

April 8, 2005

Mr. Christopher M. Crane, President  
and Chief Nuclear Officer  
Exelon Generation Company, LLC  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: REVIEW OF QUAD CITIES REPLACEMENT STEAM DRYER - REQUEST FOR  
ADDITIONAL INFORMATION (TAC NOS. MC4397 AND MC4398)

Dear Mr. Crane:

By letters dated April 2 and May 12, 2004, Exelon Generation Company (Exelon) committed to limit operation of the Quad Cities Nuclear Power Station (Quad Cities) to pre extended power uprate (EPU) power, except for brief periods to collect data, until the U.S. Nuclear Regulatory Commission (NRC) approval is obtained to return to long-term operation at EPU power. In anticipation of a request from Exelon to return the Quad Cities units to long-term operation at EPU power, the NRC staff has identified the need for additional information. This request for additional information (RAI) was mailed electronically to your staff on February 9, 2005, and is attached as Enclosure 2. Please identify those questions that you feel are not needed for NRC to make a regulatory finding concerning the return of the Quad Cities units to EPU power or if this information is already available to the NRC staff.

By letter dated April 1, 2005, Exelon submitted portions of the requested information. Based on my discussions with your staff on March 21 and 22, 2005, I understand that the remainder of the information will be submitted to NRC the week of April 18, 2005, unless the need for additional analysis delays the second submittal until May 9, 2005. According to the affidavit contained in Exelon's letter dated February 9, 2005, a portion of this RAI is considered proprietary by the developer of the acoustic circuit model and is being withheld in accordance with Section 2.390 of Title 10 of the *Code of Federal Regulations* (10 CFR). A redacted (non-Proprietary) version of the RAI is attached as Enclosure 1.

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PROPRIETARY INFORMATION

C. Crane

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Please contact me at 301-415-2863 if your staff has any questions about this RAI.

Sincerely,

**/RA/**

Lawrence W. Rossbach, Project Manager, Section 2  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-237, 50-249, 50-254  
and 50-265

Enclosures: 1. Non-Proprietary Request for Additional Information  
2. Proprietary Request for Additional Information

cc with encl. 1 only: See next page

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C. Crane

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Sincerely,  
**/RA/**

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PROPRIETARY INFORMATION

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REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF  
QUAD CITIES REPLACEMENT STEAM DRYER

1. The licensee is requested to provide the following information regarding its assumptions for steam dryer loads:
  - (a) the basis for its assumption that acoustic loading as predicted by the acoustic circuit analysis is the principal load applied to the steam dryer,
  - (b) the basis for the inclusion or exclusion of other potential flow-induced loads (such as those incurred due to turbulent or bistable flow, fluid-structure interaction, or acoustic-structure interaction), and their consideration in the steam dryer analysis, and
  - (c) validation of the analysis assumptions for the steam dryer loads and excitation sources.
  
2. The licensee is requested to provide the following information regarding its scale model test (SMT) program for the Quad Cities steam dryers:
  - (a) description of SMT apparatus and setup;
  - (b) description of testing conducted and its results in identifying the significant loads on the steam dryer and their sources;
  - (c) description of testing conducted or planned to determine the resonance flow rate at the safety relief valve and to evaluate the pressure change with flow velocity to compare with the computational fluid dynamics (CFD) results, and plans for resolution of the remaining open items;
  - (d) evaluation of SMT results for assessing the integrity of the steam dryer, including the potential for changes in peak loading based on plant operating points;
  - (e) comparison of SMT test data to acoustic circuit analytical results and CFD predictions, and resolution of differences (including maximum pressure points and locations); and
  - (f) plans to validate SMT results with Quad Cities Unit 1 replacement steam dryer pressure and strain data.

3. The licensee is requested to provide the following regarding its acoustic circuit model used in predicting loads on the steam dryer:
  - (a) description of the acoustic circuit model;
  - (b) user's manual and theoretical analysis for the acoustic circuit analysis code (containing all steps in the procedure, including how matrices are manipulated to infer the amplitudes and phasing of assumed sources throughout the steam lines and steam dome, and how steam dryer loads are computed from those sources) that confirm that the code has been benchmarked, with an example problem including a description of the problem, input data, and output results;
  - (c) definition and identification of the acoustic (vibration) sources and locations and their mathematical representations;
  - (d) [ ]
  - (e) validation of the capability and sensitivity of the MSL strain gauges and their setup for inferring changes in internal pressures in the MSLs;
  - (f) validation of the capability of the acoustic circuit model to adequately predict the steam dryer loads; and
  - (g) access to the acoustic circuit model computer code for NRC staff reviewers and contractors to perform example computations and sensitivity evaluations.
  
4. The licensee is requested to provide the following information regarding its finite element model (FEM) analysis of the steam dryer:
  - (a) description of the FEM analysis and methodology;
  - (b) justification for FEM assumptions, including damping and super-element modeling;
  - (c) validation of the adequacy of derived acoustic loads on the steam dryer from examination of FEM analyses for the original, modified and replacement Quad Cities steam dryers under pre-EPU and EPU operation, including modeling of forcing functions;
  - (d) comparison of FEM results for Quad Cities and Dresden steam dryers, and determination of any adjustments necessary to previous steam dryer analysis results described in Exelon letter dated December 10, 2004; and

- (e) access to the FEM computer code (ANSYS) for NRC staff reviewers and contractors to perform example computations and sensitivity evaluations.
5. The licensee is requested to provide the following information regarding the replacement steam dryers for Quad Cities Units 1 and 2:
- (a) finalized steam dryer design including materials, dimensions, and fabrication methods;
  - (b) description of steam dryer instrumentation, including sensor types, characteristics, locations, and qualification, and wiring and mast layout and integrity;
  - (c) comparison of the CFD and acoustic circuit analysis loads on the steam dryer;
  - (d) steam dryer analysis demonstrating acceptable performance during plant operation, up to and including EPU conditions, with forcing functions, modeling, and stresses at critical locations;
  - (e) evaluation of the impact of steam dryer instrumentation on fluid flow in the steam dome, and steam dryer dynamic characteristics (e.g., damping);
  - (f) evaluation of potential loose parts from steam dryer, instrumentation, wiring, and mast, and their consequences; and
  - (g) access to the CFD computer code for the replacement steam dryer for NRC staff reviewers and contractors to perform example computations and sensitivity evaluations.
6. The licensee is requested to describe a startup plan that will provide confidence in the integrity of the Quad Cities replacement steam dryers during startup and operation at EPU conditions. The plan is expected to include hold points during power ascension, data and parameters to be measured, acceptance criteria that will initiate proactive measures to address inadequate steam dryer performance prior to failure (e.g., evaluation of plant and dryer data, potential loose parts effects, and dryer inspection results), and decision criteria for allowing continued plant operation or commencing plant shutdown. For example, the plan is expected to provide for the performance of blind predictions of the loading of the Quad Cities replacement steam dryer by the acoustic circuit model based on MSL strain gauge data at pre-EPU baseline conditions and at specific hold points as part of the power ascension to EPU operation.

Quad Cities Nuclear Power Station Units 1 and 2

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