August 13, 1986

Docket Nos. 50-237/249
50-254/265

Mr. Dennis L. Farrar
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Dear Mr. Farrar:

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ACRS (10)	Dresden File

SUBJECT: PROGRAMMATIC APPROACH TO PROPOSED ALTERNATE SEISMIC EVALUATION CRITERIA AND METHODOLOGY

Re: Dresden Nuclear Power Station, Units 2 and 3
Quad Cities Nuclear Power Station, Units 1 and 2

By letter dated September 30, 1985, you requested NRC staff to approve alternate methods and criteria for performing seismic evaluations at Dresden and Quad Cities stations. Before the staff can satisfy your request for approval, we believe it is necessary for you to develop a more programmatic approach for this issue.

During our review of your request we have developed a number of questions, contained in the enclosure to this letter. We believe that addressing these questions will be helpful in developing the programmatic approach that is necessary before we continue our review.

The reporting and/or recordkeeping requirements contained in this letter affect fewer than 10 respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Original signed by:

John A. Zwolinski, Director
BWR Project Directorate #1
Division of BWR Licensing

Enclosure:
Request for
Additional Information

cc w/enclosure:
See next page

OFC	:DBL:PD#1	:DBL:PD#1	:DBL:PD#1	:	:	:	:
NAME	:CJamerson	:RBevan:em	:JZwolinski	:	:	:	:
DATE	:08/06/86	:08/07/86	:08/8/86	:	:	:	:

OFFICIAL RECORD COPY

Mr. Dennis L. Farrar
Commonwealth Edison Company

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Quad Cities Nuclear Power Station, Units 1 & 2

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GENERAL QUESTIONS ON PROPOSAL

The proposed criteria/methodology document lists numerous options which basically result in a mixing of "old" and "new" procedures. For example, is it appropriate to use PVRC damping, peak shifting, independent support motion, etc. if present FSAR acceptance criteria are utilized? Is the use of 1% strain criteria, yielding supports, and concrete expansion anchor bolts with safety factors of two appropriate if the loads and responses generated are based on present FSAR methodology? As a result, it becomes necessary to evaluate all the influencing factors before the proposed criteria/methodology can be evaluated to assure the continued operability of the piping systems involved.

1. What is the purpose of this proposal? Why does the licensee want to implement the proposed criteria/methodology?

2. How do Quad Cities Units 1 & 2 and Dresden Units 2 & 3 compare to newer nuclear power plants with respect to design, fabrication (assembly, installation, and erection), inspection, and testing requirements?

   A. Please list which piping materials were utilized for the piping involved in the reevaluation effort. Indicate whether seamless or welded piping was used. Are the materials currently ASME Section III approved? Include details for both piping and fittings.

   B. What quality (QA and QC) efforts were in place during plant construction?

   C. What fabrication techniques were utilized during plant construction? Include details regarding pipe and support welding procedures, acceptable construction tolerances (distance and angle) for piping, supports, support gaps, etc., cold springing procedures, etc.

Was either submerged arc or flux core welding utilized in joining the piping? Provide reasonable assurances that the weld material strength for pipe supports is greater than or equal to that of the base metal.

D. What preservice and inservice inspection procedures have been performed? Has this inspection process (either preservice or inservice) included all welds or an intermittent sampling? Is the ISI effort sufficient to detect all possible stress corrosion cracking problem locations? If the proposed criteria/methodology is accepted, would ISI be intensified with increased inspections?

E. What hydro/pneumatic testing has been performed on the piping systems affected by the proposed evaluation criteria/methodology?

F. How do the B31.1 1967 Edition and any applicable Nuclear Code Cases (please specify) utilized with these plants compare to current ASME Section III design, fabrication, inspection, and testing requirements? Address differences regarding SIFs, stress equations, stress allowables, etc.

G. How do the dimensional standards (e.g. ANSI B16.9, ANSI B16.25, etc.) utilized during the design and construction of Quad Cities and Dresden compare to current dimensional standards?

3. How do the analysis techniques utilized to evaluate Quad Cities and Dresden piping compare to those anticipated to be used during the reevaluation effort? Provide a brief description of those analysis techniques used in the past

and those anticipated to be used in the reevaluation. The response should include comments on types of analyses (static equivalent, time history, acceleration response spectra, etc.), support stiffnesses utilized (including nozzles and branch connections if decoupled), valve modeling and eccentric masses, welded attachments, close proximity restraints, nonlinear supports (pipe rests, rod hangers, excessive gaps, etc.), branch line decoupling criteria, large model overlapping criteria, mass point spacing, natural frequency of supports, high frequency effects, seismic/non-seismic piping boundary decoupling criteria, etc.

