

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-397/82-13
Docket No. 50-397 License No. CPPR-93 Safeguards Group _____

Licensee: Washington Public Power Supply System
P. O. Box 968
Richland Washington 99352

Facility Name: Washington Nuclear Project No. 2 (WNP-2)-

Inspection at: WNP-2 Site, Benton County, Washington and
Burns and Roe Office, Woodbury, New York

Inspection conducted: May 17-21 and June 7-11, 1982

Inspectors: *A. J. D'Angelo* 10-18-82
A. J. D'Angelo, Reactor Inspector Date Signed

R. T. Dodds 10/19/82
R. T. Dodds, Chief, Reactor Projects Section I Date Signed

Approved by: *R. T. Dodds* 10/19/82
R. T. Dodds, Chief, Reactor Projects Section 1, Date Signed
Reactor Projects Branch No. 1

Date Signed

Summary: Inspection during the period of May 17-21 and June 7-11, 1982
(Report No. 50-397/82-13)

Areas Inspected: Routine, announced inspection by regional based inspector and section chief of activities associated with design control and verification. The inspection activities involved 86 inspector-hours onsite by two NRC inspectors.

Results: No items of noncompliance or deviation were identified.

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used in ASME Classes I, II and III service, and Class I is now down rated by the manufacture, should Class II and III be down rated?

This item remains open pending the determination of adequacy on ASME Class II and III load data sheets.

7. Exit Interview

At the conclusion of the inspection, the scope and findings were discussed with the licensee representatives identified in paragraph 1 of this report.

1. Persons Contacted

The inspectors interviewed various engineering and management personnel of the organizations listed below. Key personnel, including those who attended the exit interview, are specifically identified below:

a. Washington Public Power Supply System (WPPSS)

- +*L. C. Floyd, Quality Assurance Engineer
- +*P. Harness, Project Engineering
- +R. T. Johnson, Project Quality Assurance Manager
- +C. S. Carlisle, Deputy Project Manager
- +R. B. Glasscock, Director of Quality Assurance
- +R. Nelson, Project Licensing Engineer
- +D. C. Timmins, Technical Specialist

b. Burns and Roe Inc. (BRI)

- *M. Zizza, Vice President, Engineering and Design
- *J. J. Verderber, Project Engineering Manager
- *H. R. Canter, Vice President, Project Operations
- *R. Snaith, Senior Project Engineer
- *D. J. McCormick, Manager, Corporate Quality Assurance
- *F. J. Patti, Chief, Nuclear Engineer
- *J. H. Blas, Engineering Quality Assurance Manager
- *F. Hess, Senior Nuclear Engineer
- *M. Kushner, Senior Nuclear Engineer
- *C. Chung, Stress Analysis Supervisor
- *S. Flanyenbaum, Senior Stress Analysis
- *R. Rockford, Senior Heating and Ventilation Engineer
- *J. A. Forrest, Project Director
- +H. R. Tuthill, Engineering Quality Assurance Manager
- +J. A. Ogawa, Engineering
- +W. G. Conn, Engineering
- +A. T. Luksie, Licensing

+Denotes those attending the exit interview onsite on May 21, 1982.

*Denotes those attending the exit interview in the Burns and Roe Woodbury office on June 11, 1982.

2. Introduction

During a previous NRC inspection (IE Inspection Report No. 50-397/81-03), the inspector had identified design verification problems with Burns and Roe (BRI), the A/E and other contractors performing design activities for WNP-2. The problems center on the issues of whether BRI and any other contractor involved in design were performing design verification in compliance with all applicable regulatory requirements imposed on WNP-2, including whether documentation was available to support the design verification efforts that had been performed.

The purpose of this inspection was to determine the following:

- a. The regulatory requirement and industry standards the WNP-2 facility is committed too.
- b. The method of checking or verification used by BRI and other contractors performing design activities.
- c. Documentation that exists to support checking or verification performed.
- d. Whether identified design related problems, discovered after the design had been finalized and approved, indicate that a insufficient design check/verification had been performed.

