

RS-04-009

February 24, 2004

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001Quad Cities Nuclear Power Station, Unit 1  
Facility Operating License Nos. DPR-29  
NRC Docket No. 50-254**Subject:** Additional Information Regarding Lost Parts Analysis for Quad Cities Unit 1 Dryer Failure**References:** Letter from T. J. Tulon (Exelon Generation Company, LLC) to U. S. NRC, "Transmittal of Lost Parts Analysis and Associated Operability Evaluation," dated November 28, 2003

On November 12, 2003, Exelon Generation Company, LLC (EGC) commenced a shutdown of Quad Cities Nuclear Power Station (QCNPS), Unit 1, as a result of suspected steam dryer degradation. The degradation was suspected due to noted increases in moisture carryover and corresponding changes in main steam flow. Following reactor vessel disassembly, EGC completed detailed inspections of 100% of the accessible interior and exterior areas of the QCNPS Unit 1 steam dryer. Details of the inspections were discussed with the NRC in a conference call on November 20, 2003.

In the referenced letter, EGC described some of the damage that was identified on the QCNPS Unit 1 steam dryer. Specifically, on November 13, 2003, EGC identified that a portion of the damaged dryer outer hood bank was missing, and comprehensive inspections performed in an attempt to locate and retrieve the missing dryer material were not successful.

On November 28, 2004, the NRC requested that EGC respond to a list of concerns related to the QCNPS Unit 1 Lost Parts Analysis. The attachments to this letter provide the requested information. Some of the details contained in Attachment 2 of this letter are classified as proprietary to General Electric (GE), and are identified as text contained between opening double brackets ([[) and closing double brackets (]]). The proprietary information is of the type that GE maintains in confidence and withholds from public disclosure. It has been handled and classified as proprietary as supported by the affidavit in Attachment 1. EGC hereby requests that this information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790, "Public inspections, exemptions, requests for withholding," paragraph (a)(4), and 10 CFR 9.17, "Agency records exempt from public disclosure," paragraph (a)(4). Attachment 1 provides a redacted, non-proprietary version of the information in Attachment 2.

APOI

February 24, 2004  
U. S. Nuclear Regulatory Commission  
Page 2

Should you have any questions concerning this letter, please contact Mr. Thomas G. Roddey at (630) 657-2811.

Respectfully,



Patrick R. Simpson  
Manager, Licensing

Attachments:

- (1) Affidavit and GE Letter dated February 20, 2004, "GE Responses to NRC Lost Parts Analysis RAIs," Non-Proprietary
- (2) GE Letter dated February 20, 2004, "GE Responses to NRC Lost Parts Analysis RAIs," GE Proprietary Information

cc: Regional Administrator - NRC Region III  
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station  
Illinois Emergency Management Agency - Division of Nuclear Safety

**ATTACHMENT 1**

**Affidavit and GE Letter dated February 20, 2004,  
"GE Responses to NRC Lost Parts Analysis RAIs,"  
Non-Proprietary**

# General Electric Company

## AFFIDAVIT

I, **George B. Stramback**, state as follows:

- (1) I am Manager, Regulatory Services, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in Attachment 2 to GE letter from Daryl Bouchie (GE) to Thomas Roddey (Exelon), *GE Responses to NRC Lost Parts Analysis RAIs*, dated February 20, 2004. The Attachment 2 proprietary information, *GE Responses to NRC Lost Parts Analysis RAIs*, is delineated by a double underline inside double square brackets. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation<sup>(3)</sup> refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.
- (3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.790(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (4) Some examples of categories of information which fit into the definition of proprietary information are:
  - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;
  - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;
  - c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

- d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

- (5) To address 10 CFR 2.790 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains further detailed results and conclusions of Quad Cities 1 Steam Dryer lost part(s) analyses, as described in the previous proprietary voluntary submittal GE-NE-0000-0023-5200-R0, *Lost Parts Analysis for Quad Cities Generating Station Unit 1 Steam Dryer Outer Hood (270° Side)*, Class III (GE Proprietary Information), dated November 2003, which identifies both the methodology and specific BWR system, thermo-hydraulic, and hardware issues to be addressed when performing this type of analyses. The development of this methodology and the specific BWR issues was achieved at a significant cost to GE, on the order of ¼ million dollars.

The development of the evaluation process along with the interpretation and application of the results is derived from the extensive experience database that constitutes a major GE asset.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the

appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

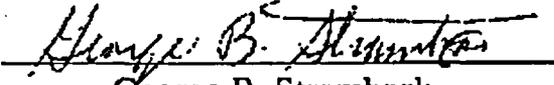
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 26<sup>th</sup> day of February, 2004.