4. How do the proposed criteria/methodology retain "at least the same design margin as the current criteria"? How was this determination made? In light of BWR stress corrosion cracking problems, explain why the proposed criteria/methodology is believed to provide a seismic safety margin greater than one.

5. What is the status of implementation regarding previous applicable NRC concerns such as the SEP, I&E Bulletins 79-02, 79-14, etc.?

6. Which seismic acceleration response spectra are to be utilized in the reevaluation; the FSAR spectra, the SEP spectra, other?

7. Due to the incorporation of many new analysis techniques, what computer code verification will be performed? Does this include independent support motion or multiple level response spectra, PVRC damping, peak shifting, etc?

8. Please provide all referenced documentation excluding the following: References 1, 3, 4, 6, 7, 9, 14, 15, and 19.

SPECIFIC QUESTIONS REGARDING PIPING ANALYSIS METHODOLOGY

1. Explain the "energy balance" method in detail including its theoretical basis, what loads will be considered, and how it would be used to evaluate the piping systems of interest. Would the "energy balance" be used to add or eliminate piping supports?

2. Regarding equipment qualification and system functionality:

   A. How will the acceptability of in-line and end-of-line equipment be determined?

   B. Do the various combinations of methodologies proposed in the criteria/methodology adequately predict valve accelerations, nozzle loadings on vessels, pumps, etc., and support loads?

3. Since Quad Cities and Dresden are BWR units, how will "chugging" loads (or any other applicable non-seismic dynamic loads) be reevaluated, if the support configuration changes. The response should also include the possibility of support configuration changes due to supports yielding/failing due to seismic loadings.

4. Regarding peak broadening of the response spectra to be utilized:

   A. Were the existing instructure floor response spectra developed using the methods described in the Quad Cities/Dresden FSARs peak broadened? If so, how? Per Regulatory Guide 1.122?

   B. Will newly generated response spectra utilized in the envelope response spectra analysis effort (excluding

when peak shifting is used) be peak broadened per Regulatory Guide 1.122?

C. Will response spectra utilized in Independent Support Motion (ISM) or multiple level response spectra analyses be peak broadened per Regulatory Guide 1.122?

5. If additional acceleration response spectra is to be generated at higher damping directly from existing spectra (per Table 4-1 or Table 4-2), how will these spectra be determined? Does this involve "direct generation"? If not, please provide complete details. Would the spectra be generated from the existing acceleration histories or would an interpolation/extrapolation technique be used?

6. Please submit complete details and references regarding the SSI methodology and analysis techniques to be used in determining new response spectra.

7. Please submit complete details and references regarding the "direct generation" method to be used in generating additional response spectra.

8. If refined SSI analyses result in new spectra greater than the present FSAR spectra, would the higher spectra be used in evaluating piping system responses?

9. Regarding the Direction/Mode Combination philosophy:

   A. Are all the requirements of Regulatory Guide 1.92 satisfied? If not, please describe any descrepancies in detail.
   B. Will modes be combined per all the requirements listed on page 2-3 of Volume 4 of NUREG-1061?

C. Please be more specific regarding "using methodology consistent with Volume 4, Appendix B, of NUREG-1061".

10. How will SAM effects be calculated? Will both OBE and DBE SAM effects be evaluated?

11. When the ISM methodology is being employed:

    A. Will peak shifting be utilized?

    B. Explain how the "psuedo static" components will be calculated and combined with the inertial response.

    C. Will high frequency effects be considered? If so, how?

    D. Indicate why group responses are not always combined by an absolute sum basis, as suggested on page 2-3, Volume 4, of NUREG-1061.

12. Will "as-built" piping system data be utilized for any of the analysis efforts?

SPECIFIC QUESTIONS REGARDING PIPE SUPPORT ANALYSIS METHODOLOGY

1. If the supports are assumed to yield or fail:

   A. How will the load redistribution be calculated?

   B. How will the altered response of the system be calculated for all loadings, taking into consideration the potential added mass of the support, the altered frequency/mode shape response, and the potential "snap back" effects if the support fails?