3. Requirement for Design Control

a. Industry Standard

Amendment No. 23 of WNP-2 FSAR states the WNP-2 position on Regulatory Guide 1.64 (which endorses ANSI N45.2.11) titled "Quality Assurance Requirements for the Design of Nuclear Power Plants." The FSAR states that "Regulatory Guide 1.64, Revision 0, Revision 1, and Revision 2 do not apply to WNP-2 since they apply to construction permits docketed after September 1973." The WNP-2 construction permit date of issuance is March 19, 1973, and therefore ANSI N45.2.11, "Quality Assurance Requirements for the Design of Nuclear Power Plants", was not committed to by WNP-2.

b. Regulatory Requirement

10 CFR 50, Appendix B, is required by the provisions of 10 CFR 50.34 and contains specific requirements which relate to design control. Specific measures imposed by Appendix B are that checking or verifying the adequacy of design, such as by the performance of designs reviews, alternate or simplified calculational, or testing be performed.

c. Discussion of Requirements

The industry standard ANSI N45.2.11 and Appendix B contain, for the most part, the same words and both require that measures be applied to verify the adequacy of design. The ANSI standard, however, requires that 19 "basic questions" be addressed and then documented to remain as auditable evidence that design verification was performed. It is apparent that the 19 basic questions are only a requirement of the ANSI standard and not Appendix B, but checking or verifying the design must still be performed as required by Appendix B and remain auditable.

4. Design Verification Review

a. Previous NRC Review

Three NRC Inspections (IE Inspection Report Nos. 50-397/81-03, 81-17, and 82-06) were performed and identified problems with the Burns and Roe Drawing Control Log (DCL) and compliance with ANSI N45.2.11. In the previous amendment of the WNP-2 FSAR, Appendix C.3 specified that WNP-2 complies with the guidance set forth in Revision 0 of Regulatory Guide 1.64, which endorses ANSI N45.2.11.

Until Amendment No. 23 of the WNP-2 FSAR, it was not clear that WNP-2 had taken exception to Regulatory Guide 1.64 and, therefore, all previous inspection were performed to determine WNP-2 compliance with the Regulatory Guide and applicable industry standards.

b. Licensee Review

The licensee had performed two reviews to determine the WNP-2 degree of compliance with ANSI N45.2.11.

First, the licensee proceeded to determine if the Burns and Roe design control procedures are in compliance with 10 CFR 50, Appendix B, and/or ANSI N45.2.11. Secondly, the licensee prepared a checklist of ANSI N45.2.11 requirements and compared these requirements with the design verification requirements imposed on the contractors and A/E.

NRC reviewed the licensee's actions in IE Inspection Report No. 50-397/82-06 and determined the following:

- (1) WPPSS did not compare the requirements of ANSI N45.2.11 against the B&R design control procedures to identify how the requirements are being satisfied on the basis that WNP-2 does not commit to Regulatory Guide 1.64. However, the WPPSS review of the B&R procedures concluded that they meet the requirements of 10 CFR 50, Appendix B, and ANSI N45.2.

- (2) WPPSS prepared a checklist which embodied the essential elements of ANSI N45.2.11 with regard to design verification. The checklist was used to evaluate and document the in-place "design verification" programs of B&R, the onsite contractors, and the prepurchased equipment suppliers. The inspector noted that: (1) the B&R design documents had not been reviewed for the complete period during which safety-related design work was performed; (2) the effectivity of the B&R special design reviews to independently detect safety significant design errors was not adequately addressed; (3) the evaluation of the in-place "design verification" program/practices of onsite contractors was essentially based on current (post 1980) work; and (4) procedures were not available and therefore, not reviewed to determine the actual in-place "design verification" programs/practices of the prepurchased equipment suppliers. The WPPSS conclusion of adequacy appears to be based on a review of selected B&R records at the B&R home office.

At this point the need became clear that sampling by NRC was desirable to determine what evidence exists that the design performed during the 1973 to 1978 time period (i.e., time period when the bulk of the design was performed) had been checked/verified in accordance with existing requirements.

c. Design Control Review

In order to access exactly what design controls were used by the A/E during the 1973 to 1978 time period, a selection of 50.55(e) items were chosen which appeared to the inspector to indicate design related problems. The 50.55(e) items were then reduced to those items where the design was believed to be performed in the 1973 to 1978 period. Also examined were a prepurchased contract for nuclear safety-related HVAC equipment, a design performed by contractor, and a design performed by A/E for a nuclear safety-related structure.

