features of the anchor design and installation. Methods of measuring and testing these features (i.e., measuring rod thread engagement in sleeve, hydraulic ram tension, and testing torquing of the nut) were also acceptable. Finally, the recording of this anchor feature data was accomplished via use of data sheets. These data sheets properly recorded pertinent information for later engineering review and approval and are retained in the plant vault.

The audit team concluded that the procedure effectively conveyed appropriate instructions for the field inspectors to follow to adequately test and record anchor data. The team noted that the sampling technique and frequency were in compliance with the requirements of IE Bulletin 79-02.

2. Determine if SP 79-22 was properly implemented in the field during the IE Bulletin 79-02 pipe hanger expansion anchor walkdown inspection and if results were properly documented and stored.

After inspection and test data from SP 79-22 was evaluated, the information was sent to the plant vault for storage. The audit team reviewed, at random, many data sheets of inspection packages retained in the plant vault. The packages were arranged by system, as mandated in IE Bulletin 79-02.

As each test anchor was inspected for attributes specified in SP 79-22, the field inspector noted on data sheets the anchor rod or bolt thread engagement, the bolt diameter, type of anchor, anchor length, type of fastener, and test torque. The inspector then determined if the anchor passed all of the acceptance criteria. If not, then the anchor was failed. All anchors were then reinstalled and retorqued and attachments regrouted as needed. Attachment reinstallation was documented. Failed anchors were either replaced or determined to be acceptable as-is by analysis.

The audit teams review of inspection packages retained in the plant vault determined that field inspection and documentation were in accordance with SP 79-22.

3. Investigate the inordinately large number of self-drilling expansion anchors which were not tested under procedure SP 79-22 due to a "frozen" leveling nut or due to a "frozen" stud and determine if these anchorages represent an unsatisfactory condition or compromise the design integrity.

As the test anchors specified in SP 79-22 were being examined, inspectors soon found that a large number of anchors could not be completely examined because of a "frozen" stud or "frozen" leveling nuts. In effect, either the bolt stud or leveling nut was seized, corroded, or otherwise being held tightly such that they could not be rotated. Note: The majority of these installations involved grout attachments.

Most attachments employed the use of self-drilling anchors and had a threaded rod to clamp the attachment to the concrete surface. If the concrete was uneven, that attachment was leveled by use of leveling nuts under the attachment. The area under the attachment was then grouted. Other attachments did not require leveling so in those cases the attachment was fastened directly to the concrete surface and no leveling nuts or grout was needed.

During the inspection process under SP 79-22, the inspector was required to unscrew the threaded rod (or hex head bolt) from the anchor and determine the amount of thread engagement of the rod into the anchor. If the attachment was surface or flush mounted, then it was simply a matter of unscrewing the rod or bolt. If leveling nuts were employed, then the grout was chipped from under the attachment to break loose the leveling nut and bolt or rod from the grout. The leveling nut was then backed off from the underside of the attachment and the rod was unscrewed from the self-drilled anchor in the concrete.

Out of a total 433 anchors that were examined, 156 anchors could not be fully evaluated because the stud (rod, bolt) or leveling nut was, for unknown reason, "frozen" or seized. The audit team went through plant vault records and examined each inspection report for all 156 anchors. The following represents a breakdown of the various causes of the frozen leveling nuts and studs:

FROZEN STUDS

A total of 115 frozen studs were reported:

1) 76 These frozen studs were grouted placements that had the grout chipped away and the leveling nut was backed off. There was no indication that anything other than grout in the anchor or corrosion was the cause of seizure. No indication of fraudulent installation was evident.

2) 15 These frozen studs were grouted placements that had the grout chipped away but the inspector made no mention in his comment section that the leveling nuts had been backed off. By procedure these nuts were required to be backed off and there was no necessity to reiterate in the comment section that the nuts had indeed been backed off. The only time a comment would be mandated was when the leveling nut could not be backed off. In this case, the absence of comment holds the presupposition that the leveling nuts were backed off. With this being the case, there is no reason to believe that anything other than grout in the anchor or corrosion was the cause of the seizure. No indication of fraudulent installation was evident.

3) 14 These frozen studs (10 threaded rods and 4 hex head bolts) were surface or flush mounted attachments. No grout was placed beneath these attachments and no leveling nuts were used. The assumption in these cases is indeterminate as there was no way to be sure what the cause of the seizure was.