   C. Will potential missile effects be evaluated?

   D. Will potential impact of the failed support onto adjacent equipment be evaluated?

SPECIFIC QUESTIONS REGARDING PIPING ACCEPTANCE CRITERIA

1. What systems are to be reevaluated using this criteria? Is the NSSS included? Are all safety related systems included?

2. What criteria will be used to evaluate design loads (pressure and weight) or thermal stresses (expansion/contraction and thermal anchor movements) if the support configuration is changed? Will this include the effects of supports that may yield/fail during seismic loading?

3. Including both large and small bore piping, please respond to the following inquiries regarding the proposed 1% strain criteria:

   A. What, if any, D/t limitations are proposed?

   B. How will K be calculated? What loads will be included in determining K? Will moment ranges be used? What edition and addenda of the ASME Code does the NB-3228.5 comment reference?

   C. Indicate how the 1% strain criterion prohibits the following from occurring:

      - onset of plastic tensile instability
      - low cycle fatigue or plastic ratcheting
      - onset of system or local buckling (compressive wrinkling)
      - excessive deformation resulting in a reduction in flow rate beyond that required by system performance.

D. What about areas where excessive deformation is not acceptable (e.g., flanges, equipment nozzles, etc.)?

E. What, if any, joint limitations are proposed? The response should specifically address butt welds, socket or girth fillet welds, threaded joints, seal welded threaded joints, etc.

F. What, if any, material limitations are involved? Define (by list or tensile/yield strength ratio criterion) the allowed materials.

G. What, if any, deflection criteria are proposed? How will it be calculated? How will potential equipment impact be checked?

H. How accurate will system responses and support loads be calculated if the 1% strain criterion is utilized?

I. What, if any, temperature or pressure limitations are proposed?

J. What type of analyses are permitted in determining the forces and moments due to earthquake? Static equivalent, time history, acceleration response spectra?

K. What would be the minimum percentage of the total stress due to earthquake loading if the 1% strain criteria is utilized?

4. As indicated in Section 2.4 of the proposed criteria, what criteria will be used to determine piping functionality? What about equipment?

SPECIFIC QUESTIONS REGARDING PIPE SUPPORT ACCEPTANCE CRITERIA

1. In Section 2.4, what are the criteria that would indicate that "a support has yielded or failed"? Is it the criteria specified in Section 3.3?

2. If the support configuration changes, what criteria will be used to evaluate weight, thermal, and other non-seismic load effects? How will these loads be combined?

3. Would any supports be "weakened" or modified if the governing design loads are reduced?

4. How are the support loads to be combined when seismic loads are included in the support evaluation?

5. How will standard components such as spring hangers, snubbers, rigid struts, rod hangers, clamps, sway braces, etc. be evaluated in light of the proposed criteria/methodology (e.g., if standard components are allowed to yield/fail)?

6. Are containment penetrations included in the pipe support reevaluation if the yield/fail criteria is implemented?

7. Clarify what specific data is necessary before the 20% increase in support yield strength is allowed? Would the data be directly related to the support material in question?

8. Explain the nonlinear support evaluation criteria in detail. How will it be performed? What loads will be utilized? What does a ductility factor of three equate to in terms of the material yield strengths specified in the AISC Steel Construction Manual?

9. What load combination technique will be utilized to evaluate concrete expansion anchor bolts? Include both load type combinations (if different from supports) and load component (axial force, shear forces, bending moments, and torsion) combinations.

10. Regarding the safety factor of two for concrete expansion anchor bolts:

    A. If the safety factor of two is implemented, is this interpreted as the support yielding or failing?

    B. Are any special inspections proposed for supports adjacent to those supports which only have safety factors of two for the concrete expansion anchor bolts?

    C. Are there any limitations contemplated regarding the number of supports in a system that will be allowed to have a safety factor of two?

    D. What effects would locally cracked concrete have on the load carrying capacity of anchor bolts having only a safety factor of two?

    E. Would additional inspections be performed for supports with concrete expansion anchor bolts having a safety factor of two? If so, what would the inspection include?

11. What inspections have been completed for existing concrete expansion anchor bolts? Have measurements been performed to check for correct installation and structural integrity? What were the installation procedures?

12. Are any concrete embedded bolts included in this reevaluation effort? If so, what is the acceptance criteria?

13. On page 16 of the proposed criteria/methodology, (under subheading iv), what is the word before "AISC Code"?