ORGANIZATION: NUCLEAR ENERGY SERVICES
DANBURY, CONNECTICUT

REPORT NO.: 99900762/85-01	INSPECTION DATE(S): 9/16-19/85	INSPECTION ON-SITE HOURS: 66

CORRESPONDENCE ADDRESS: Nuclear Energy Services
ATTN: W. J. Manion, President
Shelter Rock Road
Danbury, Connecticut 06810

ORGANIZATIONAL CONTACT: C. E. Anderson, Quality Assurance Manager
TELEPHONE NUMBER: (203) 796-5225

PRINCIPAL PRODUCT: Engineering Services for the Nuclear Power Industry

NUCLEAR INDUSTRY ACTIVITY: 100% of NES' activities

ASSIGNED INSPECTOR: R P Correia — 11-6-85
R. P. Correia, Special Projects Inspection Section (SPIS) — Date

OTHER INSPECTOR(S): R. P. McIntyre, SPIS
A. V. DuBouchet, Consultant

APPROVED BY: John W Craig — 12/6/85
John W. Craig, Chief, SPIS, Vendor Program Branch — Date

INSPECTION BASES AND SCOPE:

A. BASES: 10 CFR Part 21, 10 CFR Part 50, Appendix B

B. SCOPE: The inspection consisted of an evaluation of quality assurance and engineering activities related to the design, procurement, manufacturing, testing and installation of steam generator nozzle dams for Ft. Calhoun.

PLANT SITE APPLICABILITY: Ft. Calhoun (50-285)

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A. Violations

Contrary to the requirements of 10 CFR Part 21, Section 21.31, NES did not specify on purchase order No. N57605 that the provisions of 10 CFR Part 21 apply to Reno Machining Company who were to procure material to be used for fabricating clamps used in the steam generator nozzle dam assemblies. (85-01-01)

B. Nonconformances

1. Contrary to 10 CFR Part 50, Appendix B, Criterion III, NES design calculation for the steam generator nozzle dam assembly did not encompass all aspects of the following: a) materials selection and suitability, b) diaphram/seal sub-assembly stress analysis, c) all possible loading conditions (hydraulic, pneumatic, and seismic), d) the correct subsection of the ASME III code per contractural commitments, and e) consideration for dimensional tolerances. (85-01-02)

2. Contrary to 10 CFR Part 50, Appendix B, criterion XVI, NES Document No. 80A9010 "Computer Code Documentation Control Procedure" did not have provisions for handling computer code error reports. Computer code error reports received from vendors supplying computer code services were not promptly identified and corrective action to assure that conditions adverse to quality for past and present safety related components were not determined, documented and reported to appropriate levels of management. (85-01-03)

3. Contrary to 10 CFR Part 50, Appendix B, Criterion XVIII, NES had used Control Data Corporation's (CDC) services for computer codes used for safety related component analyses and had failed to comply with criteria in the aforementioned section of Appendix B by: (85-01-04)

   a) NES had not performed an audit of CDC to verify it's compliance with all aspects of the quality assurance program.

   b) NES did not have a planned audit of CDC scheduled.

   c) CDC was not on the NES approved vendor's list (dated 9-16-85)

C. Unresolved Items

1. Based upon observations made during steam generator nozzle dam testing, questions were raised concerning the adequacy of test equipment, procedure and classification of hardware. (85-01-05)

D. Status of Previous Inspection Findings

There were no findings on the previous inspection.

