

Northeast Utilities
Millstone - Unit 3

Independent Corrective Action Verification Program
(ICAVP)

Modification Review Checklist

CK-MP3-03-11, Rev. 0

Seismic Qualification Checklist

Prepared by: J. L. TENWINKEL
Name

[Signature]
Signature

4/7/97
Date

Approved by: A. A. NEK
Name

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Signature

4/10/97
Date

IMPLEMENTATION

System		
Modification No./Description		
Verified by:		Date:
Concurrence by:		Date:

Sheet 1 of ____

(CK-MP3-03-11, Rev. 0)
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Seismic Qualification Review Checklist

Instructions

This checklist shall be used for the design process document review process described in PI-MP3-02 and for the modification review process described in PI-MP3-03.

1. The Lead Verifier shall enter the System and, if applicable, the Modification Number/Description on the checklist cover sheet.
2. The Lead Verifier or Discipline Verifiers shall determine which components in the System or Modification are subject to seismic qualification and list those components on Attachment A of this checklist. Note that components which are identical or similar may be grouped on Attachment A such that only one Component Seismic Qualification Review Checklist (CSQRC) is prepared for that group of components. Grouping in this fashion should be based not only on component similarity, but also on the Millstone seismic qualification documentation. When Attachment A has been completed for the applicable System or Modification, print, sign, and date the bottom of Attachment A.
3. Based on Attachment A, the Lead Verifier or Discipline Verifiers shall complete a CSQRC - see Attachment B of this checklist - for each component or group of components listed in Attachment A. Each CSQRC shall be numbered sequentially for the System or Modification as delineated in Attachment A. If it becomes necessary to revise the numbering sequence, Attachment A shall be updated to agree. In completing Attachment B, the following shall be observed:
 - a. An answer shall be provided to each question; no questions are to be left blank.
 - b. Not Applicable (N/A) shall only be used where an "N/A" blank is provided in the checklist.
 - c. Whenever the answer to a question is "No," meaning that the seismic qualification aspect being reviewed is unsatisfactory, a Comment No. shall be entered in the right hand column of the checklist, and a comment shall be entered on the checklist provided at the end of Attachment B. Comments shall be numbered sequentially within an individual CSQRC. In addition, for each unsatisfactory response, the Preparer shall initiate a Discrepancy Report (DR) in accordance with PI-MP3-11. The DR number shall be referenced in the comment in Attachment B.
 - d. When the Attachment B CSQRC has been completed, the Preparer shall print, sign, and date at the end of the document in the space provided.
4. When all of the individual CSQRCs have been completed for a System or Modification, they shall be assembled together with Attachment A and the main checklist for the Lead Verifier to review. The Lead Verifier shall then print, sign, and date the CK-MP3-03-11 cover sheet to signify that the seismic qualification review has been completed for the applicable System or Modification.

[illegible]

Prepared by:

Name _____

Signature _____

Date _____

Attachment B
Component Seismic Qualification Review Checklist

Checklist No. _____ Component No.(s) _____

A. COMPONENT IDENTIFICATION

Spec.: _____ Vendor: _____

Description: _____

Manufacturer/Model No.: _____

B. DOCUMENT AND SOURCE IDENTIFICATION (Identify document no. and rev. or date)

B1. Qualification Report: _____

B2. Postulated Dynamic Loads: _____

B3. Classification: _____

B4. Mounting Details: _____

B5. Other: _____

C. CONCLUSION OF REVIEW:

_____ Accepted _____ Rejected

Comments: _____

D. REFERENCES:

- D1. IEEE-344-1975 "IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations"
- D2. NRC Regulatory Guide 1.61 "Damping Values for Seismic Design of Nuclear Power Plants"
- D3. NRC Regulatory Guide 1.92 "Combining Modal Responses and Spatial Components in Seismic Response Analysis"
- D4. NRC Regulatory Guide 1.100 "Seismic Qualification of Electric Equipment for Nuclear Power Plants"

Attachment B
Component Seismic Qualification Review Checklist

E. CLASSIFICATION AND FUNCTION

E1. Classification

_____ Nuclear Safety-Related Active: Component must operate and/or remain functional:

_____ during and after postulated dynamic events

_____ only after postulated dynamic events

_____ Nuclear Safety-Related Passive: The structural integrity and/or pressure integrity of the component must be demonstrated during and after postulated dynamic events. Operability is not required.

_____ Non-Safety-Related Seismic: Component has no safety-related function but must remain intact during and after postulated dynamic events.