4) 6 These frozen studs fell under the miscellaneous category (i.e., studs were bent, interferences existing such that the studs did not have clearance to be pulled out, or no threads available above the nut for double nutting in order to turn the studs). The assumption in these cases is indeterminate as there was no opportunity to actually examine under the attachment.

5) 4 These four were actually cast-in-place anchor bolts and were incorrectly included in the test sample. These are not expansion anchors and by design will be "frozen" in place as they were placed in concrete.

FROZEN LEVELING NUTS

A total of 41 leveling nuts were reported to be frozen in place. The audit team investigated each one of these occurrences and the results are summarized below:

1) 26 These leveling nuts were in the Service Water System and were frozen due to corrosion. They were unable to be tested and were subsequently replaced under Plant Modification 79-124. There was no evidence of any other cause of the seizure other than corrosion.

2) 15 After the grout was chipped away, these leveling nuts were found to be frozen in place. The assumption in these cases is indeterminate as the inspector did not mention if the nuts were corroded.

CONCLUSION:

The audit team concluded that out of a total of 156 frozen leveling nuts and frozen studs, only 35 cases could not be rationally and indisputably explained. These 35 cases must be labelled as indeterminate in cause. There was no indication of inappropriate installation. It should be further noted that of all the records the audit team examined, there was not a single instance of inspector comment regarding tack welds or falsification of the installation. In the absence of other implicating evidence, the audit team must conclude that these 35 unexplained cases of seizure are most likely the result of grout in the anchor sleeve or corrosion.

The results of the audit are consistent with the overall inspection results associated with IE Bulletin 79-02; only 2.5 percent of the anchor tests for Unit 1 and 3.6 percent of the anchor tests for Unit 2 failed. These results indicate that anchors bolts for piping systems were properly installed with few exceptions and are not indicative of the problems encountered with masonry block wall anchor bolts.

B. Raceway supports

Fraudulent expansion anchor installation in raceway components is not considered an issue based on past experience with work associated with raceways. Portions of raceway have been disassembled/removed/replaced due to corrosion, interference removal, and plant modifications. Fraudulent anchor installation has not been observed as a problem.

To validate these observations, a sampling plan and a schedule for physically examining raceway supports will be developed by May 1, 1992 and communicated to the NRC.

C. Building Steel

Fraudulent installation of bolt anchors for building steel is not considered an issue based on previous evaluations of building steel bolting due to activities such as plant modifications, corrosion replacements, interference removal/reinstallation and other bolt evaluations. Instances of fraudulent installations have not been reported.

To validate these observations, a sampling plan and a schedule for physically examining building steel supports will be developed by May 1, 1992 and communicated to the NRC.

D. Equipment Foundations

Fraudulent installation of bolt anchors for equipment foundations is not considered an issue for the following reasons:

1. The normal installation practice associated with foundations for large pieces of equipment employs embedded anchors.

2. For small equipment, random samples of installations due to equipment decommissioning, corrosion refurbishment, and plant modification work has not resulted in any fraudulent installations being reported.

A review of representative QC records for safety-related foundation supports will be conducted to verify that inspection activities reviewed the adequacy of anchors for foundation supports. This review will be completed by May 15, 1992. If QC records cannot validate the proper installation of foundation anchors, a plan and a schedule for physically examining foundation anchors will be prepared by June 1, 1992 and communicated to the NRC.

NRC QUESTION 3:

Describe your justification for continued operation while you conduct your evaluation of the remaining masonry walls.

CP&L RESPONSE:

I. Nonconforming Condition

During NRC Inspection 92-10, CP&L determined that the inspection technique used to ascertain which bolts were installed properly in the Diesel Generator Building masonry walls was not effective. The technique of using a shim to determine the effectiveness of the installation led to non-conservative conclusions on the adequacy of several bolts. As a result, the engineering analyses previously performed assessing the operability of the walls was invalid, and the ability of the walls to maintain their functional capability was questioned.

The non-conforming walls had been evaluated for design adequacy in response to IE Bulletin 80-11, "Masonry Wall Design". A total of 85 walls were required to be reviewed under IE Bulletin 80-11. Sixty-five of the 85 walls were evaluated as acceptable as-is, and were not modified as a result of the Bulletin review.