E. Other Findings or Comments

1. Documentation Review

The NRC Inspectors reviewed the following purchase orders used to procure services and materials for the steam generator nozzle dam assemblies:

P.O. No.	From	To	For	Date
7234	OPPD	NES	Steam Generator Nozzle Dams	05/16/85
7234 (sup. #1)	OPPD	NES	Steam Generator Nozzle Dams	07/15/85
7234 (sup. #2)	OPPD	NES	Steam Generator Nozzle Dams	08/12/85
N 51646	QualCorp (NES)	Presray Corp	Diaphram Assemblies	06/26/85
N 51624	QualCorp (NES)	Quality Castings	Dam Castings	06/03/85
N 57605	QualCorp (NES)	RENO Mach. Co.	Fabrication of Dams	09/05/85

The NRC Inspectors noted that the applicability of 10 CFR Part 21 was not indicated on OPPD's P.O. No. 7234 and supplements No. 1 & No. 2. However, P.O. No. 7234, supplement No. 2, page 2 of 2 did state in part, "This material/service is nuclear safety related..." NES P.O.'s N 51646 and N 51626 did indicate the applicability of 10 CFR Part 21 to the Presray Corporation for the diaphram

assemblies and the Quality Castings for the dam castings. NES P.O. N 57605 to Reno Machining Company for the fabrication of clamp assemblies and the machining of the dam castings did not specify the applicability of 10 CFR Part 21. This same purchase order did specify that material certifications for material procured by Reno Machining Company would be required.

One violation, 85-01-01, was identified in this area of the inspection.

Design basis documentation used for the stress analysis of the steam generator nozzle dams was reviewed. OPPD's contract No. 1453, Section H, dated March 12, 1985, and NES technical proposal 8560-103, section 2.4, dated April 1985, required that a stress analysis be performed in accordance with the guidelines of section III, NB Class 1 of the ASME Boiler and Pressure Vessel Code. The NES calculation, "The structural design calcs for Fort Calhoun dams," project 5273, task 140, dated June 3, 1985, referenced ASME section III, NF, 1983 with addenda. Subsection NF addresses component supports, however the steam generator nozzle dams act as a reactor coolant system pressure boundary element governed by subsection NB of the ASME code.

The calculation did not address the acceptability of the aluminum/stainless steel interface between the aluminum clamps and the stainless steel bolts used to restrain the dam. The clamp analysis also did not determine the maximum stresses of the bolt hole threads but rather calculated the allowable load. OPPD contract No. 1453 specified that maximum stress and minimum safety margin would be indicated. Also, the load imposed by the bolt, which is to be torqued during installation of the dam, was not addressed in the clamp analysis. The aluminum clamp body, detailed on page 7 of the calculation, depicts a curved shape design. However, the analysis employed a straight beam theory and no consideration was given to the effects of holes and shape factors in the stresses in the clamp.

The NES stress analysis of the dam assembly castings was performed by evaluating portions of a cross section as independent structural elements rather than as a whole, integral piece. Only the loading imposed by the hydrostatic pressure was used to determine the local bending effects on the casting. The loads imposed by the seal pressure and the clamping forces, the fabrication tolerance for the casting thickness and the complex stresses in the casting flange were not addressed in the analysis.

The calculation also failed to include a statement of the method used for the analysis, an evaluation of the materials selection and suitability, any analysis of the diaphram/seal assembly portions of the dams, and seismic loading conditions. During the inspection, NES committed to perform a complete, three-dimensional computer stress analysis of the nozzle dam and to include in the calculation all items noted as deficiencies above.

Nonconformance 85-01-02 was identified in this area of the inspection.

2. Computer Code Error Handling Procedures

The NRC inspector reviewed Document No. 80A9010, "Computer Code Documentation Control Procedure," and found that no procedures exist for the handling of computer code errors received from computer service bureaus such as Control Data Corporation (CDC) or for reported errors on internally developed computer codes.

The original NES service contract with CDC did not impose the requirements of 10 CFR Part 21 on CDC. On July 10, 1984, NES requested CDC to amend their contract to include the provisions of 10 CFR Part 21 and Part 50, Appendix B and to send notification of all errors reported for four specified computer codes; ANSYS, STARDYNE, PIPESD, and UNIPLOT. CDC accepted the NES proposed amendment by letter on October 3, 1984.

On October 18, 1984, NES received a complete list of all error reports known, to date, for the specified codes. Up to this point, NES had received only a limited number of error reports from CDC. NES is in the process of revising the Computer Code Documentation Control Procedure to include procedures for the handling of computer code errors and are also reviewing computer code error reports received from CDC for their impact on past and present safety-related design analyses. This review is scheduled to be completed September 30, 1985.

