



**Boston Edison**

Pilgrim Nuclear Power Station  
Rocky Hill Road  
Plymouth, Massachusetts 02360

**L. J. Olivier**

Vice President Nuclear Operations  
and Station Director

October 28, 1994  
BECO Ltr. #94-117

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555

Docket No. 50-293  
License No. DPR-35

NRC Request for Additional Information  
Pilgrim Shroud Analysis

Attached is our response to the October 19, 1994 request for additional information regarding the Reactor Core Shroud at Pilgrim Nuclear Power Station. This response, in draft form, was transmitted to the NRC on October 24, 1994. This response is based on inputs from General Electric Company.

We have also provided a response to two additional concerns raised by the staff in the October 19, 1994 conference call. Included with this letter is an affidavit covering the proprietary nature of the information supplied in the response to Question 4. Please refer any questions or comments concerning these responses to either Mr. R. V. Fairbank or me.

  
L. J. Olivier

ETB/RAH/nas/Rap94/SHROUDLT

Attachment

cc: Mr. R. Eaton, Project Manager  
Division of Reactor Projects - I/II  
Mail Stop: 14D1  
U. S. Nuclear Regulatory Commission  
1 White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Senior Resident Inspector  
Pilgrim Nuclear Power Station

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PDR ADOCK 05000293  
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# General Electric Company

## AFFIDAVIT

I, **George B. Stramback**, being duly sworn, depose and state as follows:

- (1) I am Project Manager, Licensing 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 the GE proprietary attachments to GE-NE Letter # Pilgrim 17, John W. Lukas to Dave Heard, *Response to NRC Questions to BECo*, dated October 26, 1994. The proprietary information is delineated by bars marked in the margin adjacent to the specific material.
- (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), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions 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;

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- c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;
  - d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;
  - e. 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 both paragraphs (4)a. and (4)b., above.

- (5) 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 detailed results of analytical models, methods and processes, including computer codes, which GE has developed and applied to perform evaluations of the BWR. The TRACG code and the PLEDGE model are two of these analytical tools developed by GE and used in these evaluations. The development and approval of these system, component, and thermal hydraulic models and computer codes

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(TRACG) was achieved at a significant cost to GE. The PLEDGE model was developed and compiled by GE from 1972 to 1994 at a significant cost to GE. It contains detailed historical data and analytical results not available elsewhere. The significant cost to GE for these analytical tools was on the order of several million dollars.

The development of the evaluation process along with the interpretation and application of the analytical 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.

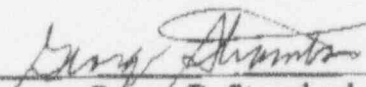
The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of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

STATE OF CALIFORNIA )  
 ) ss:  
COUNTY OF SANTA CLARA )

George B. Stramback, being duly sworn, deposes and says:

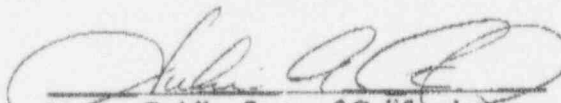
That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

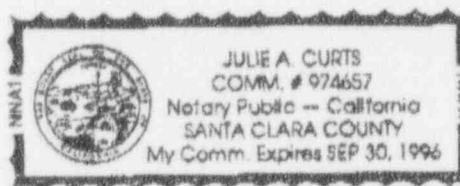
Executed at San Jose, California, this 26<sup>th</sup> day of October 1994.



George B. Stramback  
General Electric Company

Subscribed and sworn before me this 26<sup>th</sup> day of October 1994.

  
Notary Public, State of California





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## PNPS Shroud Safety Assessment - NRC Questions on 10/13/94 Submittal

### Question 1:

The licensee stated that the core shroud is calculated to tip due to a postulated recirculation line break (RLB) lateral blowdown load. The assumption is made that tipping at the H7 weld would provide the maximum tipping displacement. Provide the calculation which is the basis for determining that the shroud will tip instead of sliding laterally without tipping. What is the necessary coefficient of friction at H7 to assure tipping and what is the net minimum downward force during the blowdown at the point of friction? Include the calculation of the load distribution on the shroud structure and how the resulting load was applied in determining the resulting moment. Provide a similar assessment for the Design Basis Earthquake (DBE event).