  
George B. Stramback  
General Electric Company

**ATTACHMENT 1**

**GE Letter dated February 20, 2004**

**GE Responses to NRC Lost Parts Analysis RAIs**

**Non-Proprietary**

## **2. Lost Part Description**

### **NRC RAI 1**

It is stated that it is a low probability that pieces would be less than a 0.5-inch cube. However, a piece of any size could be worn away to become yet smaller. Smaller pieces than a 0.5-inch cube could migrate into yet smaller clearance spaces, and as pieces become smaller there could be a greater number of them. Assess the potential damage caused by pieces smaller than a 0.5-inch cube.

### **GE Response**

The steam dryer plate is Type 304 stainless steel. This is a very tough, ductile alloy such that brittle failure modes resulting in many small pieces are highly unlikely. After review of the material with expert metallurgical personnel, it was determined to be inconceivable that the material could break up into smaller pieces than the thickness of the base material (0.5 inch). In the unlikely event that the parts wore down to less than 0.5 inch, the additional consequences would be 1) Fuel fretting to GE14 fuel. The consequences would be the same as the Atrium fuel, which is discussed in Section 6.7 of the report (GE-NE-0000-0023-5200-R0). 2) Degradation of CRD motion. Potential for interference with CRD operation has been discussed in Section 6.3 of the report (GE-NE-0000-0023-5200-R0). The scram safety function would not be impacted.

**4. Assumptions**

**NRC RAI 1**

Describe in detail all the fuel orifices, their sizes, flow paths and clearance for all fuel types and CRD system.

**GE Response to RAI 1**

The fuel orifices have the following diameter sizes: [[

]] The flow paths are shown in the figure below in the responses to section 6.3. Most of the leakage paths between the lower plenum and bypass region are gaps due to the fit-up tolerances between the components and the clearances through the bypass flow paths are small.

[[

]] The CRD system is described in the QC1 FSAR.

**NRC RAI 2**

What are the dimensions of the lower tie plate (LTP), upper tie plate (UTP), and spacers clearance for GE-14 fuel? Is there any filter installed at the fuel inlet orifice? If so, what particle size will get through the filter?

**GE Response to RAI 2**

[[

]]

**NRC RAI 3**

The licensee recognizes a possibility of a 0.5-inch cube piece to get inside the lower part of a fuel bundle, between the Lower Tie Plate (LTP) and the first spacer through a maximum opening of the LTP of 0.9"X1.2". However, this is inconsistent with page 8 that says a 0.5-inch cube won't enter the lower tie plate.

**GE Response to RAI 3**

The report (GE-NE-0000-0023-5200-R0), on page 4, states the part could enter the Atrium LTP, but not the GE14 LTP.

**NRC RAI 4**

Instrument lines and CRD guide tubes, SLCS injection line at the bottom are excluded in the list.

**GE Response to RAI 4**

Component dimensions in Assumption 4 are included for confirmation by Exelon. No confirmation of Instrument lines and CRD guide tubes, SLCS injection line dimensions by Exelon was needed for LPA, therefore they are not included in 4. The dimensions are as follows:

[[

]]

**NRC RAI 5**

Please list all the instrument guide tubes and CRD stub tube lines penetrating the bottom of the vessel and specify their line size and wall thickness.

**GE Response to RAI 5**

[[

]]

### **6.3 Potential for Interference with Control Rod Operation**

#### **NRC RAI 1**

The impact of the missing piece with a size 6X9 inches with half inch thickness is not evaluated. It is possible that the big piece could impact or rub the stub tube and damage the control rod drives.

#### **GE Response to RAI 1**

With the low flow velocities in the bottom of the vessel and with the [[  
]] it is unlikely that the part would wear through the stub tube. If it did wear through, it would cause leakage but would not be a safety concern (see BWRVIP-17). [[  
]] wall that would have to be worn through for the part to actually reach the CRD. However, the 6 X 9 inches part is the intact lost part, and considering the distance between the stub tubes, the 6X9 inch part would most likely affect only one control rod and not two simultaneously. The CRD stroke tests would detect the impacted CRD before other stub tubes are affected.

#### **NRC RAI 2**

The report does not address the potential for impact or wear of the loose piece(s) on the CRD housing. Section 6.11 just states that the components in this area are relatively thick and are not expected to wear through. However, repeated impact or rubbing action could result in progressive wear through even a heavy section which could result in loss of pressure boundary integrity and impairment of the CRD safety function.

#### **GE Response to RAI 2**

The stub tubes in the bottom of the vessel cover the CRD housing to an elevation of several inches. If the lost part makes it to higher elevations where the housing is not covered by the stub tubes, the lost part would have been lifted by the flow and it would not be in a stable position where it would be able to repeatedly impact the same spot on the CRD housing. The lost part will only be stable resting on the bottom of the vessel where it could then impact the stub tubes (see previous response). The CRD scram function is redundant; failure of a single CRD will not prevent the safety function from being achieved.

#### **NRC RAI 3**

It is stated that a loose piece could not bind a CRD control blade due to the large differential CRD driving force. It appears that a wedged loose piece could inhibit motion of the blade in the guide tube.