E2. The component's safety-related function(s) is: _____

F. LOCATION AND MOUNTING

F1. Location

Building: _____

Elevation: _____

F2. Field Mounting Condition

_____ Panel/pipe/HVAC duct: _____

_____ Wall/floor: _____

_____ Other: _____

F3. Field Mounting Method

_____ Expansion anchor bolts

_____ Embedded anchor bolts

_____ Welding

_____ Other: _____

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Component Seismic Qualification Review Checklist

G. REQUIRED VIBRATORY INPUT

G1. Postulated Dynamic Loads to be Considered

_____ Seismic

_____ Seismic and hydrodynamic

_____ Other: _____

G2. Frequency range associated with postulated loads: _____

G3. Postulated dynamic loads defined as:

_____ Response Spectra

a. Method of combining required response spectra:

_____ Not applicable, only seismic loads postulated.

_____ Absolute sum

_____ SRSS

b. Damping:

Upset/Service Level B _____

Emergency/Service Level C _____

Faulted/Service Level D _____

c. Basis for damping: _____

Seismic Coefficients (Required acceleration in each direction)

a. Upset/Service Level B: H₁_____, H₂_____, V_____

b. Emergency/Service Level C H₁_____, H₂_____, V_____
Faulted/Service Level D

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Component Seismic Qualification Review Checklist

	<u>YES</u>	<u>NO</u>	<u>COMMENT NUMBER</u>	<u>N/A</u>
G4. Are these dynamic loads defined at equipment mounting?	_____	_____	_____	_____
 H. <u>METHOD OF QUALIFICATION</u>				
_____ Static Analysis _____ Test				
_____ Dynamic Analysis				
_____ Other: _____				
Is the qualification method used capable of adequately demonstrating the component's ability to perform its safety function?	_____	_____	_____	_____
 I. <u>QUALIFICATION BY TESTING</u>				
I1. Does the qualification report identify the component tested and is this component identical to the component being installed?	_____	_____	_____	
If no, has similarity been adequately demonstrated?	_____	_____	_____	
 I2. <u>Mounting</u>				
Does the qualification report identify the test mounting and does the test mounting simulate the actual service mounting in regard to:				
a. Mounting method (bolt or weld)	_____	_____	_____	
b. Bolt torque requirements or anti-loosening requirements?	_____	_____	_____	_____
c. Mounting orientation?	_____	_____	_____	

Attachment B
Component Seismic Qualification Review Checklist

	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
I3. <u>Interfacing Connections and Structures</u>				
Does the qualification report adequately address the effect of the following interfaces:				
a. Piping?	_____	_____	_____	_____
b. Electrical conduit?	_____	_____	_____	_____
c. Instrumentation tubing?	_____	_____	_____	_____
I4. <u>Test Input Motion</u>				
Single Axis; does the qualification report adequately account for cross-coupling effects in accordance with IEEE-344-1975, Section 6.6.6?	_____			
Component is rigid, no possibility of cross-coupling.	_____	_____	_____	
Dependent (pseudo) biaxial	_____			
Independent biaxial	_____			
Independent triaxial	_____			
I5. Are the number of test orientations in accordance with IEEE-344-1975, Section 6.6.6?	_____	_____	_____	

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Component Seismic Qualification Review Checklist

	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
16. <u>Test Input Waveform</u>				
_____ Sine Dwell (Single Frequency)				
a. Does the qualification report adequately account for multimode excitation in accordance with IEEE-344-1975, Section 6.6.2?	_____	_____	_____	
_____ Component is rigid, no possibility of multimode excitation.				
b. Is the sinusoidal input motion applied at:				
1. Frequencies spaced no further than 1/2 octave intervals.	_____	_____	_____	
2. Each equipment's natural frequency?	_____	_____	_____	_____
c. Is the test duration in accordance with IEEE-344-1975, Section 6.6.5 (equivalent to five OBEs and one SSE where the duration of each event is equivalent to the duration of the strong motion portion of the SSE?)	_____	_____	_____	
d. Is the peak amplitude of the input greater than or equal to the ZPA of the RRS?	_____	_____	_____	

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Component Seismic Qualification Review Checklist

	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
_____ Sine Beat (Single Frequency)				
a. Does the qualification report adequately account for multimode excitation in accordance with IEEE-344-1975, Section 6.6.2?	_____	_____	_____	
Component is rigid, no possibility of multimode excitation.				
b. Are the sine beats applied at:				
1. Frequencies spaced no further than 1/2 octave intervals.	_____	_____	_____	
2. Each equipment's natural frequency?	_____	_____	_____	_____
c. Is there a sufficient pause between application of beats (at any one frequency) to avoid superposition of equipment response motion?	_____	_____	_____	
d. Is the test duration in accordance with IEEE-344-1975, Section 6.6.5 (equivalent to five OBEs and one SSE where the duration of each event is equivalent to the duration of the strong motion portion of the SSE)?	_____	_____	_____	

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
e. Is the peak amplitude of the input greater than or equal to the ZPA of the RRS?	_____	_____	_____	
_____ Random Motion (Mutilfrequency)				
a. Is the input motion controlled using 1/6 octave or narrower bandwidth filters?	_____	_____	_____	
b. Is the amplitude of the input controlled such that:				
1. The peak amplitude of the input is greater than or equal to the ZPA of the RRS.	_____	_____	_____	
2. The TRS envelopes the RRS?	_____	_____	_____	
c. Is the duration of the test input in accordance with IEEE-344-1975, Section 6.6.5 (equivalent to five OBEs and one SEE where the duration of each event is equivalent to the duration of the strong motion portion of the SSE but is not less than 15 second)?	_____	_____	_____	