The review included an examination of calculations, drawings, specifications, and transmittals between the A/E and other organizations performing design work for indications such as checker sign-offs and comments indicative of design review. Comments made by the checker were scrutinized to establish the depth of the checkers review.

The detailed review is contained in paragraph 6.

d. Conclusions

The design work for the WNP-2 project may be placed in the following three basic categories:

- I. Design work performed by the A/E in their Woodbury Office.
- II. Design work performed by the A/E at the WNP-2 site. The Richland Office of the A/E is not included here since this office was established in 1980 and has been inspected by the Vendor Inspection Branch of NRC.
- III. Design work performed by the contractors providing equipment to the WNP-2 project.

Category I - Burns and Roe Engineering Offices

BRI used, for the most part, the design review approach to the checking of drawings, calculations, specifications, and transmittals. All design documents were signed by a checker and, where applicable, signed by the chief discipline engineer's designee for approval. Comments made by the checker clearly indicated substantial knowledge in discipline being checked.

In some cases the supervising discipline engineer had requested that an alternate calculation be performed, in addition to a design review which had already been performed.

The drawing control procedures for Burns and Roe did not specifically require the design engineer to review the design drawings. However, the design drawings examined by the inspectors were, in fact, initiated by the design engineer. Discussions with engineering managers disclosed that this has been the standard practice.

The inspector's observation is that the Burns and Roe procedures for review and approval of drawing (WNP-2-ED-001), specifications (WNP-2-ED-009), and calculations (WNP-2-ED-010) meet 10 CFR 50, Appendix B requirements but clearly would not meet the checklist and documentation requirements of ANSI N45.2.11. All calculations, drawings, and specifications had undergone a design review consistent with the design control requirement stated in the WNP-2 FSAR, Amendment No. 23.

Category II - Burns and Roe Site Engineering

Examination of Burns and Roe's site engineering was performed through review of 50.55(e) items only since the majority of the design (except for stress analysis and electrical engineering) is completed. Site engineering is then generally able to resolve problems which arise during construction. The site engineering work is considered, by the inspector, as new work since the site engineering organization was established about 1978 and, therefore, outside the time period under examination. However, a review was performed to verify that the design control measures used onsite were in compliance with applicable requirements.

All site engineering disciplines, except for stress analysis and electrical engineering, were found in compliance with applicable procedures for the design and review of calculations, drawings, specifications, and field changes.

Stress Analysis/Pipe Support was found to be using uncontrolled engineering design criteria. The uncontrolled document is the "WNP-2 Pipe Support Design Guide and Work Procedures." The design guide contains the applicable procedures to be used for the design of pipe support. The design guide also contains the manufacture's allowable load data for most pipe support components used on the WNP-2 project and designed by Burns and Roe.

This procedure was found to be a necessary tool for the pipe support designer. The designers who used the design guide were not required by procedure or in practice to document receipt of the guide. Revisions to the design guide were made via a memo by the supervisor.

The electrical engineering discipline was found to have continuing problems in the area of electrical cable reparation as documented in recent IE Inspection Reports 50-397/81-17 and 82-21.

IE Inspection Report 50-397/82-21 documents a finding where the Project Criteria Document was not maintained current. This document was not in agreement with the WNP-2 FSAR Amendment 23.

In this inspector's opinion, the site engineering activities were not as well controlled as the Burns and Roe home office. Also, it is not apparent that detailed engineering documents were controlled by procedures or that criteria documents used by engineering were maintained current.

Category III - Contractors Performing Design

The inspection included an examination of project procedures, quality control manuals, and quality assurance manuals for Burns and Roe (A/E), H. K. Porter (ventilation equipment supplies), and Pittsburgh-Des Moines Steel Company (containment and containers plus penetration). The program specifically examined included design control and verification, design changes, engineering drawing control, and drawing changes.

Section 52A of the contract specifications used for prepurchased equipment identifies the "Contractor Quality Assurance Requirements." The contractors were required by this specification to have a program compatible with 10 CFR 50, Appendix B, including design control and document control.

