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M. Service	bcc:
R. Mattson	J. Buchanan, NSIC
S. Hanauer	T. Abernathy, TIC
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R. Tedesco	

Docket Nos.: 50-390/391

Mr. H. G. Parris
Manager of Power
Tennessee Valley Authority
500A Chestnut Street Tower II
Chattanooga, Tennessee 37401

Dear Mr. Parris:

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION ON WATTS BAR

Enclosed are requests for additional information on materials integrity and mechanical engineering aspects of Watts Bar.

Your responses by June 29, 1979, are requested in order to continue our review.

Sincerely,

Original signed by:
S. A. Varga

Steven A. Varga, Chief
Light Water Reactors Branch No. 4
Division of Project Management

Enclosures:
As stated

cc: See next page

7906280016

OFFICE	DPM/LWR#4	DPM/LWR#4				
SURNAME	CRStahle/jt	SAVarga				
DATE	4/ /79	4/ /79				

NRC FORM 318 (9-76) NRCM 0240 ★ U.S. GOVERNMENT PRINTING OFFICE: 1978 - 265 - 769

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SURNAME	CRStahle/jt	SAVarga				
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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As stated

cc: See next page

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400 Chestnut Street Tower II
Chattanooga, Tennessee 37401

ENCLOSURE 1

MATERIALS INTEGRITY

121.9 To demonstrate compliance with 10 CFR Part 50, Appendix G, Paragraph IV.A.4, provide the material fracture toughness test data for all bolting greater than one inch diameter used in the reactor coolant pressure boundary.

If the exact material fracture toughness requirements of 10 CFR Part 50, Appendix G are not met, technical justification for deviation from these exact requirements must be provided to demonstrate adequate safety margins.

121.10 Reactor vessel material fracture toughness test data are presented in Table 5.2-11 for Unit No. 1 only. To demonstrate compliance with 10 CFR Part 50, Appendix G, provide the fracture toughness test results for the material in the Unit No. 2 reactor vessel.

If the exact material fracture toughness requirements of 10 CFR Part 50, Appendix G are not met, technical justification for deviation from these exact requirements must be provided to demonstrate adequate safety margins.

ENCLOSURE 2

MECHANICAL ENGINEERING

112.31
(3.6)

The response to Question 112.1 and Figures 3.6-2 through 3.6-20 in the FSAR do not provide enough detail with respect to the design and support of sleeves which are used both inside and outside of containment. The following additional information is required:

1) Provide a summary of the dynamic loads which govern the sleeve design.

2) Provide a summary of the stresses and/or deformations resulting from the dynamic loads requested in (1). Compare these stresses or deformation to the appropriate allowables.

3) Provide a more detailed description of the sleeve support design. Include a discussion of the time history analysis which describes how sleeve/support structures respond to the dynamic effects at the time of break.

4) Describe what provisions have been made in the sleeve designs to provide access to the process pipe for required inservice inspection.

112.32
(3.9)
(5.2)

Verify that the allowable bolt stresses, "S", which are referenced in the Response to Question 112.15 are totally consistent with the rules of ASME Appendix XVII-2460 which were in effect prior to the Winter of 1977 addenda.

112.33
(3.9.2.2)
(3.9.3.2)
(3.10)

The response to Question 112.18 is not acceptable. NRC Standard Review Plan, Section 3.10, Paragraphs II.1.a and II.1.b outlines acceptance criteria in addition to IEEE Standard 344-1971 for plants docketed before October 27, 1972. Revision 1 to Standard Review Plan 3.10 provides a more detailed discussion of this additional criteria. Implicit in this criteria is the position that for equipment which is required for safe shutdown of the plant and has been qualified to IEEE Standard 344-1971, justification should be presented to demonstrate that it will perform its

required safety function during a design basis seismic event. The objective of the NRC Seismic Qualification Review Team is to implement the above position at all facilities which are currently in the OL stage of review and determine whether the seismic qualification techniques applied to such equipment provides an acceptable level of safety.

The meeting between TVA and the Seismic Team which was held on September 29 through September 30, 1976 had the following objectives:

(1) To discuss, on a generic level, TVA's efforts on implementing the seismic qualification requirements of IEEE Standard 344-1975 and Reg. guide 1.100.

(2) To perform the site visit for the seismic review of the Sequoyah Plant.