#### **GE Response to RAI 3**

If the smallest part (0.5 inch cube) could get into the guide tube, [[  
]] and drop to the bottom outside edge of the guide tube, where it most

likely would stay. The smallest part is too large to enter [[  
]] if the part was lifted off the bottom  
of the guide tube. It is highly unlikely that the 0.5 inch cube would wear down to less than the  
[[  
]] size to get into the control rod drive, and even if it did, [[  
]] to prevent it from interfering with CRD motion. There are no changes or constrictions  
in the guide tube diameter. Therefore, the lost part cannot get into an area where it can bind the  
CRD motion during a scram.

#### **NRC RAI 4**

The possibility of foreign materials getting inside the control rods guide tube through the core leakage (bypass through the lower fuel assembly tie-plate channel clearance and holes in the nose piece) is not addressed. A detail discussion of CRD component functions that can be affected are not discussed. The basis for a piece not causing binding to the control blades is not clear.

#### **GE Response to RAI 4**

Most of the leakage paths between the lower plenum and bypass region are gaps due to the fit-up tolerances between the components and the clearances through the bypass flow paths are small (see Figure 1). [[

]] A part of that size will not cause binding of the control rod blade and fuel channel wall, or velocity limiter and control rod guide tube. It also will not pass through the [[  
]] between the CRD index tube and the guide tube hole.

[[

Figure 1

]]

**6.6 Potential for Interference with the Nuclear Boiler or Neutron Monitoring Instrumentation**

**NRC RAI 1**

What is the size and thickness of instrument tubes used for SRM/IRM/LPRM? Explain in detail the basis for concluding that "The impingement by the parts on the tubes would be of no consequence because of the relative small size of the parts." Is this based on the assumption that the missing part was broken into small parts and the impact of the big piece on the instrumentation tubes are not addressed?

**GE Response**

The dimensions for the SRM/IRM/LPRM instrument tubes are provided above in the last response under "4. Assumptions". Technical Specifications assure adequate diversity in the neutron monitoring systems. If lost part caused a failure in a nuclear instrumentation it would fail downscale and be detected. It would not impact the high neutron flux scram function. LPRM failures are an operational concern, however failure of one string would not limit operation. It is unlikely that multiple pieces, large or small, would cause failures in multiple instrumentation tubes.

**NRC RAI 2**

The report doesn't properly address the possible LPRM bypass-orifice blockage, which would reduce the cooling of in-core nuclear instruments and control rods. The report also doesn't address the impact of a piece entering the area between the bundles impacting the in-core instrumentations and the upward displacement of control rods to shutdown the reactor.

**GE Response**

As shown in Figure 1, there are multiple flow paths between the lower plenum and core bypass region. [[

]] which is typical of the other flow paths clearances, so as to minimize or control bypass leakage. [[  
]] therefore, several paths can plug without impacting cooling of the in-core instrumentation and control rods. The top end of the in-core instrumentation guide tubes are anchored to the bottom of the top guide, which is approximately 6 inches away from the control blade. The smallest 0.5-inch cube part could not get between the control rod blade and the channel wall, but if it did fall to the bypass region, the flows would be low where impact on in-core instrumentation is not expected. Therefore, it is unlikely the part would interact with the in-core instrumentation tubes and upward displacement of control rods for shutdown of the reactor.

**6.10 Potential for Impairment of Recirculation System Performance**

**NRC RAI 1**

The recirc discharge valve is to be closed with off-site power or with diesel power. Additional clarification is required for the conclusion that increase in PCT would only be an issue for the DBA accident with Diesel Generators available.

**GE Response**

The recirculation discharge valve will close with either off-site power or diesel power. The LPA evaluation for the potential impact on LOCA response reviewed the recirculation suction line break case with an assumed single failure of the diesel generator because this case has the highest peak clad temperature (PCT) with the LPCI systems operating (the lost part cannot affect operation of the core spray systems). Other failure scenarios which require LPCI injection would also be affected, but [[

]]

GE Letter dated February 20, 2004  
Attachment 1  
Page 9 of 10

**Attachment "A"**

**NRC RAI 1**

Page 1: Is the lower tie plate diameter of 0.410 inches for GE-14 fuel or Atrium-9B fuel?

**GE Response**

[[

]] Attachment A was provided to support a specific design input to this analysis. The dimension given in Attachment A is typical of earlier fuel designs.

**General Comment**

**NRC RAI 1**

Identify the evaluation models used for the analysis. Confirm that staff approved evaluation models were used for the analysis.

**GE Response**

The ISCOR code, which incorporates the fuel-specific GEXL boiling transition correlations, was used in the analysis. This evaluation model is consistent with the model description of NEDE 24011P-A. The SER supporting approval of NEDE-24011P Rev 0 by the May 12, 1978 letter from D.G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to calculate CPR during flow reduction is consistent with the approved models and methods. For GEXL correlations see NEDC-32868P, "GE14 Compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II)", Rev. 1, September 2000, and see NEDC-32981P-A Rev. 1 for Atrium 9B.