II. Justification for Continued Operation

Adequate design margin is generally demonstrated in recent evaluations of the deficient bolting installation in the Diesel Generator Building walls. Of the 12 walls which have completed inspection to date, all but one (Diesel Generator Building wall 8) were able to be qualified for structural integrity. Diesel Generator Building wall 8, which had a significant number of improperly installed bolts, could not be short-term qualified and was permanently repaired by installing proper anchor bolts. Therefore, the evidence to date would indicate that, although construction was not in accordance with design and did not meet the licensing bases, sufficient design margin did exist to provide structural integrity with one exception.

While no absolute statement can be made that no other inadequate walls exist, the likelihood of a wall having to sustain a design basis earthquake until remaining walls can be examined is acceptably low. All remaining Diesel Generator Building masonry block walls containing anchor bolts will be examined by April 21, 1992. Based on current EPRI seismic curves, the probability of a design basis earthquake in the interim period until April 21, 1992 is 4.6E-6. All other masonry block walls containing anchor bolts will be examined as described in response to question 2 by May 5, 1992. The probability of a design basis earthquake in the interim period until May 5, 1992 is 1.4E-5.

Therefore, CP&L believes that sufficient justification exists to demonstrate that there is negligible increased risk to the health and safety of the public associated with continued operation of the Brunswick Plant, Units 1 and 2 while evaluations continue on safety-related masonry walls.

NRC QUESTION 4:

Describe the root causes of the identified deficiencies, e.g., weaknesses in contractor oversight and weaknesses in quality assurance and quality control. Also, explain why CP&L failed to identify and correct these deficiencies when the corrective actions for Bulletin 80-11 were implemented.

CP&L RESPONSE:

ROOT CAUSE:

Information recently gathered from Diesel Generator Building Civil drawings (in particular F-1929) and recent telephone conversations with previous employees of Brown & Root and United Engineers & Constructors indicate that missile protection plate and reinforcing angles were installed on the east/west walls on the 23 foot elevation in 1973 as original construction. Consistent with construction practices of the early 1970's, construction of these masonry walls was considered seismic but non-safety related and, as such, would not have required inspection installation documentation. As a result, no turnover documentation, installation records, or audit/inspection reports were found during approximately 200 hours of document searches conducted. Turnover information was found for work completed in the Diesel Generator Buildings by the Mechanical Services, Electrical, and Instrumentation organizations within Brown & Root's work force. Documentation was also available from Civil groups on concrete pours, but again, nothing concerning the installation of masonry walls was found. It is apparent from our review that QC documentation does not exist for masonry block walls.

The following were reviewed and form the basis of the above statements:

1. Computer Key Word Searches of Plant Records on the Following:

   Missile, Missile Protection, DG, DGB, Diesel Generator, Diesel Generator Building, Masonry Walls, Walls, Engineering Change Packages/DG/DGB, Field Engineering Change Packages/DG/DGB, Brown & Root to United Engineers & Constructors Field Reports.

2. Manual Searches of Document Indices:

   Engineering Change Package, Field Engineering Change Packages, Brown & Root to United Engineers & Constructors Field Reports, Turnovers by system, Quality Assurance inspection reports

3. Brown and Root Quality Assurance Procedures

4. Diesel Generator Building Turnover Packages

5. As-built Drawing Turnover Letters from United Engineers & Constructors

6. Brunswick Civil Drawings:

   F-1926
   F-1927
   F-1928
   F-1929
   F-1301
   D-1645, sheets 1, 2, & 3
   F-1643
   F-1663
   F-1664
   F-1665
   FSC-533

7. Final Safety Analysis Report

8. Specification for Masonry and Caulking 9527-01-29-1

9. Safety Evaluation Report Brunswick 1 and 2, November 1973

IE BULLETIN 80-11:

The focus of the IE Bulletin 80-11 was the design adequacy of masonry block walls to support safety-related attached components and to remain intact for postulated design basis loads. An engineering review determined that the walls would have structural integrity assuming the installation was as designed. Some walls did not meet code allowable stresses and required modification. A field walkdown was performed to visually verify that design features, such as cover brackets, through bolts, and steel plates, existed. CP&L did not question the adequacy of installation of design features, only whether the appropriate design features were present. Further, IE Bulletin 80-11 did not require anchor bolt testing or verification as was required by IE Bulletin 79-02 for pipe supports. Therefore, the scope of IE Bulletin 80-11 would not have resulted in the identification of deficient or fraudulent bolting installation. Carolina Power & Light Company inspections, evaluations, and repairs of masonry block walls were in accordance with the scope of IE Bulletin 80-11, as indicated by our letters dated July 7, 1980, November 5, 1980, November 25, 1980, December 9, 1980, July 29, 1983 and April 27, 1984.