This visit was not intended to be a seismic review of the Watts Bar plant. Therefore, the staff seismic qualification review team will conduct a review of certain NSSS and BOP equipment at the Watts Bar plant at some mutually acceptable date. The NSSS equipment for Watts Bar has already been reviewed on a generic basis. During the seismic review, the staff will determine the applicability of this generic program to the NSSS equipment in Watts Bar.

Attachment A contains a description of the Seismic Qualification Review Team's objectives and procedures. To enable the review team to make a decision on what specific equipment will be reviewed, supplement the information in Tables 3.10-1, 3.10-2, and 3.10-3 to include all of the information requested in Section V.2.A(i) through V.2.A(iii) of Attachment A.

112.34 (3.9.3.4) The response to Question 112.23 is not completely acceptable. The staff position with respect to allowable stresses for support design is as follows:

(a) For Design, Normal, and Upset Conditions, the allowable stress shall be limited to 0.5 Su at temperature and in no case shall exceed 0.6 Sy at temperature.

(b) For Emergency and Faulted Conditions, the allowable stress shall be limited to 0.7 Su at temperature and in no case shall exceed Sy at temperature.

(c) Stresses produced by the constraint of free end displacement resulting from thermal or other movement (such as anchor point movement) are considered to be primary stresses and the limits in (a) and (b) above apply to such stresses.

Revise the response to Question 112.23 to be consistent with the above position or provide the basis for any deviation from the position.

112.35 (3.9.3.4) Provide the allowable buckling loads for all ASME Class 1 component supports subjected to faulted load combinations. Provide justification if your criteria exceed the limits of Paragraph F-1370(c) of the ASME Code Section III, Appendix F.

112.36 Recent operating reactor experience indicates that vibratory loads associated with the operation of positive displacement pumps have contirbuted to high cycle fatigue pipe failure. Such failures are known to occur on both the suction and discharge sides of positive displacement pumps in PWR charging systems.

Describe the measures that are proposed to be taken at the Watts Bar Nuclear Plant facility to absorb these vibratory loads originating from the positive displacement charging pumps. If pulsation dampers or other mechanical devices are to be used in the pumps vicinity, furnish a description of such devices, i.e., manufacturer, type, size, location, and effectiveness of the device. In case pulsation dampers or other mechanical devices are not employed to dampen vibratory loads:

1. Describe the vibratory loads originating at the positive displacement pump and transmitted to the discharge and suction pipe and associated pipe supports.

2. Describe in some detail how the maximum vibratory loads were established for calculating the maximum alternating stress in the design of the pipe runs and associated supports. Also describe the analytical procedure to determine the fatigue stresses in the affected piping system.

3. Furnish an isometric sketch of the affected piping system showing the location of the pipe supports and the peak alternating stresses. Also indicate the locations which will be monitored for vibration during the preoperational piping vibration and dynamic effects test program.

4/12/79

ATTACHMENT A

SEISMIC QUALIFICATION REVIEW TEAM (SQRT)

I. SCOPE

SQRT tasks include both generic and site specific reviews. Generic reviews cover equipment supplied by the NSSS and A/E common to more than one plant. Specific plant reviews as delineated in the Standard Review Plan Sections 3.9.2 and 3.10 will be supplemented by SQRT site visits and evaluation.

II. OBJECTIVES

SQRT is a group of NRC staff members established to conduct reviews of the design adequacy of safety related mechanical components, instrumentation and control equipment, and their supporting structures for various vibratory loads. SQRT is charged with accomplishing the following three tasks.

1. Determine the design adequacy of mechanical and electrical components and their supports for the required vibratory loading conditions which include:

   (a) Seismic

   (b) hydrodynamic (as applicable)

   (c) offsite explosion (as applicable)

   (d) other vibratory inputs from the operating environment (as applicable)

   (e) appropriate combinations of the above events.

2. Changes in seismic qualification criteria, such as the revision of IEEE Std. 344 and other IEEE Standards, and the issuance of Regulatory Guides 1.100 and 1.89 require that the staff verify:

   (a) For older plants having components qualified by previous criteria; that components have adequate margin to perform their intended design functions during and after a seismic event.

   (b) For new plant applications; that there has been uniformity and consistency in implementing the current criteria.

3. In the case of plants which have design basis seismic ground motion levels and/or other required vibratory loads increased, review to assure adequate design margin exists at the revised levels.