17. Dynamic Characteristics

_____ Natural frequencies not determined.

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
_____ Natural frequencies:				
H ₁ _____				
H ₂ _____				
V _____				
These frequencies were determined via:				
Sine Sweep, frequency range _____				
input acceleration _____				
sweep rate _____				
_____ Other: _____				

18. Normal Operating Conditions

Does the qualification report
adequately address the
following normal operating loads:

Electrical Loads?	_____	_____	_____	_____
Mechanical Loads?	_____	_____	_____	_____
Thermal Loads?	_____	_____	_____	_____
Pressure?	_____	_____	_____	_____
Operating vibration? (rotating equipment)	_____	_____	_____	_____

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
I9. <u>Monitoring</u>				
a. Was the monitoring of the component adequate to evaluate its performance?	_____	_____	_____	
b. Was the operability of the component verified?	_____	_____	_____	_____
c. Did the component's performance satisfy functional requirements?	_____	_____	_____	
I10. <u>Disposition of Test Anomalies</u>				
Have all test anomalies been adequately dispositioned?	_____	_____	_____	_____
J. <u>QUALIFICATION BY ANALYSIS</u>				
J1. <u>Type of Analysis</u>				
_____ Static Analysis				
_____ Simplified Dynamic Analysis				
_____ Response Spectrum Analysis				
_____ Time History Analysis				
_____ Other: _____				
J2. <u>Analytical Model</u>				
_____ Finite Element				
_____ Other: _____				

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
J3. <u>Method of Analysis</u>				
_____ Computer-Aided Calculation				
a. Programs used:				

b. Is there evidence that the programs used have been validated?				
_____ Yes _____ No				
_____ Hand Calculation				
J4. <u>Operating Loads</u>				
Does the qualification report adequately address the following normal operating loads?				
a. Piping nozzle reactions?	_____	_____	_____	_____
b. Electrical conduit reactions?	_____	_____	_____	_____
c. Pressure?	_____	_____	_____	_____
d. Thermal expansion?	_____	_____	_____	_____
e. Startup torque for rotating equipment?	_____	_____	_____	_____
J5. <u>Static/Simplified Dynamic Analysis</u>				
a. Is the analysis method used justified in accordance with the guidelines established by NRC Regulatory Guide 1.100, Section C1?	_____	_____	_____	_____

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
b. Do the seismic coefficients used in the analysis envelope the required input postulated to occur at the equipment base?	_____	_____	_____	
c. Are the seismic coefficients applied in each of the three orthogonal directions simultaneously?	_____	_____	_____	
J6. <u>Response Spectra Modal Analysis</u>				
a. Do the response spectra used in the analysis envelop the RRS?	_____	_____	_____	
b. Does the model used adequately represent the equipment's:				
1. Mass distribution?	_____	_____	_____	
2. Stiffness characteristics?	_____	_____	_____	
3. Boundary conditions?	_____	_____	_____	
c. Is the cutoff frequency for the analysis adequate to ensure that the effect of all significant modes is considered?	_____	_____	_____	
d. Is the method of combining modal responses in accordance with NRC Regulatory Guide. 1.92?	_____	_____	_____	
J7. <u>Results</u>				
a. Are the correct allowable stresses identified?	_____	_____	_____	
b. Does the analysis demonstrate that all stresses are below the allowable?	_____	_____	_____	
c. Does the analysis adequately assure operability by demonstrating that all deflections/clearances are within the allowables?	_____	_____	_____	_____

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
K. <u>DESIGN REQUIREMENTS/CONSTRAINTS</u>				
K1. Does the qualification report identify any design requirements/constraints which need to be implemented by parties other than the supplier (and/or his subcontractor, if any)?	_____	_____	_____	
If no, go to Section L.				
If yes, list these requirements/constraints in the comments section and provide references. Then complete Item K2.				
K2. Are these design requirements/constraints incorporated (as applicable) in the:				
a. Design Change Documents for existing configurations?	_____	_____	_____	
If yes, specify in the comments section.				
b. appropriate design documents (including vendor drawings) for new or alternate replacement components or new construction within the design scope?	_____	_____	_____	
L. <u>DOCUMENTATION</u>				
L1. Does the qualification report define all input data and assumptions?	_____	_____	_____	
L2. Does the report indicate that it has been reviewed and approved by the originating organization?	_____	_____	_____	
L3. For test reports:				
a. Is the test facility identified?	_____	_____	_____	
b. Is the test equipment along with date of last calibration identified?	_____	_____	_____	

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	<u>YES</u>	<u>NO</u>	<u>COMMENT</u> <u>NUMBER</u>	<u>N/A</u>
c. Is the report complete (i.e., no pages missing)?	_____	_____	_____	

Prepared by: _____
Name Signature Date