ADDITIONAL NRC REQUEST

On April 13, 1992, the NRC verbally requested that this response include a discussion of events occurring since the initial identification of bolting issues associated with Diesel Generator Building masonry block walls. Due to the lateness of this request, there was insufficient time to prepare and validate this information. This item will be discussed in response to a potential violation resulting from NRC Inspection 92-10.

ATTACHMENT 1

DESIGN GUIDE NUMBER DG-II.20
DESIGN GUIDE FOR
CIVIL/STRUCTURAL OPERABILITY REVIEWS

CAROLINA POWER & LIGHT COMPANY

NUCLEAR ENGINEERING DEPARTMENT

DESIGN GUIDE FOR

CIVIL/STRUCTURAL OPERABILITY REVIEWS

DESIGN GUIDE NUMBER DG-II.20

REVISION	SUBMITTED	APPROVED
1	7/11/90	
2	3/14/92	

(1033DG92.GEN/che)

NED CONTROL COPY #

LIST OF EFFECTIVE PAGES

Page	Revision
II.20-1	0
II.20-2	2
II.20-3	2
II.20-4	1
II.20-5	1
II.20-6	0
II.20-7	0
II.20-8	1
II.20-9	2
II.20-10	2

TABLE OF CONTENTS

I. INTRODUCTION

A. Purpose

The purpose of this design guide is to establish technical criteria to be followed by Civil Discipline personnel when performing operability/reportability reviews for HNP, BNP, and RNP. These reviews/analyses relate strictly to the structural aspects of structure/component/piping as related to post-seismic operability inclusive of all other loading conditions.

B. Applicability

This guidance is applicable to all Civil Discipline personnel (direct and contract) involved in nuclear plant structure/component/piping operability reviews.

Deviations from this design guide shall be with the approval of the Principal Engineer only. It is the responsibility of the Responsible Engineer to inform the Project and Principal Engineers of deviations existing in any submitted calculation. Deviation approval shall be deemed the approval of the calculation by the Principal Engineer. In addition, any deviation which occurs consistently shall be brought to the attention of the Discipline Manager for resolution.

II. GENERAL

A. References

1. NED Guideline E-28
2. 10CFR50.72
3. BNP OI-04, OI-4.1
4. RNP Memorandum RNPD/89-3551, 10/25/89 (Contained in E-28)

B. Responsibilities

Lead Engineer	Perform appropriate evaluations as directed by the Principal Engineer.
Principal Engineer (Lead Section)	Ensure evaluation is performed in accordance with plant guidance and this document.
Discipline Manager (Civil)	Concurrence with operability/reportability evaluations. Assists in informing plant of conditions per E-28.

C. General Design Criteria

Issues which are identified either by plant personnel or internally through the design process may require operability review if the condition is considered to deviate from the analyzed design basis. A determination whether operability review is required per 10CFR50.72 will be the joint decision of plant management and NED and should consider such factors as:

- Plant condition at the time the issue is found.
- Whether the issue is covered by other Tech Spec contingencies.
- Required condition of the system in question.

When notified that an operability review is required, the time frame in which the review must be done and the notification process shall be per E-28 (i.e., administrative activities). This design guide establishes technical criteria to be followed in the course of the evaluation consistent with requirements specified in NRC Generic Letter 91-18.

III. PRACTICE

The evaluation to determine the status of an existing civil field condition which does not comply with design will consist of three stages: acceptability, operability, and reportability.

A. Acceptability

Once the issue is defined and the review has begun, the first cut to be reviewed is whether or not the condition is acceptable 'as-is' with no modification. This is defined as meeting:

- All applicable code allowable stresses (AISC, ACI, AWS, Piping Codes).
- Expansion anchor Factor of Safety of 4 or 5 as required.
- Use of committed damping ratio.
- FSAR and technical specification commitments.
- Utilizing accepted industry practice for analysis.