III. GENERAL CRITERIA

The bases used by the staff to determine the acceptability of equipment qualification will be IEEE Std. 344-1975 as supplemented by Regulatory Guides 1.100 and 1.92, and Standard Review Plan Sections 3.9.2 and 3.10

IV. GENERAL PROCEDURES

SQRT will conduct generic and plant specific reviews:

1. Generic reviews will be conducted of all NSSS vendors and most architect engineers (major equipment vendors and testing laboratories may be included if necessary) to assure proper interpretation and implementation of the current equipment qualification criteria applied

to plants applying for construction permits and operating licenses.

2. A plant specific equipment qualification review will be conducted of each plant now undergoing licensing review having components qualified to criteria different from current requirements.

   A. For components having multi-plant application (such as those within the scope of an NSSS vendor), an equipment qualification review at specific sites will provide generic qualifications.

   B. For components which have only specific plant application (mostly those within the scope of the BOP supply), an equipment qualification review at specific sites will provide site-specific qualifications.

3. Equipment qualification review for plants with revised increased design basis seismic ground motion levels and/or other required vibratory loads will be conducted on a plant by plant basis.

V. SPECIFIC PROCEDURES

SQRT procedures provide for both generic discussion meetings and plant site visits.

1. Generic Discussion Meeting:

   To implement the generic review specified in IV.1 and IV.2.A, a generic discussion meeting will be held to discuss the following:

   A. Meeting Agenda

      Meeting Objectives by SQRT

B. NSSS or A/E personnel should be prepared to present the following information:

(1) A detailed description of current practice followed in equipment qualification, including acceptance criteria, methods, and procedures used in conducting testing and analysis. Present and discuss the equipment qualification program on certain specified items (i.e., pumps, valves, diesel generators, motors, bistable units, relays, electrical cabinets, etc.)

(2) Information regarding administrative control of equipment qualification, especially the handling of interface problems, documentation, and internal review procedures.

(3) Identifying the scope of their suppliers. A list of equipment should be made available if possible prior to the meeting.

C. For the cases specified in IV.2.A, methods and procedures for conducting equipment qualification review are discussed, including selection of plants for site visits and setting up a tentative schedule for such visits.

D. Discuss necessary documentation.

E. Inspect testing facilities, if any. Testing capability, format of testing reports, wave forms of shaker table motions, and monitoring and control devices are the major items for inspection.

F. SQRT concludes the meeting and specifies the follow-up items.

2. Plant Site Reviews:

To implement plant specific equipment qualification reviews specified in IV.2 above, on-site inspection of equipment and supporting structures in question is required. Site visits generally follow the following procedures:

A. Pre-visit information submission:

Step 1

The applicant (plant owner) receives initial information concerning the intended visit, and should subsequently submit the following:

(i) Two summary equipment lists (one for NSSS supplied equipment and one for BOP supplied equipment). These lists should include all safety related mechanical components, instrumentation, and control equipment, including valve actuators and other appurtenances of active pumps and valves. In the lists, the following information should be specified for each item of equipment:

(1) Method of qualification used:

(a) Analysis or test (indicate the reference report number)

(b) If by test, describe whether it was a single or multi-frequency test and whether input was single axis or bi-axial

(c) If by analysis, describe whether static or dynamic,

single or multiple-axis analysis was used. Present natural frequency of equipment.

(2) Indicate whether the equipment is required for:

(a) hot stand-by

(b) cold shutdown

(c) both

(d) neither

(3) Location of equipment, i.e., building, elevation.

(4) Availability for inspection (Is the equipment already installed at the plant site?)

(ii) An accceptable scenario of how to maintain hot stand-by and cold shutdown based on the following assumptions:

(1) SSE or OBE

(2) Loss of offsite power

(3) Any single failure

(iii) A compilation of the required response spectra (RRS) for all applicable vibratory loads (individual and combined if required) for each floor of the nuclear station under consideration.

Step 2

SQRT screens the above information and decides which items will be evaluated during our forthcoming site visit. The applicant will be informed of these items and will be expected to submit

two weeks prior to the visit an equipment qualification summary as shown on pages 10-12 for each of the selected items.

B. A brief meeting is held at the beginning of a site visit with the following agenda:

(1) SQRT explains the objectives of the site visit and procedures to conduct equipment inspection.

(2) Utility personnel or their designees present an overview of the seismic qualification program conducted.

(3) The seismic qualification of certain specified items may be discussed as necessary.

(4) SQRT specifies items that need to be inspected.