The NRC inspectors reviewed the NES Approved Vendors List and noted that CDC was not on the list. It was further determined that NES has not performed any audits of CDC in the past nor was an audit scheduled for the near future. During the inspection, NES' QA Manager committed to plan and perform a quality assurance audit of Control Data Corporation (CDC).

Nonconformances 85-01-03 and 85-01-04 were identified in this area of the inspection.

3. Other Information

The NRC inspectors toured the Reno Machining Company of Newington, Connecticut with representatives of NES on September 19, 1981, to observe current activities on the machining of nozzle dam components and the general operation of the facility. The inspectors observed several machining operations including the milling of the steam generator nozzle dam clamps. Reno Machining Company makes extensive use of numerical control machine tools and has an in house computer department in which programs are used to generate control tapes which direct the machining processes. The inspection and calibration area was visited to observe calibration equipment, records and the general layout. Additionally, an interview with the quality control manager was also conducted to discuss Reno's quality assurance and control program and commitments.

The NRC inspector observed testing of the steam generator nozzle dam assembly conducted at the Reno Machining Company on October 3, 1985.

A 32 in. diameter steam generator nozzle dam assembly for the Ft. Calhoun Station and a control console were prepared for testing as part of the contract between Omaha Public Power District and NES. The dam assembly was mounted to a test fixture which was fabricated to simulate the steam generator nozzle. It was then connected to the control console which is used to control and monitor air supplies to the inflatable seals annulus components of the nozzle dam diaphram assembly. The seals were then inflated to 60 psig and maintained at that pressure for approximately 20 minutes without any leakage detected. The test fixture was then filled with water, vented, and pressurized to approximately 15 psig and held at that pressure for 20 minutes, again without any leakage detected. The hydrostatic pressure was then increased to the maximum required test pressure, 25 psig, held at that pressure for 20 minutes and no leakage was detected.

As a means of determining the adequacy of the redundancy of the sealing system, the wet seal (i.e., seal in first line contact with the water) was deflated. A leak was detected: the air

supply connection for the annulus section of the diaphram did not maintain its bond and water leaked through the diaphram, filled the space between the diaphram and the aluminum dam support segments and subsequently leaked through the seams between the aluminum dam support segments. As a matter of course, the secondary or dry seal was deflated to determine the integrity of the passive seal or the portion of the diaphram which is compressed between the nozzle and the aluminum dam support assembly. Because of the aforementioned leak of the air supply connection, it was difficult to determine visually if the passive seal did in fact not leak. This concluded the testing of the 32 in. nozzle dam assembly.

NES decided that all diaphrams for both the 32 in. and 24 in. nozzle dams would be returned to the manufacturer Presray Corp., for revulcanizing and that a retest of all dam assemblies would be performed.

The following items were noted during the nozzle dam test:

1) When the 32 in. dam assembly was mounted to the test fixture, three people performed all necessary procedures and no timing of the mounting was recorded. The actual assembly of the dam inside the steam generators at Fort Calhoun will be performed by one (1) person and must be completed in eight (8) minutes or less.

2) The control used to control and monitor the nozzle dam test did not have its gages calibrated.

3) The air supply lines, connectors, check valves and clamps were purchased by NES as commercial grade. Also, the control console assembly (gages, instrumentation, hardware etc.) was considered non-safety-related. No documentation for the selection and use of these items was available.

Based on the above, the test procedure, monitoring and regulating equipment and the commercial grade hardware used on the nozzle dam assembly do not appear to meet the requirements of the Quality Assurance Criteria of 10 CFR Part 50, Appendix B for a safety-related component.

Unresolved item 85-01-05 was identified in this area.