If the condition meets the acceptability criteria, the analysis may be stopped, documented by standard calculation, and the plant verbally notified.

If the condition does not meet acceptability criteria, based on the issue and upon management concurrence, generate a Design Deficiency Report per 3.18 and proceed to the operability review.

B. Operability

Civil/structural operability is defined as the ability of a structure/component to remain elastic and perform its design function without permanent deformation or detrimental effect on adjacent safety-related components/structures.

This evaluation may be accomplished in either of two ways:

- Specific analysis or testing using acceptance limits established in this guideline. This method may be used in all cases.
- A review and approval of an established "Senior Structural Review Panel." This method may only be used with the concurrence of the Civil Discipline Manager or designee.

1. Specific Analysis:

The component/structure in question may be considered operable based on specific computer or hand calculations provided the following conditions are satisfied:

- The following material stress limits are not exceeded:
  Tensile Stress = $.9F_y$*

* Special consideration required for pin-connected members and threaded parts.

  Shear Stress = $.6F_y$*
  Bending Stress = $1.5F_b \leq .9F_y$
  Compressive Stress = $1.5F_a \leq .9F_y$
  Weld Stress = $.45F_u$

- Factor of safety for expansion anchors is greater than 2. For embedded plate Nelson studs, factor of safety > 1.4 against concrete ultimate capacity.
- Damping ratios increased based on increased stress levels or test data.
- No visible signs of permanent component/structure deformation are introduced resulting in questionable component/structure performance.
- No excessive deflections are introduced resulting in spatial interaction with adjacent safety-related components/structures.

The piping in question may be considered operable provided the following conditions are satisfied:

- The primary material stresses do not exceed the higher value of $.9S_y$, $2.4S_h$, or $3S_m$ (Appendix F criteria).
- Secondary load,s have been considered in the support design.
- No excessive deflections are introduced resulting in spatial interaction with adjacent safety-related components/structures.

NOTE: Other evaluation conditions may be imposed at the discretion of the Civil Discipline Manager. In lieu of analysis, a test (static or dynamic) may be used and the component deemed operable if the test shows it can meet its intended function following a seismic event.

2. Structural Review Panel:

This method of evaluation of operability concerns is to be used only with the concurrence of the Civil Discipline Manager or his designee. Considerations to be addressed when using this method include:

- Complexity of problem being evaluated.
- Similarity of the problem with other designs or evaluation.
- Availability of industry data directly relating to the issue.
- Experience of engineers involved with related issues.

The purpose of the structural review method of operability determination is to utilize engineering judgement, experience, and evaluation of only those quality attributes critical to the ability of the structure to function to its design requirements post-earthquake. It will be used as an interim measure only, not as method to determine long-term acceptability.

The method consists of two primary parts:

a) System Walkdown:

The system whose operability is in question will be walked down and reviewed by two experienced structural engineers. These engineers shall have a minimum five years of nuclear structural experience. The walkdown shall review and identify critical areas of potential failure and gather enough field data for an evaluation. Examples of critical attributes include seismic anchor movements or spatial interactions. The appropriate Project or Principal Engineer will outline to the Walkdown Team critical attributes which must be considered but will not limit the Team's judgement.

b) Evaluation and Approval:

The evaluation of system structural operability will consist of enough information to convey the logic used to determine that the system will function post-earthquake. This could be a

simple write-up of the conditions considered with simplified calculations on critical attributes. This evaluation will be signed by both Walkdown Team members. The minimum approval of the evaluation will be three Civil Discipline supervisory personnel to include the Civil Discipline Manager.

Upon approval of structural operability using either of these methods, it is the Project Engineer's responsibility to ensure steps are taken to document the evaluation in accordance with NED Guideline E-4 utilizing the Operability Review Approval Sheet (Attachment B). Also, the Project Engineer shall be responsible for scheduling plant activities to restore the condition to long-term acceptable status as soon as possible. This time frame is normally within one refueling outage.