### Answer 1:

Our October 13th response to Question 1 needs clarification. A conventional tipping calculation was not prepared. The basis for shroud tipping, rather than sliding, is the assumption of an irregular profile characteristic of stress corrosion cracking and the conservative assumption that the shroud weight is balanced by the upward pressure from inside the shroud at the beginning of the RLB event. For PNPS, this condition will exist either for a 360 degree through wall crack at low core flow operation or for a limited ligament condition at high core flow operation. In either case, the shroud at the H7 weld is not separated, and will not separate because there are no additional upward forces introduced by the RLB event. In fact, the RLB event exerts an almost instantaneous downward pull on the shroud. Based on the above postulated model the net minimum downward force and friction forces are not applicable to the tipping assumptions. Tipping will occur as a result of the existing ligament or the irregular surface associated with the crack.

The horizontal force required to resist the sliding movement must equal or exceed the integrated lateral force exerted by the RLB blowdown on the shroud above the weld to assure that tipping will occur. This force is 77 kips at the H7 weld location. For either condition discussed above, this reaction force will be produced by the interaction of the two shroud surfaces, and sliding movement would only occur if the force on the shroud exceeds the shear strength of the cracked surface. The shroud is not expected to slide because only 1% of the shroud area is sufficient to produce the required reaction force (minimum ligament integrity required based on shear stress).

The required area is determined by solving for the maximum shroud inside radius which will produce the shear stress:

$$\text{Shear Stress} = \text{Yield Stress} / 2 = \text{Force} / [\pi(R_o^2 - R_i^2)].$$

Where:            Yield Stress = 18.8 ksi  
                     Force = 77 kips  
                     Ro = 92 inches

Then:             Ri = 91.986 inches,

and % ligament is  $0.014 \times 100 / 1.5 = 0.945\% < 1\%$ .

The eccentricity of the applied load and the reaction force at the base would cause tipping to occur.

The tipping moments are listed in the table provided in response to Question 2. Note that the vertical force created by the internal pressure will result in the initial overturning moment which is caused by the lateral blowdown force. Additionally, the internal pressure on the shroud will be decreased by both the loss of core flow due to the RLB (within one second) and the flow escaping through the gap created by the tipping. Thus, the restoring moment will overcome the blowdown moment and return the shroud to its original upright position.

Alternatively, the shroud could be postulated to translate rather than tip. In this case the distance the shroud is allowed to move laterally toward the Recirculation Line Suction Nozzle is limited by the Jet Pump Riser Braces. These Braces are located at 30 degrees on each side of the nozzle. The distance from the Vessel Wall to the Riser Pipe Center is 11.25 inches, the OD of the Riser Pipe is 10.75 inches, and the thickness of the brace in front of the Riser Pipe is 2.12 inches. Therefore, since the clearance between the shroud and the vessel is 20 inches, the clearance between the brace and the shroud is as follows:

$$\text{Clearance} = 20 - 11.25 - 10.75 / 2 - 2.12 = 1.255 \text{ inches}$$

Also, since the shroud will move toward the Recirculation Line Suction Nozzle rather than the Jet Pump Riser Brace, with a 30 degree angle, the actual lateral displacement is  $1.255 / \cos(30) = 1.45$  inches.

Therefore, even if the shroud were to translate laterally rather than tip under a RLB event, the upper section of the shroud would remain in contact with the lower surface because the total allowable translation is less than the 1.5" thickness of the shroud. As no significant gap would exist and the pressures across the shroud following an RLB are small, the leakage would be minimal, and the refloodable volume would be maintained. The yield stress of the braces is not exceeded during this transient. (See Question 3).