The review of the separate manuals and procedures for the aforementioned companys disclosed that each had a written approved program that included design control and verification, design changes, engineering drawing control, and drawing changes. All programs required that design reviews be accomplished by an engineer (individuals or groups) other than the engineer preparing the original design. Design changes are required to be examined by the organizations that performed the original design, review, and approved.

5. Overall Conclusions on Design Control

The Burns and Roe Quality Assurance Plan (Rev. 0), Chapter III, describes the design control measure established for WNP-2. The Quality Assurance Plan states that, "The design control program has been established to assure that all design related activities are carried out in a planned, controlled, and orderly manner."

The applicable method for controlling design documents, in the Burns and Roe system, is by the use of the Project Criteria Document Procedure ED-008. The procedure describes the contents and control of the project criteria document. The procedure states that, "The Project Criteria Documents contains the technical and functional requirement...to which the project is to be designed." However, the design guides or other documents used to control detailed engineering were not controlled by this procedure. Burns and Roe management stated that a procedural change was in process to allow incorporation of design guides into the project criteria document.

The procedures requires that, "The Project Criteria Document contains criteria and is used to control the detailed engineering and design effort." Furthermore, "If design guides are required to support detail design, they shall become part of the Criteria Document. Special distribution of design guides are provided to engineering and design personnel, who implement their requirements."

It is the inspectors observation that in the drawings, calculations, and transmittals examined that a detailed check was performed by engineers comptent in the discipline. A system was in place to insure checking was performed. However, detailed procedures and references to be used by the design engineer were not established. In practice, each supervisor interviewed did have their own method established within the supervisors working group of engineers but it was not controlled by the procedure.

6. 50.55(e) Items Examined

a. (Closed) Tornado Missile Barrier in Diesel Generator Building (DG Bldg.) Inadequate

Final report was submitted by licensee (S.S. no. G02-78-151) and recorded as NRC No. 7810A.

This item dealt with the sizing of the door opening from the diesel generator (DG) building to the outside and sizing of the labyrinth. The labyrinth is used to provide a shield in front of the door and prevent any tornado-generated missiles from entering the DG rooms. In this case, there was a line of sight path approximately one inch wide from the diesel engine past the labyrinth through the door opening to the outside.

The size of the labyrinth was determined by Burns and Roe, New York Office by laying out the geometry of the DG rooms on an orthographic drawing and sizing the labyrinth to intercept all missile paths into the room. Cause of error was simply not sufficient oversizing of the labyrinth to allow for errors in the scaling and construction. The deficiency was identified by a Burns and Roe engineer during an inspection of the DG rooms.

This deficiency does not indicate program weakness, but merely a judgement error. The door opening has been reduced to remove the one-inch clear travel path for the missile. This item is closed.

b. (Closed) Penetration x69 Exceeded Thermal Cycle Life

Final report was submitted by licensee (S.S. No. G02-79-27) and recorded as NRC No. 7810C.

This item dealt with design of instrument penetrations designed by (PDM). PDM was the containment designer and responsible for the penetration. Each penetration design was submitted to Burns and Roe via a transmittal and reviewed by the Burns and Roe stress analysis group.

The original design submitted to Burns and Roe of penetration X-69 contained stainless steel instrument line passing through a carbon steel support plate with a fillet weld on one side of the support plate to the line. The design was approved by Burns and Roe.

PDM resubmitted the X-69 design however, and now the support plate had a fillet weld on both sides of the plate. The problem was that the instrument line passing through the plate was restrained on both sides of the support plate. The coefficient of thermal expansion for the stainless steel line exceeds that of the carbon steel support plate. The differential expansion between the stainless steel line and carbon steel support plate could cause the line to exceed the thermal cycle life limit. This second design was also approved by Burns and Roe.

The GE specification for design of process instrumentation was reviewed and approved by Burns and Roe in 1973. GE Specification 22A3039 does require that thermal cycling and transients be considered in the design of instrument systems.

The cause of this deficiency was attributed to poor interface between the system design group and stress analysis group within Burns and Roe. The problem however was later detected by the stress analysis supervisor after the PDM drawing was approved.