If the condition does not meet the operability criteria, the following steps should be taken:

- The Civil Discipline Manager should be notified for concurrence with the evaluation.
- Provisions of E-28 should be invoked to notify the plant to determine responsibility for performing JCO (Justification for Continued Operation).
- Work with the plant to determine if fixes can be made within system LCO (Limited Condition of Operation) window per Tech Specs.
- Work with other NED discipline personnel to determine if component is necessary for safe shutdown (i.e., Mechanical, Electrical personnel may determine the component need not operate post-earthquake).
- Document operability calculation in accordance with NED Guideline E-4 utilizing the Operability Review Approval Sheet (Attachment B).

NOTE: The criteria contained herein is for general conditions. Specific criteria cited for specific conditions will supersede this document.

C. Reportability

Reportability calls to the NRC per Tech Spec guidance and 10CFR50.72 is the responsibility of the plant. For Civil/Stress/Structural items, the plant will request assistance in determining reportability once an item is determined to be inoperable. Various plant procedures are involved, however, a typical situation

put the plant in a condition it could potentially not shut down safely post-earthquake. Criteria to perform reportability evaluations for Civil are as follows:

- Advanced evaluation techniques, such as plastic analysis may be used to determine the actual mode of failure of the component.

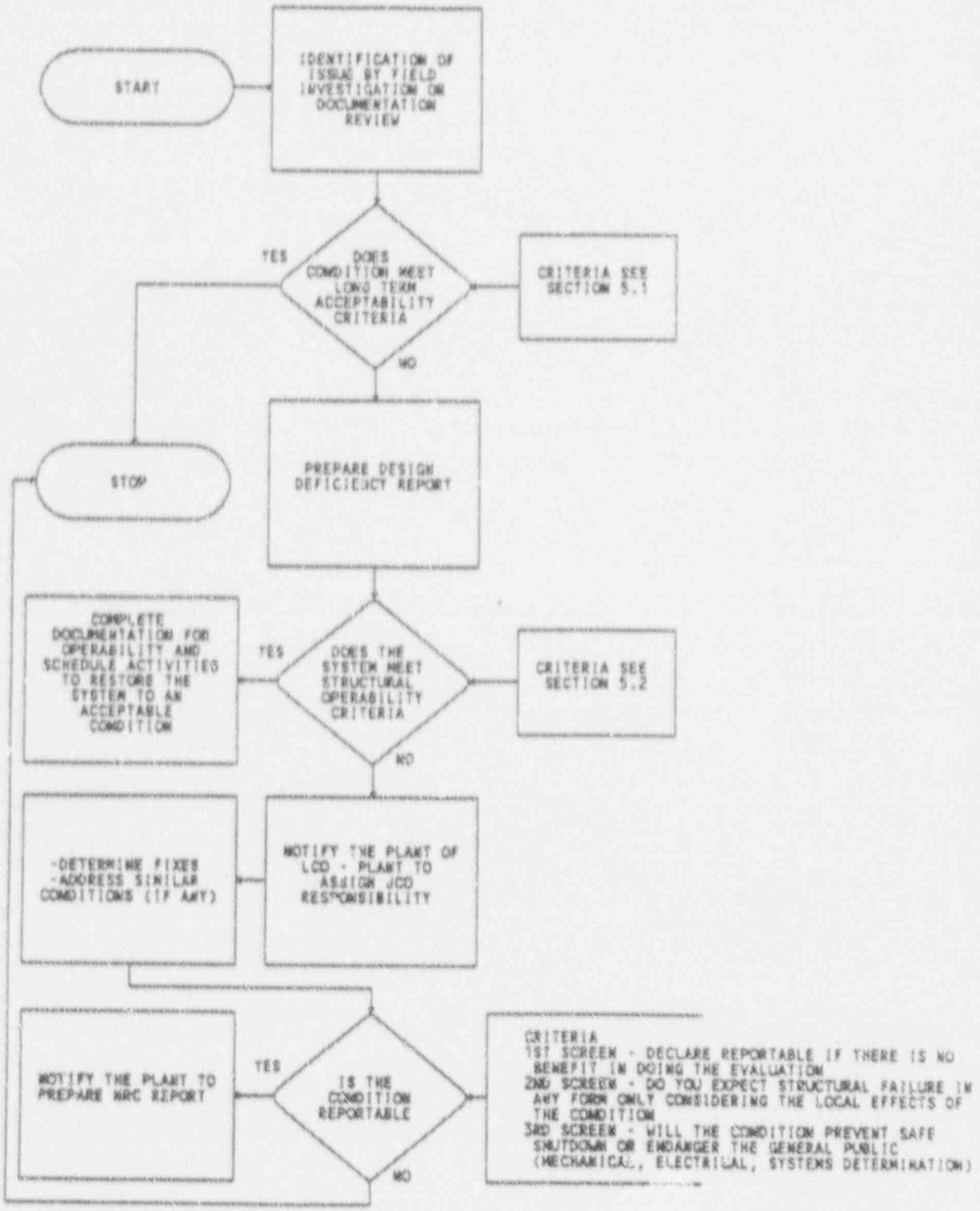
- Testing may be used on the component as a whole or critical parts.