F. Persons Contacted

Louis J. Zezza, Mgr. Des/Eng., Eng. Prods, NES
Craig E. Anderson, Quality Assurance Mgr., NES
W. J. Manion, President of NES,
Mary-Ellen Alling, Quality Assurance Engineer, NES
H. J. Larson, Sr. VP, NES
Mark Weiner, Project Manager, NES
George Hamilton, Sr. VP, NES
Louis J. Barbieri, Sr. QA Engr., NES
J. Shah, Engineer, NES
R. D. Stefano, Mgr. OPS. Eng., NES
T. Kettler, Systems Eng., NES
Jack Atashian, Q.C.M., Reno Machine Co., Inc.
Mark Occhialini, Production Manager, Reno Machine Co., Inc.
Arnold Gundersen, VP Engineering, NES
Albert Uziel, Gen. Mgr. Eng'd ProD's, NES

G. Documents Examined

1. Q. A. Manual, No. 80A9002, Rev. 7, dated 11/23/83, NES Division/Engr. Operations/QA Manual.

2. Procedure No. 80A9007, Rev. 7, 06/15/82, NES Procurement Control Procedure.

3. Procedure No. 80A9010, Rev. 3, dated 12/01/83, Computer Code Documentation Control PROC.

4. Procedure No. 80A9022, Rev. 8, dated 08/02/84, QA Audit Procedure.

5. Procedure No. 80A9004, Rev. 5, dated 12/01/83, Calculation Notebook Procedure.

6. P.O. No. N 51646, dated 06/26/85, for diaphram assemblies/NES to Presray Corp/Pawling, NY.

7. P.O. No. N 57605, dated 09/05/85, to fabricate & deliver S.G. nozzle dams/NES to Reno Machining Co./Newington, CT.

8. P.O. N 51624, dated 06/03/85, to fabricate S.G.Nozzle Dams castings/NES to Quality Castings/Greensboro, NC.

9. P.O. 7234, dated 05/16/85, steam gen nozzle dams and mock up for Ft. Calhoun/Omaha Public Power District (OPPD) to NES.

10. Letter, MSM-809, dated 05/30/85, NES to OPPD/Acceptance of order from OPPD for SG nozzle dams.

11. List, NQA-1923, Rev. 2, dated 09/16/85, Approved Vendors List for category 1 & 2.

12. Report, QAA-320, dated 06/07/85, Audit report/vendors survey of Quality Castings.

13. Internal Memo, GES-2246, 09/16/85, Computer code error report handling meeting.

14. Letter, GES-2131, dated 07/10/85, NES to CDC for the modification of services contract to assure NES receives errors for safety related codes.

15. Internal Memo, 85-7, dated 04/29/85, meeting minutes on computer code error handling.

16. Letter, EO-144110-VI, dated 10/03/84, CDC to NES for the amendment to CDC agreement for addition of 10 CFR 50 Appendix B & 10 CFR Part 21.

17. LOG, computer code usage log of Ansys, Stardyen and Uniplot.

18. Report, dated 08/01/85, CDC to NES software problem report for Ansys errors.

19. List, dated 07/30/85, Administrative Procedures.

20. Contract P.O./SPEC, No. 1453, dated 03/12/85, OPPD contract 1453.

21. Specification No. 8560-103, dated 04/85, NES proposal to the OPPD for the supply...for Ft. Calhoun station contract No. 1453.

22. Specification No. 80A9503, Rev.1, 07/09/81, General Specification For The Fabrication of Safety-Related Special Tools and Equipment For Nuclear Applications.

23. Q.C. Manual, dated 06/07/83, Q.C. manual for the Reno Machine Co., Inc.

24. Q.A.Manual, QAM-2, Rev. D, dated 05/15/84, Presray QAM.

25. NES DWG 83E2364,5, noz. dam. diaphram details & ass'y.

26. Design calculation for Ft. Calhoun st. gen. nozzle dams, project 5273, task 140.

27. Code, dated 07/01/83, sect.III Rules for Construction of Nuclear Power Plant Components, Division 1-sub.-sec. NB, Class 1 components.

28. Catalog, 1/85-SM, dated 1985, Presray-seal catalog.

29. Catalog, 1979 cat'l, Presray-seal.