C. SQRT conducts inspection of some specified items.

D. SQRT reviews the qualification documents of the selected equipment.

E. SQRT describes findings of the inspection and the review.

F. General discussion.

G. SQRT concludes the visit and specifies needed information and the follow-up actions.

3. After each visit SQRT will issue a trip report, which identifies findings, conclusions and follow-up items. Status reports may be issued as necessary. The site review will include the issuance of

an Evaluation Report for the specific plant. Generic evaluations will be referenced to the NSSS vendor or A/E.

VI. RESPONSIBILITIES OF NRC PARTICIPANTS:

A. The Seismic Qualification Review Team consists of members of the Mechanical Engineering Branch (MEB), the Instrumentation and Control Systems Branch (ICSB), and the Power Systems Branch (PSB). One additional member from MEB will join the team when a review of a specific plant is going to be conducted. This member will be the reviewer of the plant.

The Team Leader is responsible for scheduling actions, coordinating staff positions, and contacting appropriate authorities for work assignments to each member. He reports to the MEB Branch Chief regarding the progress of SQRT performance. He will set up necessary contacts for generic reviews and will contact project management for specific plant site visits. He will specify the meeting objectives and concludes meetings.

The MEB members and Team Leader are responsible for reviewing assigned equipment qualifications in the area of responsibility of the Mechanical Engineering Branch, including the methods and procedures used in test and analysis.

Members representing the Power Systems Branch (PSB) and the Instrumentation & Control Systems Branch (ICSB) are responsible for reviewing assigned equipment qualification in the area of responsibility of

their branch, including equipment signal interpretations for functional verification. They serve as a liaison between SQRT and ICSB and PSB.

All members shall present their opinion and professional judgement to the Team Leader in order to arrive at consistent and uniform SQRT positions.

B. The MEB, PSB, and ICSB project reviewers will be advised of SQRT activities which relate to specific plants. The MEB project reviewer is responsible for evaluating the impact of SQRT activity on the specific plant review and for taking appropriate action to include pertinent information in the plant safety evaluation. The MEB project reviewer is expected to participate in the site visit and attend pertinent generic meetings as necessary.

The DPM project manager, after being informed of the intended plant visit, is expected to contact the applicant and arrange for the visit. The project manager serves as a liaison between the SQRT and the applicant.

C. Generic meetings will be arranged by the SQRT or via the DPM generic project manager if one is assigned.

D. Representatives from I&E Regional Offices and other interested organizational groups within NRC are welcome to attend either generic meetings or plant site visits as observers. The SQRT should be informed of expected attendance at such meetings or site visits.

Qualification Summary of Equipment

I. Plant Name: _____ Type:

1. Utility: _____ PWR _____

2. NSSS: _____ 3. A/E: _____ BWR _____

II. Component Name _____

1. Scope: [ ] NSSS [ ] BOP

2. Model Number: _____ Quantity: _____

3. Vendor: _____

4. If the component is a cabinet or panel, name and model No. of the devices included: _____

_____

5. Physical Description a. Appearance _____

b. Dimensions _____

c. Weight _____

6. Location: Building: _____

Elevation: _____

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[ ] Weld (Length____)
[ ] _____

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S: _____ F/B: _____ V: _____

9. a. Functional Description: _____

_____

b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[ ] Both _____

10. Pertinent Reference Design Specifications: _____

_____

III. Is Equipment Available for Inspection in the Plant: [ ] Yes [ ] No

IV. Equipment Qualification Method: Test: _____

Analysis: _____

Combination of Test and Analysis: _____

Test and/or Analysis by _____
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1.[ ]Seismic only 2.[ ]Hydrodynamic only 3.[ ]Explosive only

4.[ ] Other (Specify)_____ 5.[ ] Combination of_____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ]_____
(other, specify)

2. Required Response Spectra (attach the graphs):_____

3. Required Acceleration in Each Direction:

S/S =_____ F/B =_____ V =_____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ]_____

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE_____ SSE_____ Other_____
(specify)

4. Frequency Range:_____

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Plot TRS on RRS graphs) [ ] No

6. Input g-level Test at S/S = _____ F/B = _____ V = ____

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]_____

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made:_____

_____

10. Other tests performed (such as fragility test, including results):_____

_____

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: _____

_____

_____

2. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: _____ (specify)

6. Damping: _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B. Max. Deflection	Location	Effect Upon Functional Operability