Additional criteria may be imposed by the Civil Principal Engineer or Civil Discipline Manager as conditions warrant.

Results of the evaluation should be able to determine if actual gross structural failure of the component is expected and if that failure would put the plant in a condition in which it could not safely shut down. The reportability evaluation documentation should include cause, corrective actions required, and address any similar plant conditions.

ATTACHMENT A

PROCEDURE TO EVALUATE OPERABILITY OF SYSTEMS OTHER THAN PIPING



ATTACHMENT B

CAROLINA POWER & LIGHT COMPANY

OPERABILITY REVIEW FOR

_____
(Plant)

_____
(System)

EVALUATION ID NUMBER: _____

SAFETY CLASSIFICATION: _____

SEISMIC CLASSIFICATION: _____

METHOD OF EVALUATION UTILIZED: METHOD 1: SPECIFIC ANALYSIS/TESTING

METHOD 2: SENIOR STRUCTURAL REVIEW PANEL

WALKDOWN TEAM:

_____

_____

APPROVALS: (Method 2 Only)

Rev.	By	Checked	Project Engineer	Approved Principal Eng.	Discipline Manager

APPENDIX C

ASME APPENDIX F EVALUATION

The following evaluation compares the NED Design Guide II.20, SDG7, and M20 to two editions of ASME Appendix F. Both pipe and pipe support criteria are compared. Note that ASME Appendix F is for pressure boundary only and does not assure operability of components. This is due to large deflections allowed by the analysis. This should be considered if operable valves are in the vicinity of high stress areas. The following is a comparison of the major stress limits, but is not inclusive for all restrictions. Refer to the particular document being used as the acceptance criteria prior to using stress limits shown below to determine applicability. Also note that the stress limits for piping are given in terms of stress intensity for Class 1 analysis and not stress categories for Class 2/3 pipe. This results in significantly different allowable limits and different stress multipliers (stress indices vs. stress intensifiers) when using the rules of Appendix F.

In summary, the stress limits that have been used for normal STSI evaluations for BNP are more conservative than those provided in Appendix F. For example, straight pipe stress limit is 54ksi in Appendix F vs 36ksi NED II.20 allowable. Structural pipe support in tension is 1.2 Fy in Appendix F vs .9 Fy in NED II.20. The length of time that a component found to be qualified only to some interim criteria would reinforce the continued use of existing interim allowables as given in II.20. My recommendation is that the Appendix F allowables would more closely fit our current practice as criteria for reportability determinations.

APPENDIX C

	NED II.20	SDG-7/M-20	APP. F 1977	APP. F 1986		
Stress Category						
Primary Stress Pipe; see Note 1	Higher of 2.4 Sh or .9 Sy	2.4 Sh	3.0 Sm, P < 2P design	Lesser of 3.0 Sm or 2 Sy		
Allowable Stress, Component Standard Suppo	ft < .9 Fy fs < .6 Fy	ft < Fy fs < .625 Fy or NF faulted limits	NF App XVII limits* iesser of 1.2* Sy/Ft or .7 Su/Ft Approx 1.9 for A36	NF 3320 limits* lesser of 2 or 1.167*Su/Sy Approx 1.9 for A36		
Note 1: Only pressure boundary integrity is evaluated; component operability is not assured.						

ATTACHMENT 2

SEISMIC BLOCK WALL INSPECTION SCHEDULE
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

SEISMIC BLOCK WALL INSPECTIONS