The DBE has been evaluated as resulting in a one inch vertical and one inch horizontal motion (General Electric design record file #L1200819 Vol. 4 section 11) (See pg. 33 of the Pilgrim Shroud Safety Assessment GENE 523-A119-0894) and does not alter the previous discussion.

Under normal operating conditions in the presence of a postulated 360 ° through wall crack, the shroud may separate as indicated in our initial safety assessment for all welds. This condition should be detectable for all welds based on the following analysis of the limiting H7 weld:

1. The shroud differential pressure (DP) necessary to initiate separation is calculated to be 5.8 psid which corresponds to approximately 95% reactor power.

2. The shroud DP at 100% flow is calculated to be 6.5 psid. As core flow is increased to raise reactor power above 95%, the shroud will begin to lift and reactor power will remain approximately constant if shroud separation has occurred.
3. When 100% core flow is achieved, there will be approximately a 4% power anomaly that will be detectable.
4. If the separation occurs while operating at 100% flow, reactor power will decrease approximately 4% and remain approximately constant. This power anomaly will be detectable.

The load distribution on the shroud is based on the attached "Core Shroud Blowdown Load Calculation During Recirculation Suction Line Break by TRACG Analysis for Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2" dated September 1994. This report is applicable to all BWRs.



General Electric Company

AFFIDAVIT

I, George B. Stramback, being duly sworn, depose and state as follows:

- (1) I am Project Manager, Licensing 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 the GE proprietary report GENE-L12-00819-05, *Core Shroud Blowdown Load Calculation During Recirculation Suction Line Break by TRACG Analysis for Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2, Class 3* (GE Company Proprietary Information), dated September 1994. This document, taken as a whole, constitutes a proprietary compilation of information, some of it also independently proprietary, prepared by the General Electric Company. The independently proprietary elements are delineated by bars marked in the margin adjacent to the specific material.
- (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), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions 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;

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- 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 cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;
  - d Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;
  - e Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

Both the compilation as a whole and the marked independently proprietary elements incorporated in that compilation are considered proprietary for the reason described in items (4)a. and (4)b., above.

- (5) The information sought to be withheld is being submitted to NRC in confidence. That information is of a sort customarily held in confidence by GE, and has, to the best of my knowledge, consistently been held in confidence by GE, has not been publicly disclosed, and 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 by bars in the margin is classified as proprietary because it contains detailed results and conclusions from these evaluations, utilizing analytical models and methods, including computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of transient and accident events in the GE Boiling Water Reactor ("BWR"). The development and approval of these system, component, and thermal hydraulic models and computer codes was achieved at a significant cost to GE, on the order of several million dollars.

The development of the evaluation process along with the interpretation and application of the analytical and inspection 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 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, including justifications for not including certain analyses in applications to change the licensing basis.

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

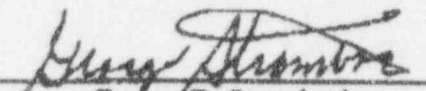
While some of the underlying analyses, and some of the gross structure of the process, may at various times have been publicly revealed, enough of both the analyses and the detailed structural framework of the process have been held in confidence that this information, in this compiled form, continues to have great competitive value to GE. This value would be lost if the information as a whole, in the context and level of detail provided in the subject GE document, were to be disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources, including that required to determine the areas that are not affected by a power uprate and are therefore blind alleys, 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 its analytical process.

STATE OF CALIFORNIA       )  
                                      )  
COUNTY OF SANTA CLARA    ) ss:

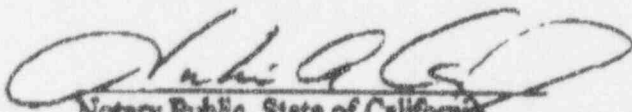
George B. Stramback, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief

Executed at San Jose, California, this 1st day of September 1997.

  
George B. Stramback  
General Electric Company

Subscribed and sworn before me this 1st day of September 1997.

  
Notary Public, State of California