The resolution to this problem by Burns and Roe was to abandon this penetration. The lines were rerun into a penetration which has sufficient thermal cycle life. This item is closed.

c. (Closed) Condensate Impingement on RCIC Turbine

Final report was submitted by licensee (S.S. No. G02-80-67) and recorded as NRC no. 8002A.

The item dealt with the steam supply piping to the RCIC turbine. The piping system design was performed by Burns and Roe. A orthographic drawing was prepared by Burns and Roe showing a supply line, for the RCIC turbine, coming off the main steam line in the drywell. The problem is that the supply line normally has no flow in the line.

With steam as the working fluid, the lines must always be sloped and drained to remove condensate. The orthographic drawing (M 715) shows the supply line sloped. However, the drawing is very congested and does not clearly show the entire run of piping to the turbine. The piping contractor prepared the piping isometric of the system for fabrication. When the piping contractor interpreted the Burns and Roe orthographic drawing, the piping contractor generated isometric with a condensate pocket in the line.

The problem was discovered by a Burns and Roe review of the system made after the isometric had been approved for fabrication. The review was conducted to insure compliance with GE criteria.

The repair for this system was to add a drain line to the condensate pocket. This item is closed.

d. (Open) Potential Missile Hazard in Switchgear Area

Final report was submitted by licensee (S.S. No. G02-80-227) and recorded as NRC no. 8002B.

This item dealt with the placing of an M-G set for the reactor protection system in an area with 1E switchgear. The M-G set is not 1E and therefore, does not have the necessary quality assurance for overspeed protection. This equipment was supplied by GE as part of the reactor system. Quality classification of the M-G set was not transmitted to Burns and Roe during the design. The WNP-2 PSAR, Section 7.0, was prepared by GE and described the Reactor Protection System. Burns and Roe assumed the M-G sets were safety-related but no specific quality classification was assigned in the PSAR.

The problem here was due to Burns and Roe not specifically requesting the quality classification of the M-G sets from GE. This was the only deficiency found related to quality classification. The resolution to the problem will be to install a shield around the M-G set flywheel. This item will remain open pending the final design and installation of the shield.

e. (Closed) Spray Pond Piping Supports

Final report was submitted by licensee (S.S. No. G02-81-30) and recorded as NRC no. 8011C.

A review was conducted in response to IE Bulletin 79-07. The review discovered a missing axial restraint and a support overload. The errors were attributed to the stress engineer's failure to properly transpose information from the engineering work copy drawing to a second copy for drafting personnel use.

Corrective action was to add the support and missing lugs. This item is closed.

f. (Closed) One Sided Clamp Loading of Supports

Final report was submitted by licensee (S.S. No. G02-81-20) and recorded as NRC no. 8011K.

This item dealt with a design requirement in ASME (NF-3691) for considering load shift. The shifting occurs on vertical lines supported by clamps on the vertical run and experience thermal movement.

The Burns and Roe "Pipe Support Design Guide and Work Procedures" did not contain a requirement for load shifting. The problem supports were identified in Technical Memorandum 1216, and were reworked. This item is closed.

g. (Open) Catalog Data on ASME Section III Class I Support Not Conservative

Final report was submitted by licensee (S.S. No. G02-82-154) and recorded as NRC No. 8106F.

This item dealt with the certifying load capacity data sheets for Class I supports. ASME (NF-3141) requires all Class I support components be certified by the manufacture. The 215-contractor purchased the support components without requesting the certified load sheet. Burns and Roe, however, has continued the design based on catalog data obtained from the manufacturer. The supports in question were purchased approximately in the 1975 to 1976 time frame.

The manufacturer is now unwilling to certify Class I supports to the loads shown in the 1975-1976 catalogs. The supports were then down rated by the manufacturer to a lower-load capacity.

The inspector found that the Burns and Roe design guide, which contains the load capacities of supports used at WNP-2, did not require certified load sheets at the time of purchase. Had they been required, the certified load data sheets could then have been checked against the design guide allowable and catalog data to insure the specified supports were adequate to perform their function.

Further the inspector expressed concern over ASME Class II and Class III supports. These supports do not require certified load data sheets by ASME. However, if the same component is